



AMERICAN ENERGY
MARCELLUS

American Energy Marcellus, LLC

**G70-A General Air Permit Modification
Application**

Mary Miller GRT Natural Gas Production Site

Wileyville, West Virginia



Prepared By:

**ENVIRONMENTAL RESOURCES MANAGEMENT, Inc.
Hurricane, West Virginia**

April 2015



AMERICAN ENERGY
MARCELLUS

April 17, 2015

Mr. William F. Durham, Director
West Virginia Department of Environmental Protection
Division of Air Quality
601 57th Street, SE
Charleston, West Virginia, 25304

**RE: G70-A Permit Application
Mary Miller GRT Well Pad
American Energy – Marcellus, LLC**

Dear Director Durham:

American Energy – Marcellus, LLC (AEM) is pleased to submit the enclosed application for a General Permit G70-A for the Mary Miller GRT well pad near Wileyville in Wetzel County, West Virginia. The original and two copies of the complete application package are enclosed.

A check for the application fee in the amount of \$4,000.00 made payable to the WVDEP – Division of Air Quality is also included with this package.

A public notice for the proposed project will be published in *The Wetzel Chronicle* as soon as possible. AEM will forward the original Affidavit of Publication to your attention once it is received from the publisher.

If you have any questions about the information submitted or if you would like to discuss this project, please do not hesitate to contact me at (405) 607-5411.

Sincerely,

John McGreevy
EH&S Coordinator

cc: Grant Morgan, ERM – Grant.morgan@erm.com

INTRODUCTION

American Energy Marcellus, LLC (AEM) is submitting this G70-A Class II Permit Application to the WVDEP's Department of Air Quality for the Mary Miller GRT natural gas production site located in Wetzel County, West Virginia. This application addresses the operational activities associated with the production of natural gas and condensates at the Mary Miller GRT pad.

FACILITY DESCRIPTION

The AEM Mary Miller GRT natural gas production site operates in Wetzel County, WV and consists of four (4) natural gas wells. Natural gas and liquids (including water and condensates) are extracted from underground deposits. The natural gas will be transported from the wells to a gas line for compression and additional processing, as necessary. The produced liquids are stored in storage vessels.

The applicant seeks to authorize the operation of:

- Four (4) gas processing unit (GPU) burners each rated at 1.5 MMBtu/hr heat input;
- Four (4) line heaters each rated at 1.5 MMBtu/hr heat input;
- One (1) flash separator line heater rated at 1.0 MMBtu/hr heat input;
- Two (2) reciprocating compressor engines rated at 203 bhp;
- Three (3) 400 barrel (bbl) produced water tanks;
- Three (3) 400 barrel (bbl) condensate tanks;
- One (1) condensate stabilizer line heater rated at 0.75 MMBtu/hr heat input;
- One (1) National Oilwell Varco MEVC200 Enclosed Combustion Device with a capacity of 18.24 MMBtu/hr;
- One (1) Produced Water Tank Truck Loading Operations;
- One (1) Condensate Tank Truck Loading Operations; and
- One (1) 47 bhp Hipower natural gas prime-power generator;

AEM seeks the authority to operate a condensate stabilizer with a burner rated at 0.75 MMBtu/hr. The condensate stabilizer serves as a third stage of fluid separation for the condensate produced at the Site. The condensate stabilizer heats the condensate and routes the volatilized hydrocarbons through a condenser to a pressurized Natural Gas Liquids (NGLs) storage vessel.

Based upon current observed daily condensate production at similar facilities, AEM does not expect the quantity of condensate production that would justify the operation of the condensate stabilizer. AEM is filling this application to account for the loading of the condensate tanks directly from the flash separator. E&P Tank process simulation model results have been included with this

application, which were used to calculate the flashing, working, and breathing emissions associated with this method of condensate tank loading. The daily and annual condensate production rates have been filed to reflect the highest level of production expected at the Site. With this permitting approach, AEM is reasonably conservative in its permitting actions and is authorized to operate the condensate stabilizer should field conditions deem it necessary. In the event that the condensate stabilizer is operated, VOC emissions from the flashing of condensate would be reduced below the potential emissions included in this application.

A process flow diagram is included in this application in Attachment D.

STATEMENT OF AGGREGATION

The Mary Miller GRT facility will be located in Wetzel County, WV and operated by AEM. Stationary sources of air pollutants may require aggregation of total emission levels to evaluate the potential applicability of Title I, Parts C and D preconstruction permitting programs and the Title V operating permit program if these sources share the same industrial grouping, are operating under common control, and are classified as contiguous or adjacent facilities. AEM will operate the Mary Miller GRT facility with the same industrial grouping as nearby facilities, and some of these facilities are under common control. AEM is not subject to the aggregation of stationary emission sources because these sites do not meet the definition of contiguous or adjacent facilities.

The Mary Miller GRT facility will operate under SIC code 1311 (Crude Petroleum and Natural Gas Extraction). There are surrounding wells and compressor stations operated by AEM that share the same two-digit major SIC code of 13 for Crude Petroleum and Natural Gas Extraction. Therefore, the Mary Miller GRT Facility does share the same SIC codes as the surrounding wells and compressor stations.

AEM is the sole operator of the Mary Miller GRT pad. AEM is also the sole operator of other production sites and compressor stations in the area. Therefore, AEM does qualify as having nearby operations under common control.

Nearby sites do not meet the definition of contiguous or adjacent properties since they are not in contact and do not share common boundaries.

Based on the above reasoning, AEM is not subject to the aggregation of stationary emission sources since the stationary sources are not considered contiguous or adjacent facilities.

REGULATORY DISCUSSION

This section outlines the State air quality regulations that could be reasonably expected to apply to the Mary Miller GRT facility and makes an applicability determination for each regulation based on activities conducted at the site and the emissions of regulated air pollutants. This review is presented to supplement and/or add clarification to the information provided in the WVDEP G70-A permit application forms.

The West Virginia State Regulations address applicable state (i.e. State Implementation Plan) rules as well as federal regulations, including Prevention of Significant Deterioration or Nonattainment New Source Review Preconstruction Permitting, Title V, New Source Performance Standards, and National Emission Standards for Hazardous Air Pollutants. The regulatory requirements in reference to Mary Miller GRT are described in detail in the below section.

WEST VIRGINIA STATE AIR REGULATIONS

45 CSR 02 – To Prevent and Control Particulate Air Pollution From Combustion of Fuel in Indirect Heat Exchangers

The line heaters are indirect heat exchangers that combust natural gas. Such units are subject to 10% opacity as a six-minute block average limitation, but are exempt from most other requirements in the rule aside from discretionary testing requirements.

45 CSR 04 – To Prevent and Control the Discharge of Air Pollutants into the Air Which Causes or Contributes to an Objectionable Odor

Operations conducted at the Mary Miller GRT facility are subject to this requirement. Based on the nature of the process at the wellpad, the presence of objectionable odors is unlikely.

45 CSR 06 – Control of Air Pollution from the Combustion of Refuse

The enclosed combustion device located on the Mary Miller GRT natural gas production site is subject to this regulation. Per 45 CSR 6-4.3, opacity of emissions from the enclosed combustion device shall not exceed 20 percent, except as provided by 4.4. Particulate matter emissions from this unit will not exceed the levels calculated in accordance with 6-4.1.

45 CSR 10 – To Prevent and Control Air Pollution From the Emission of Sulfur Oxides

The line heaters are indirect heat exchangers that combust natural gas. Such units are subject to the 2,000 ppm_v sulfur dioxide concentration limitation but are exempt from most other requirements in the rule aside from discretionary testing requirements. Compliance with the allowable sulfur dioxide concentration limitations is based on a block (3) hour averaging time.

45 CSR 13 – Permits for Construction, Modification, Relocation, And Operation of Stationary Sources of Air Pollutants

This G70-A permit application is being submitted for the operational activities associated with AEM's production of natural gas.

45 CSR 14 / 45 CSR 19 – Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration / Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contributed to Non-attainment

Federal construction permitting programs regulate new and modified sources of attainment pollutants. The G70-A applicability criteria exclude facilities that meet the definition of a major source, as defined in 45 CSR 19, from being eligible for the general permit.

Operation of equipment at the Mary Miller GRT facility will not exceed major source emission thresholds established by these permitting programs. AEM will monitor future construction and modification activities at the site closely and will compare any future increase in emissions with major source thresholds to ensure these activities will not trigger either program.

45 CSR 16 - Standards of Performance for New Stationary Sources (NSPS)

45 CSR 16 applies to all registrants that are subject to any of the NSPS requirements described in more detail in the Federal Regulations section. Applicable requirements of NSPS, Subpart JJJJ and OOOO are included in the G70-A general permit.

45 CSR 30 – Requirements for Operating Permits

45 CSR 30 applies to the requirements of the federal Title V operating permit program (40 CFR 70). The major source thresholds with respect to the West Virginia Title V operating permit program regulations are 10 tons per year (tpy) of a single HAP, 25 tpy of any combination of HAP, and 100 tpy of all other regulated pollutants.

The potential emissions of all regulated pollutants are below the corresponding threshold(s) at this facility. The facility is not major source with respect to the Title V operating permit program.

45 CSR 34 – National Emission Standards for Hazardous Air Pollutants (NESHAP)

45 CSR 34 applies to all registrants that are subject to any of the NESHAP requirements described in more detail in the Federal Regulations section. Applicable requirements of NESHAPS, Subpart ZZZZ and HH are included in the G70-A general permit.

FEDERAL REGULATIONS

40 CFR 60, Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines)

Subpart JJJJ established standards and compliance schedules for the control of volatile organic compounds (VOC), Nitrogen Oxides (NO_x), and Carbon Monoxide (CO) emissions from affected facilities that commence construction, modification, or reconstruction after June 12, 2006. The applicable provisions and requirements of Subpart JJJJ are included under the G70-A permit.

The natural gas-fired generator that will be installed at the Mary Miller GRT is subject to the requirements of this Rule. The generator is a spark ignition internal combustion engine that commenced construction in 2015 and was manufactured in 2014. This engine is subject to an emission limit of 3.8 g/KW-hr for HC+NO_x. This engine has received EPA Certification with regards to Subpart JJJJ, which is included in this permit application.

40 CFR 60, Subpart OOOO (Standards of Performance for Crude oil and Natural Gas Production, Transmission and Distribution)

Subpart OOOO establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO₂) emissions from affected facilities that commence construction, modification or reconstruction after August 23, 2011. The applicable provisions and requirements of Subpart OOOO are included under the G70-A permit.

This facility includes gas well affected facilities under Subpart OOOO.

There are several equipment types that will be installed at Mary Miller GRT that do not meet the affected facility definitions as specified by EPA. These include pneumatic controllers and storage vessels.

Pneumatic Controllers: Any pneumatic controller installed at this facility will be intermittent bleed devices. Therefore, there will not be any pneumatic controller affected facilities located at this site.

Storage vessels: Based on PTE calculations included within this permit, emissions from each storage vessel will be routed to an enclosed combustion device such that the total tank emissions for the entire facility are below 6 tons per year (tpy) of VOC. The operation of the enclosed combustion device will be a legally and practically enforceable permit condition. For this reason, the Mary Miller GRT Facility does not meet the definition of Storage Vessel Affected Facility under 40 CFR Part 60 Subpart OOOO.

No additional NSPS are currently applicable to this facility.

40 CFR 63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines)

The CAT G3306TA Compressor Engine Unit 1501 is subject to the requirements of 40 CFR 63 Subpart ZZZZ. The engine was manufactured in August of 2005 and has been reconstructed or modified. The engine qualifies as a 4 stroke rich burn Spark Ignition (SI) Internal Combustion Engine (ICE). The engine is not classified as a black start or emergency engine. With a brake horsepower rating of 203, this engine is subject to the requirements of 63.6603(a), as outlined in Table 2d.10. The requirements for non-emergency, non-black start 4SRB stationary RICE with less than 500 hp are as follows:

- Change oil and filter every 1,440 hours of operation or annually, whichever comes first;
- Inspect spark plugs every 1,440 hours of operation or annually, whichever comes first, and replace as necessary; and
- Inspect all hoses and belts every 1,440 hours of operation or annually, whichever comes first, and replace as necessary.

The following NESHAP included in the G70-A permit are not applicable to the Mary Miller GRT facility:

- 40 CFR 63 Subpart HH (National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities).



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

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

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

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

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

SECTION I. GENERAL INFORMATION

| | | |
|--|--|--|
| 1. Name of applicant (as registered with the WV Secretary of State's Office): American Energy – Marcellus, LLC | | 2. Federal Employer ID No. (FEIN): 25-0724685 |
| 3. Applicant's mailing address: 301 NW 63rd St., Suite 600 Oklahoma City, OK 73116 | | 4. Applicant's physical address: Hoyt Ridge Road, Wileyville, WV |
| 5. If applicant is a subsidiary corporation, please provide the name of parent corporation: | | |
| 6. WV BUSINESS REGISTRATION. Is the applicant a resident of the State of West Virginia? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO - IF YES , provide a copy of the Certificate of Incorporation/ Organization / Limited Partnership (one page) including any name change amendments or other Business Registration Certificate as Attachment A . - IF NO , provide a copy of the Certificate of Authority / Authority of LLC / Registration (one page) including any name change amendments or other Business Certificate as Attachment A . | | |

SECTION II. FACILITY INFORMATION

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

A: PRIMARY OPERATING SITE INFORMATION

| | | |
|---|---|---|
| 11A. Facility name of primary operating site: Mary Miller GRT Natural Gas Production Facility | 12A. Address of primary operating site: Mailing: 301 NW 63rd St., Suite 600, Oklahoma City, OK 73116 Physical: Hoyt Ridge Road, Wileyville, WV | |
| 13A. Does the applicant own, lease, have an option to buy, or otherwise have control of the proposed site? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO - IF YES , please explain: The applicant leases the proposed site. - IF NO , YOU ARE NOT ELIGIBLE FOR A PERMIT FOR THIS SOURCE. | | |
| 14A. <input type="checkbox"/> 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 . From Route 7 East out of New Martinsville towards Morgantown for 17 miles. Turn right onto Barker Run Road and continue for 1.2 miles, before taking a left onto Hoyt Ridge Road. Follow Hoyt Ridge Road for three miles. Well site Mary Miller GRT will be present on your right. | | |
| 15A. Nearest city or town: Wileyville | 16A. County: Wetzel | 17A. UTM Coordinates: Northing (KM): 533.057 Easting (KM): 4,384.756 Zone: 17S |
| 18A. Briefly describe the proposed new operation or change (s) to the facility: The Mary Miller GRT natural gas production site is a proposed new facility and is planned to be operational by August 25, 2015. | | 19A. Latitude & Longitude Coordinates (NAD83, Decimal Degrees to 5 digits): Latitude: 39.61490 Longitude: -80.61380 |

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 **(NOT APPLICABLE)**
- ☒ ATTACHMENT L: GENERAL PERMIT REGISTRATION APPLICATION FEE
- ☐ ATTACHMENT M: SITING CRITERIA WAIVER **(NOT APPLICABLE)**
- ☐ ATTACHMENT N: MATERIAL SAFETY DATA SHEETS (MSDS) **(NOT APPLICABLE)**
- ☒ ATTACHMENT O: EMISSIONS SUMMARY SHEETS
- ☐ OTHER SUPPORTING DOCUMENTATION NOT DESCRIBED ABOVE (Equipment Drawings, Aggregation Discussion, etc.) **(NOT APPLICABLE)**

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 **Tim Cummings, Director, AEM**
(please print or type)

Signature _____
(please use blue ink) Authorized Representative (if applicable) Date

Applicant's Name **American Energy – Marcellus, LLC**

Phone & Fax **(405) 608-5491**
Phone Fax

Email **tim.cummings@aep-lp.com**

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| | OTHER SUPPORTING DOCUMENTATION NOT DESCRIBED ABOVE (NOT APPLICABLE) |

Attachment A

State of West Virginia



Certificate

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

AMERICAN ENERGY-MARCELLUS, LLC

Control Number: 9A5GM

a limited liability company, organized under the laws of the State of Oklahoma
has filed its "Application for Certificate of Authority" in my office according to the provisions
of West Virginia Code §31B-10-1002. I hereby declare the organization to be registered as a
foreign limited liability company from its effective date of May 6, 2014, until a certificate of
cancellation is filed with our office.

Therefore, I hereby issue this

CERTIFICATE OF AUTHORITY OF A FOREIGN LIMITED LIABILITY COMPANY

to the limited liability company authorizing it to transact business in West Virginia

*Given under my hand and the
Great Seal of the State of
West Virginia on this day of
May 6, 2014*



Secretary of State



Attachment B

Attachment B

Process Description

This permit application is being filed for American Energy – Marcellus, LLC (AEM), and addresses operational activities associated with the Mary Miller GRT natural gas production site. Incoming raw natural gas from the four (4) wells is first routed through the 1.5 MMBtu/hr gas production units (GPUs) (S001 – S004) where the first stage of fluid separation occurs. The GPUs separate the well stream flow into a high pressure natural gas sales stream and condensate liquid stream. In the second stage of separation, the liquid streams are routed through four (4) 1.5 MMBtu/hr line heaters (S005 – S008) to aid in the downstream separation process. The fluids are then routed to the 1.0 MMBtu/hr low pressure flash separator (S009) where condensate and produced water are separated. The flash from the low pressure separator is captured via two (2) flash gas compressors driven by natural gas-fired engines (S017 – S018) and routed to the sales gas pipeline. Produced water from the flash separator is routed to three (3) 400-bbl produced water storage tanks (S014 – S016). The condensate from the flash separator is routed to the three (3) 400-bbl condensate storage tanks (S011 – S013).

The natural gas stream will exit the facility for transmission via pipeline. Condensate and produced water are transported offsite via tank truck. Flashing, working, and breathing, emissions from the three (3) 400-bbl produced water storage tanks and three (3) 400-bbl condensate storage tanks will be routed to the enclosed combustion device (S019). Tank truck loading operations from the produced water loading operations (S020) and the condensate loading operations (S021) will be vapor balanced to the tanks and controlled by the enclosed combustion device (S019).

Based upon current observed daily condensate production at similar facilities, AEM does not expect the quantity of condensate production that would justify the operation of the condensate stabilizer. AEM is filling this application to account for the loading of the condensate tank directly from the flash separator. With this permitting approach, AEM is reasonably conservative in its permitting actions and has the authorization to operate the condensate stabilizer should field conditions deem it necessary.

One (1) 47 bhp Hipower prime-power natural gas generator (S022) is included in this permit application and provides power to the Mary Miller GRT natural gas production site.

Attachment C

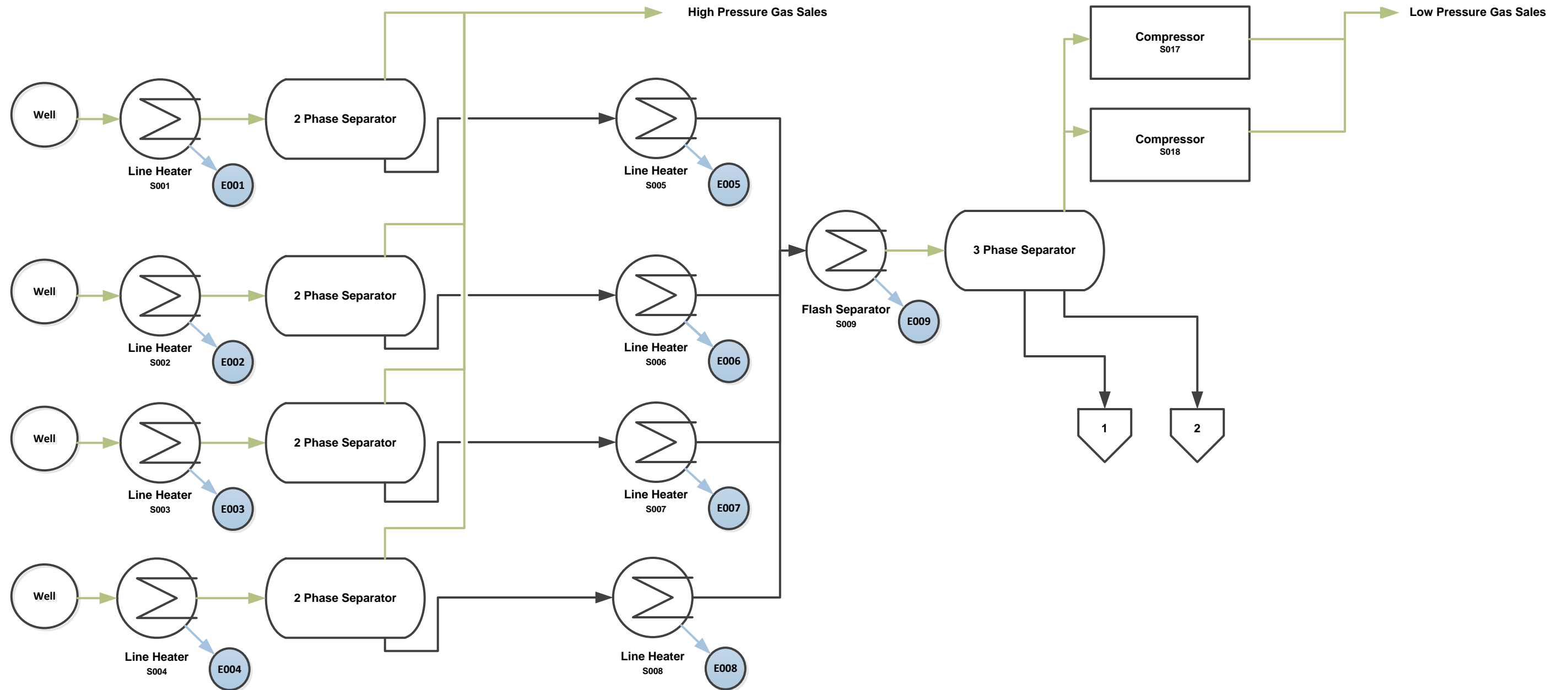
Attachment C

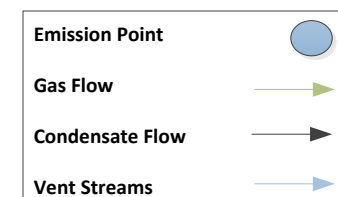
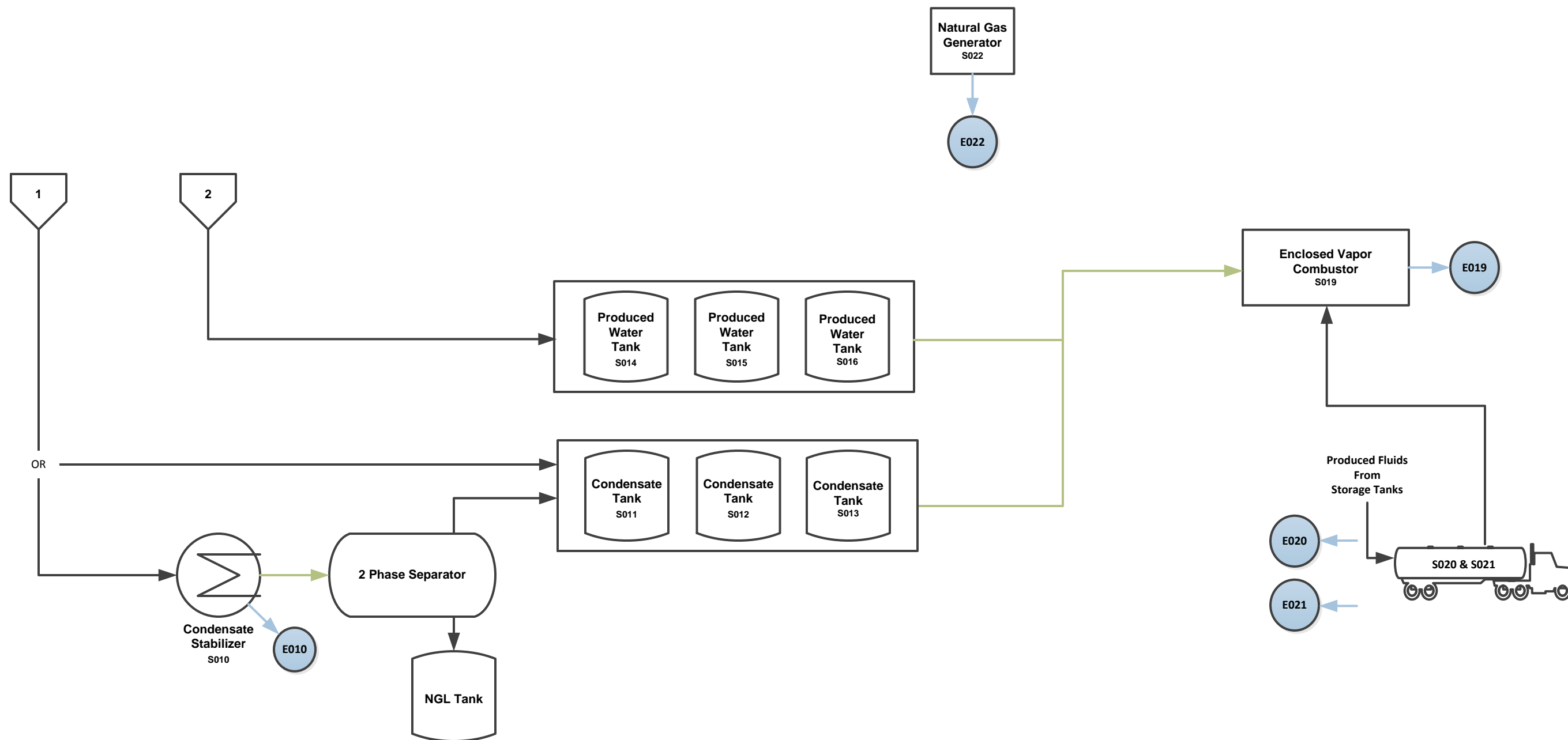
G70-A General Permit Description of Fugitive Emissions

This permit application is being filed for American Energy – Marcellus, LLC (AEM) and addresses operational activities associated with the Mary Miller GRT natural gas production site. Fugitive emissions on the site are generated from a number of sources, including an unpaved haul road and equipment leaks. These fugitive emission sources cannot be controlled by air pollution control devices. Emission levels for fugitive emissions were calculated using AP-42 emission factors, results of a gas analysis, and 40 CFR 98 Subpart W factors and equipment counts. A summary of the fugitive emissions on the Mary Miller GRT natural gas production site can be found in Attachment O – Emissions Summary Sheet.

Attachment D

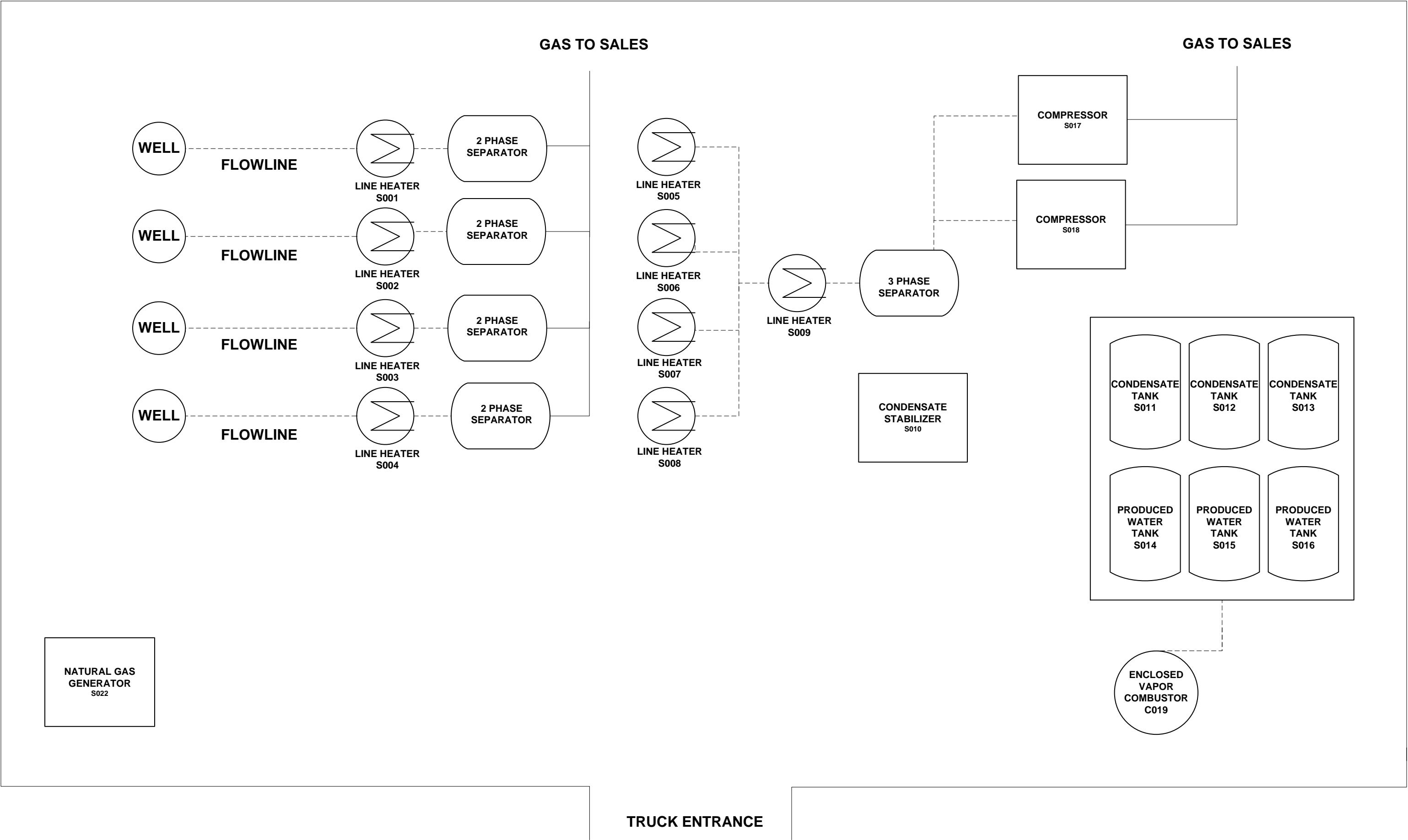
Attachment D
Mary Miller GRT Natural Gas Production
Process Flow Diagram



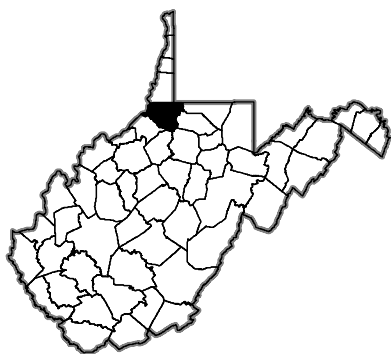


Attachment E

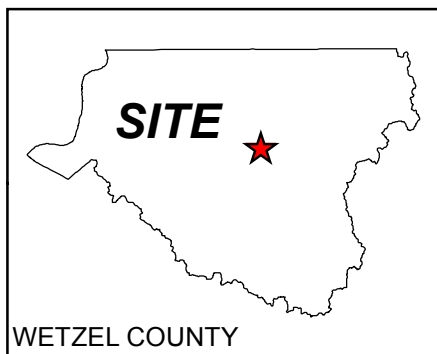
Attachment E
Plot Plan
MARY MILLER GRT Natural Gas Production Site



Attachment F

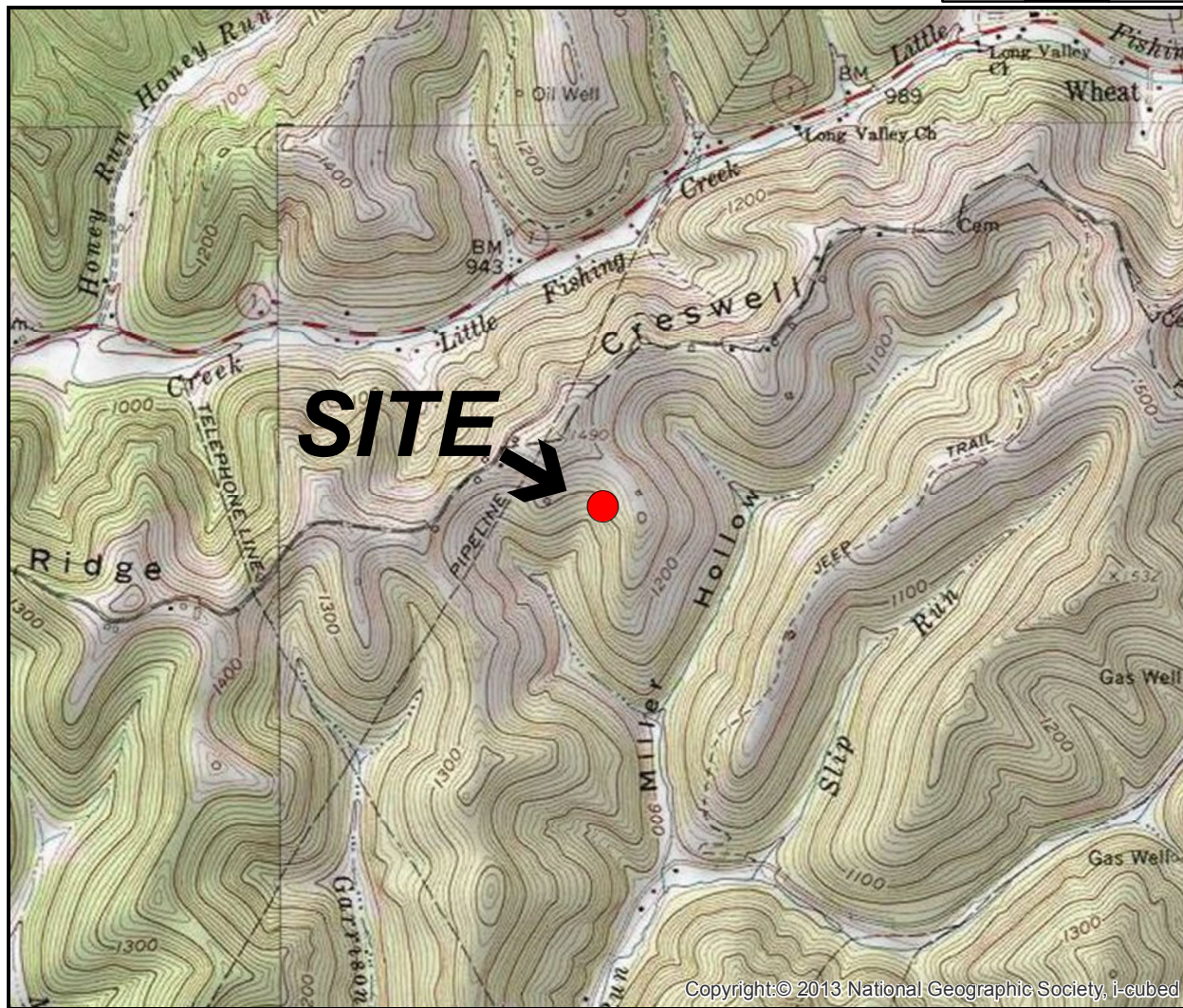


WEST VIRGINIA



WETZEL COUNTY

LAT. 39.6149 LONG. -80.6138
WILEYVILLE TOWNSHIP
WETZEL COUNTY
WEST VIRGINIA



SITE LOCATION MAP

USGS 24K QUAD GRID
PINE GROVE & BIG RUN



AMERICAN ENERGY MARCELLUS, LLC
Mary Miller GRT

HOYT RIDGE ROAD
WETZEL COUNTY, WEST VIRGINIA

Review MC

CHK'D MC

0292624

Drawn By
FB 4/7/15

Environmental Resources Management

ATTACHMENT F

Attachment G

General Permit G70-A Registration Section Applicability Form

General Permit G70-A was developed to allow qualified applicants to seek registration for a variety of sources. These sources include natural gas well affected facilities, storage tanks, natural gas-fired compressor engines (RICE), natural gas producing units, natural gas-fired in-line heaters, pneumatic controllers, heater treaters, tank truck loading, glycol dehydration units, completion combustion devices, flares, enclosed combustion devices, and vapor recovery systems. All registered facilities will be subject to Sections 1.0, 2.0, 3.0, and 4.0.

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

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

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

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

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

Emission Units Table
(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 |
|-------------------------------|--------------------------------|------------------------------|-------------------------|-----------------|--------------------------------------|-----------------------------|
| S001 | E001 | GPU Burner | 2015 | 1.50 MMBTU/hr | New | NA |
| S002 | E002 | GPU Burner | 2015 | 1.50 MMBTU/hr | New | NA |
| S003 | E003 | GPU Burner | 2015 | 1.50 MMBTU/hr | New | NA |
| S004 | E004 | GPU Burner | 2015 | 1.50 MMBTU/hr | New | NA |
| S005 | E005 | Line Heater | 2015 | 1.50 MMBTU/hr | New | NA |
| S006 | E006 | Line Heater | 2015 | 1.50 MMBTU/hr | New | NA |
| S007 | E007 | Line Heater | 2015 | 1.50 MMBTU/hr | New | NA |
| S008 | E008 | Line Heater | 2015 | 1.50 MMBTU/hr | New | NA |
| S009 | E009 | Flash Separator Heater | 2015 | 1.00 MMBTU/hr | New | NA |
| S010 | E010 | Condensate Stabilizer | 2015 | 0.75 MMBTU/hr | New | NA |
| S011 | E019 | Condensate Tank | 2015 | 400 bbl | New | C019 |
| S012 | E019 | Condensate Tank | 2015 | 400 bbl | New | C019 |
| S013 | E019 | Condensate Tank | 2015 | 400 bbl | New | C019 |
| S014 | E019 | Produced Fluids Tank | 2015 | 400 bbl | New | C019 |
| S015 | E019 | Produced Fluids Tank | 2015 | 400 bbl | New | C019 |
| S016 | E019 | Produced Fluids Tank | 2015 | 400 bbl | New | C019 |
| S017 | E017 | Compressor | 2015 | 203 bhp | New | NSCR |
| S018 | S018 | Compressor | 2015 | 203 bhp | New | NSCR |
| S019 | E019 | Enclosed Combustion Device | 2015 | 18.42 MMBTU/hr | New | NA |
| S020 | S020 | Condensate Truck Loading | 2015 | 195 bbl/day | New | C019 |
| S021 | S021 | Produced Water Truck Loading | 2015 | 195 bbl/day | New | C019 |
| S022 | S022 | Natural Gas Generator | 2015 | 47 hp | New | NA |

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.

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: | |
|---|--|
| 04710303070 | |
| 04710303071 | |
| 47110303072 | |
| 47110303073 | |
| | |
| | |
| | |

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.

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 |
|---------------------------------|---------------------------------|---|-----------------------------|--|--------------------------------|---|---|
| S001 | E001 | GPU Burner | 2015 | New | N/A | 1.5 | 1,285 |
| S002 | E002 | GPU Burner | 2015 | New | N/A | 1.5 | 1,285 |
| S003 | E003 | GPU Burner | 2015 | New | N/A | 1.5 | 1,285 |
| S004 | E004 | GPU Burner | 2015 | New | N/A | 1.5 | 1,285 |
| S005 | E005 | Line Heater | 2015 | New | N/A | 1.5 | 1,285 |
| S006 | E006 | Line Heater | 2015 | New | N/A | 1.5 | 1,285 |
| S007 | E007 | Line Heater | 2015 | New | N/A | 1.5 | 1,285 |
| S008 | E008 | Line Heater | 2015 | New | N/A | 1.5 | 1,285 |
| S009 | E009 | Flash Separator Burner | 2015 | New | N/A | 1.5 | 1,285 |
| S010 | E010 | Condensate Stabilizer Burner | 2015 | New | N/A | 0.75 | 1,285 |

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.

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. ¹ | | S022 | | | | | |
| Emission Point ID No. ² | | E022 | | | | | |
| Engine Manufacturer and Model | | Hipower HRGM 30 T6 | | | | | |
| Manufacturer's Rated bhp/rpm | | 47 bhp / 1,800 rpm | | | | | |
| Source Status ³ | | NS | | | | | |
| Date Installed/Modified/Removed ⁴ | | 2015 | | | | | |
| Engine Manufactured/Reconstruction Date ⁵ | | 2014 | | | | | |
| Is this engine subject to 40CFR60, Subpart JJJJ? | | YES | | | | | |
| Is this a Certified Stationary Spark Ignition Engine according to 40CFR60, Subpart JJJJ? (Yes or No) ⁶ | | YES | | | | | |
| Is this engine subject to 40CFR63, Subpart ZZZZ? (yes or no) | | No | | | | | |
| Engine, Fuel and Combustion Data | Engine Type ⁷ | LB4S | | | | | |
| | APCD Type ⁸ | None | | | | | |
| | Fuel Type ⁹ | PQ | | | | | |
| | H ₂ S (gr/100 scf) | 0.25 | | | | | |
| | Operating bhp/rpm | 47 bhp / 1,800 rpm | | | | | |
| | BSFC (Btu/bhp-hr) | 8,680 | | | | | |
| | Fuel throughput (ft ³ /hr) | 400 | | | | | |
| | Fuel throughput (MMft ³ /yr) | 3.5 | | | | | |
| | Operation (hrs/yr) | 8,760 | | | | | |
| Reference ¹⁰ | Potential Emissions ¹¹ | lbs/hr | tons/yr | lbs/hr | tons/yr | lbs/hr | tons/yr |
| EPA Certification | NO _x | 0.37 | 1.63 | | | | |
| EPA Certification | CO | 0.61 | 2.68 | | | | |
| EPA Certification | VOC | 0.37 | 1.63 | | | | |
| AP-42 | SO ₂ | <0.001 | 0.001 | | | | |
| AP-42 | PM ₁₀ | 0.01 | 0.02 | | | | |
| AP-42 | Formaldehyde | 0.03 | 0.12 | | | | |
| MRR ¹² | Proposed Monitoring: | AEM will comply with all monitoring requirements set forth in the issued permit. | | | | | |
| | Proposed Recordkeeping: | AEM will comply with all recordkeeping requirements set forth in the issued permit. | | | | | |
| | Proposed Reporting: | AEM will comply with all reporting requirements set forth in the issued permit. | | | | | |

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. ¹ | | S017 | | S018 | | | |
| Emission Point ID No. ² | | E017 | | E018 | | | |
| Engine Manufacturer and Model | | CAT G3306TA (1501) | | CAT G3306TA (1940) | | | |
| Manufacturer's Rated bhp/rpm | | 203 / 1800 | | 203 / 1800 | | | |
| Source Status ³ | | NS | | NS | | | |
| Date Installed/Modified/Removed ⁴ | | 2015 | | 2015 | | | |
| Engine Manufactured/Reconstruction Date ⁵ | | 8/8/2005 | | 1/21/2008 | | | |
| Is this engine subject to 40CFR60, Subpart JJJJ? | | No | | No | | | |
| Is this a Certified Stationary Spark Ignition Engine according to 40CFR60, Subpart JJJJ? (Yes or No) ⁶ | | No | | No | | | |
| Is this engine subject to 40CFR63, Subpart ZZZZ? (yes or no) | | Yes | | No | | | |
| Engine, Fuel and Combustion Data | Engine Type ⁷ | 4SRB | | 4SRB | | | |
| | APCD Type ⁸ | NSCR | | NSCR | | | |
| | Fuel Type ⁹ | PQ | | PQ | | | |
| | H ₂ S (gr/100 scf) | 0.25 | | 0.25 | | | |
| | Operating bhp/rpm | 203 / 1800 | | 203 / 1800 | | | |
| | BSFC (Btu/bhp-hr) | 8,983 | | 8,738 | | | |
| | Fuel throughput (ft ³ /hr) | 1,419 | | 1,380 | | | |
| | Fuel throughput (MMft ³ /yr) | 12.43 | | 12.09 | | | |
| | Operation (hrs/yr) | 8,760 | | 8,760 | | | |
| Reference ¹⁰ | Potential Emissions ¹¹ | lbs/hr | tons/yr | lbs/hr | tons/yr | lbs/hr | tons/yr |
| Vendor Guarantee | NO _x | 0.89 | 3.90 | 1.49 | 6.52 | | |
| Vendor Guarantee | CO | 1.78 | 7.80 | 0.16 | 0.71 | | |
| Vendor Guarantee | VOC | 0.05 | 0.24 | 0.05 | 0.22 | | |
| AP-42 | SO ₂ | 0.001 | 0.005 | 0.001 | 0.005 | | |
| AP-42 | PM ₁₀ | 0.02 | 0.08 | 0.02 | 0.07 | | |
| Vendor Guarantee | Formaldehyde | 0.11 | 0.49 | 0.07 | 0.29 | | |
| MRR ¹² | Proposed Monitoring: | AEM will comply with all monitoring requirements set forth in the issued permit. | | | | | |
| | Proposed Recordkeeping: | AEM will comply with all recordkeeping requirements set forth in the issued permit. | | | | | |
| | Proposed Reporting: | AEM will comply with all reporting requirements set forth in the issued permit. | | | | | |

TANK TRUCK LOADING EMISSION UNIT DATA SHEET

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

| | | | | |
|--|--|---|--------------|-------------|
| 1. Emission Unit ID: S020 (Condensate) | 2. Emission Point ID: E19 / E20 | 3. Year Installed/ Modified: 2015 | | |
| 4. Emission Unit Description: Condensate Truck Loading | | | | |
| 5. Loading Area Data: Adjacent to tanks | | | | |
| 5A. Number of pumps: 1 | 5B. Number of liquids loaded: 1 | 5C. Maximum number of tank trucks loading at one time: 2 | | |
| 6. Describe cleaning location, compounds and procedure for tank trucks: Transfer point is kept clear of debris. Lines are kept in good working order. | | | | |
| 7. Are tank trucks pressure tested for leaks at this or any other location? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If YES, describe: Cargo vessels are pressure tested in accordance with DOT requirements, if applicable. | | | | |
| 8. Projected Maximum Operating Schedule (for rack or transfer point as a whole): | | | | |
| Maximum | Jan. - Mar. | Apr. - June | July - Sept. | Oct. - Dec. |
| hours/day | 24 | 24 | 24 | 24 |
| days/week | 7 | 7 | 7 | 7 |

| | | | |
|---|---------------------------|--|--|
| 9. Bulk Liquid Data <i>(add pages as necessary)</i> : | | | |
| Liquid Name | Condensate Liquids | | |
| Max. daily throughput (1000 gal/day) | 5.25 | | |
| Max. annual throughput (1000 gal/yr) | 1,916 | | |
| Loading Method ¹ | SUB | | |
| Max. Fill Rate (gal/min) | 5.7 | | |
| Average Fill Time (min/loading) | 60 | | |
| Max. Bulk Liquid Temperature (°F) | 50 | | |
| True Vapor Pressure ² | 8.13 | | |
| Cargo Vessel Condition ³ | U | | |
| Control Equipment or Method ⁴ | ECD | | |
| Minimum collection efficiency (%) | 70% | | |
| Minimum control efficiency (%) | 95% | | |
| <i>* Continued on next page</i> | | | |

| | | | | |
|--|-----------------|-------------|--|--|
| Maximum Emission Rate | Loading (lb/hr) | 1.84 | | |
| | Annual (ton/yr) | 8.07 | | |
| Estimation Method ⁵ | | EPA | | |
| Notes: | | | | |
| ¹ BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill | | | | |
| ² At maximum bulk liquid temperature | | | | |
| ³ B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe) | | | | |
| ⁴ List as many as apply (complete and submit appropriate <i>Air Pollution Control Device Sheets as Attachment "H"</i>): CA = Carbon Adsorption VB = Dedicated Vapor Balance (closed system) ECD = Enclosed Combustion Device F = Flare TO = Thermal Oxidation or Incineration | | | | |
| ⁵ EPA = EPA Emission Factor as stated in AP-42 MB = Material Balance TM = Test Measurement based upon test data submittal O = other (describe) | | | | |

| | |
|--|--|
| 10. Proposed Monitoring, Recordkeeping, Reporting, and Testing Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits. | |
| MONITORING <i>Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment operation/air pollution control device.</i> The loadout operation will be visual monitored during the procedure. | RECORDKEEPING <i>Please describe the proposed recordkeeping that will accompany the monitoring.</i> Records will be kept of the amount of liquids transferred, as well as the frequency of the operation. |
| REPORTING <i>Please describe the proposed frequency of reporting of the recordkeeping.</i> Reporting of records will be performed as required by permit standards. | TESTING <i>Please describe any proposed emissions testing for this process equipment/air pollution control device.</i> Testing will be performed as required by applicable standards. |
| 11. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty: N/A | |

TANK TRUCK LOADING EMISSION UNIT DATA SHEET

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

| | | | | |
|--|--|---|--------------|-------------|
| 1. Emission Unit ID: S021 (Produced Water) | 2. Emission Point ID: E19 / E21 | 3. Year Installed/ Modified: 2015 | | |
| 4. Emission Unit Description: The emissions from truck loading. | | | | |
| 5. Loading Area Data: Adjacent to tanks | | | | |
| 5A. Number of pumps: 1 | 5B. Number of liquids loaded: 1 | 5C. Maximum number of tank trucks loading at one time: 2 | | |
| 6. Describe cleaning location, compounds and procedure for tank trucks: Transfer point is kept clear of debris. Lines are kept in good working order. | | | | |
| 7. Are tank trucks pressure tested for leaks at this or any other location? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If YES, describe: Cargo vessels are pressure tested in accordance with DOT requirements, if applicable. | | | | |
| 8. Projected Maximum Operating Schedule (for rack or transfer point as a whole): | | | | |
| Maximum | Jan. - Mar. | Apr. - June | July - Sept. | Oct. - Dec. |
| hours/day | 24 | 24 | 24 | 24 |
| days/week | 7 | 7 | 7 | 7 |

| | | | | |
|--|-----------------------|--|--|--|
| 9. Bulk Liquid Data (<i>add pages as necessary</i>): | | | | |
| Liquid Name | Produced Water | | | |
| Max. daily throughput (1000 gal/day) | 8.25 | | | |
| Max. annual throughput (1000 gal/yr) | 3,013 | | | |
| Loading Method ¹ | SUB | | | |
| Max. Fill Rate (gal/min) | 5.7 | | | |
| Average Fill Time (min/loading) | 60 | | | |
| Max. Bulk Liquid Temperature (°F) | 50 | | | |
| True Vapor Pressure ² | NA | | | |
| Cargo Vessel Condition ³ | U | | | |
| Control Equipment or Method ⁴ | ECD | | | |
| Minimum collection efficiency (%) | 70% | | | |
| Minimum control efficiency (%) | 95% | | | |
| <i>* Continued on next page</i> | | | | |

| | | | | |
|--|-----------------|-------------|--|--|
| Maximum Emission Rate | Loading (lb/hr) | 0.00 | | |
| | Annual (ton/yr) | 0.01 | | |
| Estimation Method ⁵ | | EPA | | |
| Notes: | | | | |
| ¹ BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill | | | | |
| ² At maximum bulk liquid temperature | | | | |
| ³ B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe) | | | | |
| ⁴ List as many as apply (complete and submit appropriate <i>Air Pollution Control Device Sheets as Attachment "H"</i>): CA = Carbon Adsorption VB = Dedicated Vapor Balance (closed system) ECD = Enclosed Combustion Device F = Flare TO = Thermal Oxidation or Incineration | | | | |
| ⁵ EPA = EPA Emission Factor as stated in AP-42 MB = Material Balance TM = Test Measurement based upon test data submittal O = other (describe) | | | | |

| | |
|--|---|
| 10. Proposed Monitoring, Recordkeeping, Reporting, and Testing Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits. | |
| MONITORING <i>Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment operation/air pollution control device.</i> The loadout operation will be visual monitored during the procedure. | RECORDKEEPING <i>Please describe the proposed recordkeeping that will accompany the monitoring.</i> Records will be kept of the amount of liquids transferred, as well as the frequency of the operation. Produced Water truck tickets will be maintained. Production data will be recorded. |
| REPORTING <i>Please describe the proposed frequency of reporting of the recordkeeping.</i> Reporting of records will be performed as required by permit standards. | TESTING <i>Please describe any proposed emissions testing for this process equipment/air pollution control device.</i> Testing will be performed as required by applicable standards. |
| 11. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty: N/A | |

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 | 196 | N/A | N/A | 306.31 |
| | Light Liquid VOC | -- | -- | -- | -- |
| | Heavy Liquid VOC | -- | -- | -- | -- |
| | Non-VOC | -- | -- | -- | -- |
| Safety Relief Valves ¹¹ | Gas VOC | 8 | N/A | N/A | 18.52 |
| | Non VOC | -- | -- | -- | -- |
| Open-ended Lines ¹² | VOC | 18 | N/A | N/A | 63.55 |
| | Non-VOC | -- | -- | -- | -- |
| Sampling Connections ¹³ | VOC | -- | -- | -- | -- |
| | Non-VOC | -- | -- | -- | -- |
| Compressors | VOC | -- | -- | -- | -- |
| | Non-VOC | -- | -- | -- | -- |
| Flanges | VOC | 876 | N/A | N/A | 152.11 |
| | Non-VOC | -- | -- | -- | -- |
| Other | VOC | -- | -- | -- | -- |
| | Non-VOC | -- | -- | -- | -- |

^{1 - 13} See notes on the following page.

Attachment H

AIR POLLUTION CONTROL DEVICE

Vapor Combustion Control Device Sheet

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

IMPORTANT: READ THE INSTRUCTIONS ACCOMPANYING THIS FORM BEFORE COMPLETING.

General Information

| | | | |
|--|--|---|--|
| 1. Control Device ID#: S019 / E019 | | 2. Installation Date: 01/2015 <input type="checkbox"/> New | |
| 3. Maximum Rated Total Flow Capacity: 200,000 scfd | 4. Maximum Design Heat Input: 18.42 MMBtu/hr | 5. Design Heat Content: 2,200 BTU/scf | |

Control Device Information

6. Select the type of vapor combustion control device being used: ☒ Enclosed Combustion Device
☐ Elevated Flare ☐ Ground Flare ☐ Thermal Oxidizer ☐ Completion Combustion Device

| | |
|--|--|
| 7. Manufacturer: National Oilwell Varco (NOV) Model No.: MEVC200 | 8. Hours of operation per year: 8,760 |
|--|--|

9. List the emission units whose emissions are controlled by this vapor combustion control device:
(Emission Point ID#: S011-S013, S014-S016, S020, S021)

| 10. Emission Unit ID# | Emission Source Description: | Emission Unit ID# | Emission Source Description: |
|-----------------------|------------------------------|-------------------|------------------------------|
| S011 – S013 | Produced Water Tanks | S020 | Tank Truck Loading |
| S014 – S016 | Condensate Tanks | S021 | Tank Truck Loading |
| | | | |

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

| | | | |
|---|------------------|------------------|---|
| 11. Assist Type | 12. Flare Height | 13. Tip Diameter | 14. Was the design per §60.18? |
| <input type="checkbox"/> Steam - <input type="checkbox"/> Air - <input type="checkbox"/> Pressure - <input checked="" type="checkbox"/> Non - | 20 ft | N/A ft | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

Waste Gas Information

| | | | |
|---|--|--|--|
| 15. Maximum waste gas flow rate (scfm): | 16. Heat value of waste gas stream (BTU/ft3) | 17. Temperature of the emissions stream (°F) | 18. Exit Velocity of the emissions stream (ft/s) |
| 139.6 | 1,285 | 1,400 – 2,100 | N/A |

19. Provide an attachment with the characteristics of the waste gas stream to be burned.

| Pilot Information | | | | |
|--|-----------------------------|--|------------------------------------|--|
| 20. Type/Grade of pilot fuel: | 21. Number of pilot lights: | 22. Fuel flow rate to pilot flame per pilot (scf/hr): | 23. Heat input per pilot (BTU/hr): | 24. Will automatic re-ignition be used? |
| Natural Gas | Continuous Pilot | 13.6 | 17,500 | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 25. If automatic re-ignition will be used, describe the method: | | | | |
| 26. Describe the method of controlling flame: Smokeless Capacity | | | | |
| 27. Is pilot flame equipped with a monitor to detect the presence of the flame? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | | 28. If yes, what type? <input checked="" type="checkbox"/> Thermocouple <input type="checkbox"/> Infra-Red <input type="checkbox"/> Ultra Violet <input type="checkbox"/> Camera with monitoring control room <input type="checkbox"/> Other, describe: | | |

| | | |
|--|--------------------------|--|
| 29. Pollutant(s) Controlled | 30. % Capture Efficiency | 31. Manufacturer's Guaranteed Control Efficiency (%) |
| VOC | 98 | 98 |
| | | |
| | | |
| | | |
| 32. Has the control device been tested by the manufacturer and certified? See Attached Information | | |
| 33. Describe all operating ranges and maintenance procedures required by the manufacturer to maintain warranty: See Attached Information | | |
| 34. Additional Information Attached? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Please attach a copy of manufacturer's data sheet. Please attach a copy of manufacturer's drawing. Please attach a copy of the manufacturer's performance testing. | | |

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



QUOTATION

CLIENT: American Energy Partners, LP

SUBJECT: Mission Enclosed Vapor Combustor (MEVC200)

NOV PROPOSAL: H-14100-14-200 Rev.4

| | | | | | |
|-----|---------|----|---------|----------|-----------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 0 | 5/19/14 | TW | RC | PM | Quotation |
| REV | DATE | BY | CHECKED | APPROVED | COMMENTS |

NOV
10011 MEADOWGLEN LANE, 2ND FLOOR
HOUSTON, TX 77042
TEL: 1-713-395-5000 FAX: 1-713-395-5001

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1 COMMERCIAL AND TECHNICAL

1.1 Introduction

In response to your inquiry, NOV is pleased to offer the following proposal for a NOV Mission Enclosed Vapor Combustor (MEVC). The model MEVC200 is capable of 18.42 MMBTU/HR, Medium Temperature Flares (MTF). NOV Mission offers a full line of reliable enclosed combustors for the ever changing requirements of today's regulation filled oil and gas industry. Mission's MEVC design incorporates years of experience with tank vapors with a combustor design which is highly effective, tested and certified "99%" for destruction of vent emissions from oil and condensate tank batteries, loading operations and storage facilities. NOV's stainless steel enclosed flare design is capable of meeting industry regulations while offering significant cost savings. Scalable to customer application, this flare is proven throughout the world. The following items will show the advantages and benefits to incorporating this equipment into the Storage Tank facility:

APPLICATIONS

- Associated gas
- Dehydrators
- Pipeline blow down
- Oil and condensate loading facilities
- Equipment maintenance
- Oil and condensate storage tanks

FEATURES AND BENEFITS:

- Meets EPA 40 CFR 60.00 regulations
- Remote location solar panel option available
- 98%+ destruction efficiency (independent 3rd party tested)
- Flexible & fully automated and programmable system (additional parameters optional)
- Quad O compliant ready
- Special custom application larger units available
- Low capital and operating costs
- Very high turndown ratio
- Scalable flow rates
- Field proven design
- Only requires 300 btu/ft³ gas to maintain combustion
- High Temperature Flares (HTF) with 99.99% DRE are also available

Thank you for this opportunity to quote on your combustor needs. Should you have any questions or concerns regarding the commercial terms, the scope of supply offered, or any technical points which may need clarification, please feel free to contact NOV at:

| | | |
|-----------|---|--|
| Contact | : | Pete Magnani |
| Email | : | pete.magnani@nov.com |
| Telephone | : | 1-713-395-5000 |
| Fax | : | 1-713-395-5001 |
| Address | : | 10011 Meadowglen Lane, 2 nd Floor Houston, TX 77042 USA |

1.2 Prices

Base Unit Price

| Item | Description | Quantity | Unit Price (USD) | Total Price (USD) |
|------|---|----------|------------------|-------------------|
| 1 | MEVC200, Enclosed Vapor Combustor Flow \geq 40-200MSCFD. Inlet Pressure from 2oz/in2 minimum. 20ft height, 47" OD diameter, and 3" 150#RF connection. Includes the Data logging, pressure transmitter in lieu of pressure switch, and continuous pilot. This includes 14.25" stack extension. This is a DC Control Panel unit. All as described in 1.3 below. | 1 | \$22,795.00 | \$22,795.00 |

Accessories

| Part No. | Description | Unit Price (USD) |
|-------------|---|------------------|
| MEVC200-BP | Stainless Steel Bird Screen for MEVC200 | \$913.00 |
| MEVC200-KOP | Stainless Steel Condensate Knock Out Pot for MEVC200 | \$1,500.00 |
| MEVC200-WG | Galvanized Steel Wind Guard for MEVC200 Air Intake | \$417.00 |
| MEVC200-SP | Skid mounted solar panel and battery backup for MEVC200 | \$3,920.00 |

Spare Parts

| Part No. | Description | Unit Price (USD) |
|----------|--|------------------|
| MEVC-CP | Replacement Control Panel for MEVC100 | \$3,485.00 |
| MEVC-PT | Replacement Pressure Transmitter for MEVC200 | \$535.00 |
| MEVC-TC | Replacement Thermocouple for MEVC200 | \$115.00 |
| MEVC-IC | Replacement Ignition Transformer for MEVC200 | \$360.00 |
| MEVC-IE | Replacement Ignition Electrode for MEVC200 | \$25.00 |

All prices are quoted Ex-Works manufacturing facility and exclude all taxes, import duties, freight and/or insurance charges.

1.3 Technical Summary

- **Flare Gas Stream: 5.4 MW MTF:**
 - Type: Enclosed Tank Battery Flare
 - Composition: 2200 btu/ft³ gas
 - Temperature: Ambient to 100°F +/- 20 deg°F
 - Flow Rate: up to 200,000 scfd (based on 2200 BTU /ft³ gas) or 139.6 scfm
 - Auxiliary Fuel Requirements N/A
 - Burner Size 18.42 million BTU/hr (5.4 MW)
 - Inlet Pressure Requirements 2-4 oz/in² (3.5-7.0 “w.c.)
 - Turndown Ratio 5:1
 - Data points recorded include combustion temperature, operation pressure, and run time
- **Mechanical:**
 - Design Wind Speed 100 mph
 - Ambient Temperature -20 deg F up to 110 deg F
 - Electrical Area Classification General Area Classification (non-hazardous)
 - Elevation Up to 3,000 ft ASL – please advise if higher elevation
- **Process:**
 - Smokeless Capacity 100% Sdf
 - Operating Temperature 1400 deg F to 2100 deg F (1500 deg F Nominal); Retention Time 0.3 sec.
 - Flare Inlet Pressure 2-4 oz/in² (3.5-7.0 “w.c.)
- **Utilities:**
 - Pilot Gas Process Gas
 - Electricity 24VDC Panel/ 10A (Solar Option) Auxiliary Fuel N/A
 - Instrument air/gas 80 psig for valve actuation.
- **Emissions:**
 - Destruction Efficiency: 98% DRE

1.4 Delivery

The delivery for the Equipment listed in NOV Scope of Supply is as follows:

- Delivery:
 - 2-3 weeks ARO, Ex-Works Chattanooga, TN

1.5 Commercial Clarifications/Exceptions

- 1.5.1 Terms are net 30 days:
 - 100% - Upon notice of readiness to ship.
- 1.5.2 Quoted prices exclude all taxes, import duties, freight and/or insurance charges.
- 1.5.3 Delivery to be confirmed upon acceptance of purchase order.
- 1.5.4 NOV Worldwide Terms and Conditions shall apply.

1.5.7 NOV standard documentation will apply.

1.6 Quotation Validity

Validity is 30 days from the date of this proposal.

1.7 Service

Available upon request.

2 ATTACHMENTS

2.1 NOV Documents

- NOV Terms and Conditions

Attachment I

GPUs S001, S002, S003, S004 / Line Heaters S005, S006, S007, S008

| Pollutant | Emission Factor | Emission Factor Units | Emission Factor Basis / Source | Boiler Rating (MMBtu/hr) | Heat Value of Natural Gas (Btu/scf) | Annual Operating Hours | Max. Hourly Emissions. (lb/hr) | Max. Annual Emissions. (tpy) |
|-------------------------|-----------------|-----------------------------|--------------------------------|--------------------------|-------------------------------------|------------------------|--------------------------------|------------------------------|
| VOC's | 5.5 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | 0.006 | 0.03 |
| Hexane | 1.8 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | 0.002 | 0.009 |
| Formaldehyde | 0.075 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | <0.001 | <0.001 |
| Benzene | 0.0021 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | <0.001 | <0.001 |
| Toluene | 0.0034 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | <0.001 | <0.001 |
| Pb | 0.0005 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | <0.001 | <0.001 |
| CO | 84 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | 0.10 | 0.43 |
| NOx | 100 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | 0.12 | 0.51 |
| PM ₁₀ | 7.6 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | 0.009 | 0.04 |
| SO ₂ | 0.6 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.50 | 1,285 | 8,760 | <0.001 | 0.003 |
| CO ₂ | 53.06 | kg CO ₂ / MMBtu | 40 CFR Subpart C | 1.50 | 1,285 | 8,760 | 175.47 | 768.54 |
| CH ₄ | 0.001 | kg CH ₄ / MMBtu | 40 CFR Subpart C | 1.50 | 1,285 | 8,760 | 0.003 | 0.01 |
| N ₂ O | 0.0001 | kg N ₂ O / MMBtu | 40 CFR Subpart C | 1.50 | 1,285 | 8,760 | <0.001 | 0.001 |
| Total HAPs | | | | | | | 0.002 | 0.010 |
| Total CO ₂ e | | | | | | | 175.65 | 769.33 |

- Notes:**
- Emission rates displayed above represent the maximum hourly and maximum annual emissions for one line heater. Cumulative emission rates for all line heaters are displayed in the Total Site Emissions Table.
 - Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
 - AP-42, Chapter 1.4 references are from the July 1998 revision.
 - Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
 - CO₂ equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298

Example Equations:
Max. Hourly Emission Rate (lb/hr) = Emission Factor (lb/10⁶ scf) ÷ Heating Value of Natural Gas (Btu/scf) x Boiler Rating (MMBtu/hr)

Flash Separator S009

| Pollutant | Emission Factor | Emission Factor Units | Emission Factor Basis / Source | Boiler Rating (MMBtu/hr) | Heat Value of Natural Gas (Btu/scf) | Annual Operating Hours | Max. Hourly Emissions. (lb/hr) | Max. Annual Emissions. (tpy) |
|-------------------------|-----------------|-----------------------------|--------------------------------|--------------------------|-------------------------------------|------------------------|--------------------------------|------------------------------|
| VOC's | 5.5 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | 0.004 | 0.02 |
| Hexane | 1.8 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | 0.001 | 0.006 |
| Formaldehyde | 0.075 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | <0.001 | <0.001 |
| Benzene | 0.0021 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | <0.001 | <0.001 |
| Toluene | 0.0034 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | <0.001 | <0.001 |
| Pb | 0.0005 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | <0.001 | <0.001 |
| CO | 84 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | 0.07 | 0.29 |
| NOx | 100 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | 0.08 | 0.34 |
| PM ₁₀ | 7.6 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | 0.006 | 0.03 |
| SO ₂ | 0.6 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 1.00 | 1,285 | 8,760 | <0.001 | 0.002 |
| CO ₂ | 53.06 | kg CO ₂ / MMBtu | 40 CFR Subpart C | 1.00 | 1,285 | 8,760 | 116.98 | 512.36 |
| CH ₄ | 0.001 | kg CH ₄ / MMBtu | 40 CFR Subpart C | 1.00 | 1,285 | 8,760 | 0.002 | 0.01 |
| N ₂ O | 0.0001 | kg N ₂ O / MMBtu | 40 CFR Subpart C | 1.00 | 1,285 | 8,760 | <0.001 | <0.001 |
| Total HAPs | | | | | | | 0.001 | 0.006 |
| Total CO ₂ e | | | | | | | 117.10 | 512.89 |

Notes:
-Emission rates displayed above represent the max. hourly and max. annual emissions for one line heater.
-Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
-AP-42, Chapter 1.4 references are from the July 1998 revision.
Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
-CO₂ equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298

Example Equations:
Max. Hourly Emission Rate (lb/hr) = Emission Factor (lb/10⁶ scf) ÷ Heating Value of Natural Gas (Btu/scf) x Boiler Rating (MMBtu/hr)

Condensate Stabilizer S010

| Pollutant | Emission Factor | Emission Factor Units | Emission Factor Basis / Source | Boiler Rating (MMBtu/hr) | Heat Value of Natural Gas (Btu/scf) | Annual Operating Hours | Max. Hourly Emissions. (lb/hr) | Max. Annual Emissions. (tpy) |
|-------------------------|-----------------|-----------------------------|--------------------------------|--------------------------|-------------------------------------|------------------------|--------------------------------|------------------------------|
| VOC's | 5.5 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | 0.003 | 0.01 |
| Hexane | 1.8 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | 0.001 | 0.005 |
| Formaldehyde | 0.075 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | <0.001 | <0.001 |
| Benzene | 0.0021 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | <0.001 | <0.001 |
| Toluene | 0.0034 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | <0.001 | <0.001 |
| Pb | 0.0005 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | <0.001 | <0.001 |
| CO | 84 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | 0.05 | 0.21 |
| NOx | 100 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | 0.06 | 0.26 |
| PM ₁₀ | 7.6 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | 0.004 | 0.02 |
| SO ₂ | 0.6 | lb/10 ⁶ scf | AP-42 Chapter 1.4 | 0.75 | 1,285 | 8,760 | <0.001 | 0.002 |
| CO ₂ | 53.06 | kg CO ₂ / MMBtu | 40 CFR Subpart C | 0.75 | 1,285 | 8,760 | 87.73 | 384.27 |
| CH ₄ | 0.001 | kg CH ₄ / MMBtu | 40 CFR Subpart C | 0.75 | 1,285 | 8,760 | 0.002 | 0.01 |
| N ₂ O | 0.0001 | kg N ₂ O / MMBtu | 40 CFR Subpart C | 0.75 | 1,285 | 8,760 | <0.001 | <0.001 |
| Total HAPs | | | | | | | 0.001 | 0.005 |
| Total CO ₂ e | | | | | | | 87.82 | 384.67 |

Notes:
-Emission rates displayed above represent the max. hourly and max. annual emissions for one line heater.
-Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
-AP-42, Chapter 1.4 references are from the July 1998 revision.
Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
-CO₂ equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298

Example Equations:
Max. Hourly Emission Rate (lb/hr) = Emission Factor (lb/10⁶ scf) ÷ Heating Value of Natural Gas (Btu/scf) x Boiler Rating (MMBtu/hr)

Natural Gas Generator S022

| Pollutant | Emission Factor | Emission Factor Units | Emission Factor Basis / Source | Engine Rating (bhp) | Fuel Consumption (Btu/bhp-hr) | Heat Value of Natural Gas (Btu/scf) | Annual Operating Hours | Max. Hourly Emissions. (lb/hr) | Max. Annual Emissions. (tpy) |
|-------------------------|-----------------|-----------------------------|--------------------------------------|---------------------|-------------------------------|-------------------------------------|------------------------|--------------------------------|------------------------------|
| VOC's | 3.6 | g/bhp-hr | Vendor Guarantee (EPA Certification) | 47.0 | 10,936 | 1,285 | 8,760 | 0.37 | 1.63 |
| Hexane | 1.11E-03 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | 0.002 |
| Formaldehyde | 5.28E-02 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | 0.03 | 0.12 |
| Benzene | 4.40E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | <0.001 |
| Toluene | 4.08E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | <0.001 |
| Ethylbenze | 3.97E-05 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | <0.001 |
| Xylene | 1.84E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | <0.001 |
| CO | 5.90 | g/bhp-hr | Vendor Guarantee (EPA Certification) | 47.0 | 10,936 | 1,285 | 8,760 | 0.61 | 2.68 |
| NOx | 3.60 | g/bhp-hr | Vendor Guarantee (EPA Certification) | 47.0 | 10,936 | 1,285 | 8,760 | 0.37 | 1.63 |
| PM ₁₀ | 9.91E-03 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | 0.01 | 0.02 |
| SO ₂ | 5.88E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | 0.001 |
| CO ₂ | 53.06 | kg CO ₂ / MMBtu | 40 CFR Subpart C | 47.0 | 10,936 | 1,285 | 8,760 | 57.77 | 253.03 |
| CH ₄ | 0.001 | kg CH ₄ / MMBtu | 40 CFR Subpart C | 47.0 | 10,936 | 1,285 | 8,760 | 0.001 | 0.005 |
| N ₂ O | 0.0001 | kg N ₂ O / MMBtu | 40 CFR Subpart C | 47.0 | 10,936 | 1,285 | 8,760 | <0.001 | <0.001 |
| Total HAPs | | | | | | | | 0.03 | 0.12 |
| Total CO ₂ e | | | | | | | | 57.83 | 253.30 |

- Notes:**
- Emission rates displayed above represent the max. hourly and max. annual emissions for one NG generator.
 - Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
 - AP-42, Chapter 3.2, Table 3.2-2 - Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines
 - Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
 - CO₂ equivalency solved for using Global Warming Potentials found in 40 CFR 98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298
 - Vendor Guarantee Emissions are listed in Attachment I
 - Vendor Guarantee Emissions are converted from g/kW-hr to g/bhp-hr. 1 kW = 1.34 bhp

Example Equations:
Max. Hourly Emission Rate (lb/hr) = Emission Factor (lb/10⁶ scf) ÷ Heating Value of Natural Gas (Btu/scf) x Boiler Rating (MMBtu/hr)

Natural Gas Compressor Engine (1501) S017

| Pollutant | Emission Factor | Emission Factor Units | Emission Factor Basis / Source | Engine Rating (bhp) | Fuel Consumption (Btu/bhp-hr) | Heat Value of Natural Gas (Btu/scf) | Annual Operating Hours | Catalytic Converter Reduction Percentage | Precombustion Hourly Emissions (lb/hr) | Precombustion Annual Emissions (tpy) | Post-Combustion Hourly Emissions. (lb/hr) | Post-Combustion Annual Emissions. (tpy) |
|-------------------------|-----------------|-----------------------------|--------------------------------|---------------------|-------------------------------|-------------------------------------|------------------------|--|--|--------------------------------------|---|---|
| VOC's | 1.20E-01 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.05 | 0.24 | 0.05 | 0.24 |
| Formaldehyde | 2.50E-01 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.11 | 0.49 | 0.11 | 0.49 |
| Benzene | 1.58E-03 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.003 | 0.01 | 0.003 | 0.013 |
| Toluene | 5.58E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.001 | 0.004 | 0.001 | 0.004 |
| Ethylbenze | 2.48E-05 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,983 | 1,285 | 8,760 | 0% | <0.001 | <0.001 | <0.001 | <0.001 |
| Xylene | 1.95E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,983 | 1,285 | 8,760 | 0% | <0.001 | 0.002 | <0.001 | 0.002 |
| CO | 16.57 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,983 | 1,285 | 8,760 | 76% | 7.42 | 7.80 | 1.78 | 7.80 |
| NOx | 16.57 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,983 | 1,285 | 8,760 | 88% | 7.42 | 3.90 | 0.89 | 3.90 |
| PM ₁₀ | 9.50E-03 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.02 | 0.08 | 0.02 | 0.08 |
| SO ₂ | 5.88E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.001 | 0.005 | 0.001 | 0.005 |
| CO ₂ | 53.06 | kg CO ₂ / MMBtu | 40 CFR Subpart C | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 204.96 | 897.71 | 204.96 | 897.71 |
| CH ₄ | 0.001 | kg CH ₄ / MMBtu | 40 CFR Subpart C | 203.0 | 8,983 | 1,285 | 8,760 | 0% | 0.004 | 0.017 | 0.004 | 0.02 |
| N ₂ O | 0.0001 | kg N ₂ O / MMBtu | 40 CFR Subpart C | 203.0 | 8,983 | 1,285 | 8,760 | 0% | <0.001 | 0.002 | <0.001 | 0.002 |
| Total HAPs | | | | | | | | | 0.12 | 0.51 | 0.12 | 0.51 |
| Total CO ₂ e | | | | | | | | | 205.17 | 898.63 | 205.17 | 898.63 |

- Notes:**
- Emission rates displayed above represent the max. hourly and max. annual emissions for one NG compressor.
 - Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
 - AP-42, Chapter 3.2, Table 3.2-3 - Uncontrolled Emission Factors for 4-Stroke Rich Burn Engines
 - Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
 - CO₂ equivalency solved for using Global Warming Potentials found in 40 CFR 98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298
 - Vendor Guarantee Emissions are listed in Attachment I
 - Vendor Guarantee Emissions are converted from g/kW-hr to g/bhp-hr. 1 kW = 1.34 bhp

Example Equations:
Max. Hourly Emission Rate (lb/hr) = Emission Factor (lb/10⁶ scf) ÷ Heating Value of Natural Gas (Btu/scf) x Boiler Rating (MMBtu/hr)

Natural Gas Compressor Engine (1940) S018

| Pollutant | Emission Factor | Emission Factor Units | Emission Factor Basis / Source | Engine Rating (bhp) | Fuel Consumption (Btu/bhp-hr) | Heat Value of Natural Gas (Btu/scf) | Annual Operating Hours | Catalytic Converter Reduction Percentage | Precombustion Hourly Emissions (lb/hr) | Precombustion Annual Emissions (tpy) | Post-Combustion Hourly Emissions (lb/hr) | Post-Combustion Annual Emissions (tpy) |
|-------------------------|-----------------|-----------------------------|--------------------------------|---------------------|-------------------------------|-------------------------------------|------------------------|--|--|--------------------------------------|--|--|
| VOC's | 1.10E-01 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 0.05 | 0.22 | 0.05 | 0.22 |
| Formaldehyde | 1.50E-01 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 0.07 | 0.29 | 0.07 | 0.29 |
| Benzene | 1.58E-03 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 0.003 | 0.01 | 0.003 | 0.01 |
| Toluene | 5.58E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,738 | 1,285 | 8,760 | 0% | <0.001 | 0.004 | <0.001 | 0.004 |
| Ethylbenze | 2.48E-05 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,738 | 1,285 | 8,760 | 0% | <0.001 | <0.001 | <0.001 | <0.001 |
| Xylene | 1.95E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,738 | 1,285 | 8,760 | 0% | <0.001 | 0.002 | <0.001 | 0.002 |
| CO | 1.50 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,738 | 1,285 | 8,760 | 76% | 0.67 | 2.94 | 0.16 | 0.71 |
| NOx | 27.71 | g/bhp-hr | Vendor Guarantee | 203.0 | 8,738 | 1,285 | 8,760 | 88% | 12.40 | 54.33 | 1.49 | 6.52 |
| PM ₁₀ | 9.50E-03 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 0.02 | 0.07 | 0.02 | 0.07 |
| SO ₂ | 5.88E-04 | lb/MMBtu | AP-42 Chapter 3.2 | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 0.001 | 0.005 | 0.001 | 0.005 |
| CO ₂ | 53.06 | kg CO ₂ / MMBtu | 40 CFR Subpart C | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 199.37 | 873.22 | 199.37 | 873.22 |
| CH ₄ | 0.001 | kg CH ₄ / MMBtu | 40 CFR Subpart C | 203.0 | 8,738 | 1,285 | 8,760 | 0% | 0.004 | 0.016 | 0.004 | 0.02 |
| N ₂ O | 0.0001 | kg N ₂ O / MMBtu | 40 CFR Subpart C | 203.0 | 8,738 | 1,285 | 8,760 | 0% | <0.001 | 0.002 | <0.001 | 0.002 |
| Total HAPs | | | | | | | | | 0.07 | 0.31 | 0.07 | 0.31 |
| Total CO ₂ e | | | | | | | | | 199.57 | 874.12 | 199.57 | 874.12 |

- Notes:**
- Emission rates displayed above represent the max. hourly and max. annual emissions for one NG compressor.
 - Greenhouse Gas Emissions are calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
 - AP-42, Chapter 3.2, Table 3.2-3 - Uncontrolled Emission Factors for 4-Stroke Rich Burn Engines
 - Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
 - CO₂ equivalency solved for using Global Warming Potentials found in 40 CFR 98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298
 - Vendor Guarantee Emissions are listed in Attachment I
 - Vendor Guarantee Emissions are converted from g/kW-hr to g/bhp-hr. 1 kW = 1.34 bhp

Example Equations:
Max. Hourly Emission Rate **(lb/hr)** = Emission Factor **(lb/10⁶ scf)** ÷ Heating Value of Natural Gas **(Btu/scf)** x Boiler Rating **(MMBtu/hr)**

Condensate Tanks S011, S012, S013

| Pollutant | Max. Hourly Emissions using E&P Tanks (lb/hr) | Max. Yearly Emissions using E&P Tanks (tons/yr) |
|-------------------------|---|---|
| VOCs | 50.63 | 221.74 |
| HAPs | 1.28 | 5.59 |
| CO ₂ | 0.00 | 0.00 |
| CH ₄ | 0.40 | 1.76 |
| Total CO ₂ e | 10.03 | 43.91 |

Notes:
-Emission rates for Condensate Tanks S011, S012, and S013 were calculated using E&P Tanks software. E&P Tanks software output sheets for the Mary Miller GRT Pad are attached.
-The emission rates displayed above are pre-control device emissions.
-CO₂ equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298
-For emission calculation purposes, the total throughput for the condensate tanks is modeled as being received through a single tank. The throughput value represents the total throughput for all three (3) 400-barrel tanks. Therefore, emission rates represent a total from all condensate tanks located on the well pad. Actual throughput for each tank will vary based on operations.

Produced Water Tanks S014, S015, S016

| Pollutant | Max. Hourly Emissions using E&P Tanks (lb/hr) | Max. Yearly Emissions using E&P Tanks (tons/yr) |
|-------------------------|---|---|
| VOCs | 0.81 | 3.55 |
| HAPs | 0.02 | 0.09 |
| CO ₂ | 0.000 | 0.000 |
| CH ₄ | 0.006 | 0.03 |
| Total CO ₂ e | 0.15 | 0.66 |

Notes:
-Emission rates for Produced Water Tanks S014, S015, S016 were calculated using E&P Tanks software. E&P Tanks output sheets for the Mary Miller GRT Pad are attached.
Emissions were calculated using Engineering Estimates to establish input to the E&P Tanks software. AEM has applied an industry standard assumption that 1% of the produced water realized in the tank will be condensate, based upon imperfect fluid separation. AEM believes that this is a conservative estimation, since the Mary Miller GRT natural gas production facility utilizes 2 stages of fluid separation.
-The emission rates displayed above are pre-control device emissions.
-CO₂ equivalency solved for using Global Warming Potentials found in 40CFR98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298
-For emission calculation purposes, the total throughput for all produced water tanks is modeled as being received through a single tank. The throughput value represents the total throughput for all three (3) 400-barrel tanks. Therefore, emission rates represent a total from all produced water tanks located on the well pad. Actual throughput for each tank will vary based on operations.

Tank Loading Operations S018 - S019

| Unit ID | Description | S, Saturation Factor | P, psia | MW (lb/lb-mol) | Temperature (°F) | Temperature (°R) | L (lb/Mgal) | Throughput (Mgal/yr) | VOC (tpy) | HAP (tpy) | CO ₂ (tpy) | CH ₄ (tpy) |
|---------|--------------------------|----------------------|---------|----------------|------------------|------------------|-------------|----------------------|-----------|-----------|-----------------------|-----------------------|
| S020 | Condensate Truck Loading | 0.6 | 8.13 | 96.24 | 50 | 510 | 11.48 | 1,916 | 8.07 | 0.21 | 0.000 | 0.23 |
| S021 | Produced Water Loading | 0.6 | 0.24 | 18.02 | 50 | 510 | 0.06 | 3,013 | 0.07 | 0.002 | 0.000 | 0.002 |

| Total VOC Emissions from Condensate Truck Loading Operations | | | | | | | | | | |
|--|-------------------------------|--------------------------------|-----------------------------|---|--|--|--|--|----------------|---------------|
| Pollutant | Max. Hourly Emissions (lb/hr) | Max Annual Emissions (tons/yr) | Vapor Collection Efficiency | Enclosed Combustion Device Combusion Efficiency | Post-Control Max. Hourly Emissions (lb/hr) | Post-Control Max. Annual Emissions (tons/yr) | Max. Hourly Uncaptured Emissions (lb/hr) | Max. Annual Uncaptured Emissions (tons/yr) | Gas Stream | Mole Fraction |
| VOCs | 1.84 | 8.07 | 70% | 98% | 0.03 | 0.11 | 0.55 | 2.42 | Methane | 0.02 |
| HAPs | 0.05 | 0.21 | 70% | 98% | <0.001 | 0.003 | 0.014 | 0.06 | Ethane | 0.22 |
| CO ₂ | <0.001 | <0.001 | 70% | 98% | 26.14 | 114.50 | <0.001 | <0.001 | Propane | 0.40 |
| CH ₄ | 0.05 | 0.23 | 70% | 98% | <0.001 | 0.003 | 0.015 | 0.07 | Butane | 0.23 |
| Total CO ₂ e | 1.29 | 5.64 | -- | -- | 26.16 | 114.58 | 0.39 | 1.69 | Pentanes | 0.08 |
| | | | | | | | | | Hexane | 0.02 |
| | | | | | | | | | Carbon Dioxide | 0.000 |

| Total Emissions from Produced Water Truck Loading Operations | | | | | | | | | | | |
|--|-------------------------------|--------------------------------|-----------------------------|---|--|--|--|--|----------------------|-----------------------|------------------|
| Pollutant | Max. Hourly Emissions (lb/hr) | Max Annual Emissions (tons/yr) | Vapor Collection Efficiency | Enclosed Combustion Device Combusion Efficiency | Post-Control Max. Hourly Emissions (lb/hr) | Post-Control Max. Annual Emissions (tons/yr) | Max. Hourly Uncaptured Emissions (lb/hr) | Max. Annual Uncaptured Emissions (tons/yr) | Vent Gas Properties | Mass Flowrate (lb/hr) | Density (lb/ft³) |
| VOCs | 0.002 | 0.01 | 70% | 98% | <0.001 | <0.001 | <0.001 | 0.002 | | | |
| HAPs | <0.001 | 0.002 | 70% | 98% | <0.001 | <0.001 | <0.001 | <0.001 | | | |
| CO ₂ | <0.001 | <0.001 | 70% | 98% | 2.16 | 9.48 | <0.001 | <0.001 | | | |
| CH ₄ | <0.001 | 0.002 | 70% | 98% | <0.001 | <0.001 | <0.001 | <0.001 | | | |
| Total CO ₂ e | 0.01 | 0.05 | -- | -- | 2.16 | 9.48 | 0.003 | 0.01 | | | |
| | | | | | | | | | Condensate Unloading | 11.00 | 0.10 |
| | | | | | | | | | Produced Unloading | 0.92 | 0.10 |

Notes:

- Emission rates for liquid unloading operations were calculated using E&P Tanks software. E&P Tanks summary sheets are attached.
- The gas composition for Tank Truck Unloading events is assumed to be similar to the working and breathing losses solved in the E&P Tank simulation.

Enclosed Combustion Devices S019

| Emissions from Tanks | | | | | | | Gas Composition of Vent Gas | | | |
|---|-------------------|---|--|--|-------------------------------|---------------------------------|-----------------------------|------------------------|-------------------------------|--|
| Input to Enclosed Combustion Device | Pollutant | Pollutant Loading Rate to Enclosed Combustion Device (lbs/hr) | Pollutant Loading Rate to Enclosed Combustion Device (tons/year) | Enclosed Combustion Device Combustion Efficiency | Max. Hourly Emissions (lb/hr) | Max. Annual Emissions (tons/yr) | Gas Stream | Mole Fraction | | |
| Condensate Tanks (S011, S012, S013) | VOCs | 50.63 | 221.74 | 98% | 1.01 | 4.43 | Methane | 0.02 | | |
| | HAPs | 1.28 | 5.59 | 98% | 0.03 | 0.11 | Ethane | 0.22 | | |
| | CO ₂ | <0.001 | <0.001 | 98% | 112.03 | 490.68 | Propane | 0.40 | | |
| | CH ₄ | 0.40 | 1.76 | 98% | 0.01 | 0.04 | Butane | 0.23 | | |
| Produced Water Tanks (S014, S015, S016) | VOCs | 0.81 | 3.55 | 98% | 0.02 | 0.07 | Pentanes | 0.08 | | |
| | HAPs | 0.02 | 0.09 | 98% | <0.001 | 0.002 | Hexane | 0.02 | | |
| | CO ₂ | <0.001 | <0.001 | 98% | 3.09 | 13.54 | Carbon Dioxide | 0.000 | | |
| | CH ₄ | 0.01 | 0.03 | 98% | <0.001 | <0.001 | Vent Gas Properties | | | |
| Truck Loading - (S020) Condensate Loading | VOCs | 1.29 | 5.65 | 98% | 0.03 | 0.11 | Vent Gas Properties | Mass Flow Rate (lb/hr) | Density (lb/ft ³) | |
| | HAPs | 0.03 | 0.14 | 98% | <0.001 | 0.00 | | | | |
| | CO ₂ | <0.001 | <0.001 | 98% | 26.14 | 114.50 | | | | |
| | CH ₄ | 0.04 | 0.16 | 98% | <0.001 | 0.00 | Condensate Tank | 32.99 | 0.10 | |
| Truck Loading - (S021) Produced Water Loading | VOCs | 0.00 | 0.005 | 98% | <0.001 | <0.001 | Produced Water Tank | 0.92 | 0.10 | |
| | HAPs | <0.001 | 0.001 | 98% | <0.001 | <0.001 | | | | |
| | CO ₂ | <0.001 | <0.001 | 98% | 2.16 | 9.48 | | | | |
| | CH ₄ | <0.001 | 0.001 | 98% | <0.001 | <0.001 | | | | |
| Totals | VOCs | 52.73 | 230.94 | -- | 1.05 | 4.62 | | | | |
| | HAPs | 1.33 | 5.83 | -- | 0.03 | 0.12 | | | | |
| | CO ₂ | <0.001 | <0.001 | -- | 143.43 | 628.21 | | | | |
| | CH ₄ | 0.44 | 1.94 | -- | 0.01 | 0.04 | | | | |
| | CO ₂ e | 11.08 | 48.55 | -- | 143.65 | 629.18 | | | | |

Emissions from Pilot Operations

| Pollutant | Emission Factor (lb/10 ⁶ scf) | Emission Factors (kg X/MMBtu) | Heat Value of Natural Gas (Btu/scf) | Enclosed Ground Flare Pilot Rating (Btu/hr) | Enclosed Ground Flare Burner Rating (Btu/hr) | Pilot Max. Hourly Emissions (lb/yr) | Pilot Max. Hourly Emissions (tons/yr) | Burner Max. Hourly Emissions (lb/hr) | Burner Max. Annual Emissions (tons/hr) | Max. Hourly Emissions (lb/hr) | Max. Annual Emissions (tons/yr) |
|-------------------|--|-------------------------------|-------------------------------------|---|--|-------------------------------------|---------------------------------------|--------------------------------------|--|-------------------------------|---------------------------------|
| VOCs | 5.5 | -- | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.08 | 0.35 | 0.08 | 0.35 |
| Hexane | 1.8 | -- | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.03 | 0.11 | 0.03 | 0.11 |
| Formaldehyde | 0.075 | -- | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.001 | 0.005 | 0.001 | 0.005 |
| CO | 84 | -- | 1,285 | 17,500 | 18,420,000 | 0.001 | 0.01 | 1.20 | 5.27 | 1.21 | 5.28 |
| NO _x | 100 | -- | 1,285 | 17,500 | 18,420,000 | 0.001 | 0.01 | 1.43 | 6.28 | 1.43 | 6.28 |
| PM ₁₀ | 7.6 | -- | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.11 | 0.48 | 0.11 | 0.48 |
| SO ₂ | 0.6 | -- | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.009 | 0.04 | 0.009 | 0.04 |
| CO ₂ | -- | 52 | 1,285 | 17,500 | 18,420,000 | 2.01 | 8.80 | 1,937.51 | 8,486.30 | 1,939.52 | 8,495.10 |
| CH ₄ | -- | 0.0 | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.04 | 0.16 | 0.04 | 0.16 |
| N ₂ O | -- | <0.001 | 1,285 | 17,500 | 18,420,000 | <0.001 | <0.001 | 0.004 | 0.02 | 0.004 | 0.02 |
| Total HAPs | | | | | | <0.001 | <0.001 | 0.03 | 0.12 | 0.03 | 0.12 |
| CO ₂ e | | | | | | 2.01 | 8.81 | 1,939.55 | 8,495.24 | 1,941.56 | 8,504.04 |

| Total Enclosed Combustion Device Emissions | | |
|--|-------------------------------|---------------------------------|
| Pollutant | Max. Hourly Emissions (lb/hr) | Max. Annual Emissions (tons/yr) |
| VOCs | 1.13 | 4.96 |
| HAPs | 0.05 | 0.23 |
| CO | 1.21 | 5.28 |
| NOx | 1.43 | 6.28 |
| PM ₁₀ | 0.11 | 0.48 |
| SO ₂ | 0.01 | 0.04 |
| CO ₂ | 2,082.95 | 9,123.31 |
| CH ₄ | 0.05 | 0.20 |
| N ₂ O | 0.004 | 0.02 |
| CO ₂ e | 2,085.21 | 9,133.22 |

Notes:

- Emissions from Enclosed Combustion Device Operations from AP-42, Chapter 1.4 references are from the July 1998 revision.
- Greenhouse Gas Emissions from the Enclosed Combustion Device Pilot and Burner calculated using 40 CFR 98 Subpart C Table C-1 and C-2 emission factors.
- Max. Annual Emissions based upon Max. Hourly Emissions @ 8760 hr/yr.
- CO₂ equivalency solved for using Global Warming Potentials found in 40 CFR 98 Table A-1 (Updated January 2014). GWP CO₂=1, GWP CH₄=25, GWP N₂O=298

Example Calculations:

Emissions from Tanks VOCs (lb/hr) = Amount of Gas sent to Enclosed Combustion Device (lb/hr) x 0.02 = Max. Hourly Emissions (lb/hr)

Emissions from Enclosed Combustion Device Operations (lb/hr) = Emission factor (lb/106 Btu) x Heat Value of Natural Gas (Btu/scf) ÷ 1,000,000 x Enclosed Combustion Device Pilot Gas Usage (mcf/d) x 1,000 ÷ 24

Emissions from Enclosed Combustion Device Vapor Destruction CO2 Methodologies shown below sample equation

Emissions from Enclosed Combustion Device Operations CO₂ (tons/yr) = ((Enclosed Combustion Device Pilot Gas Usage (mcf/d) x 1,000 x 365 x Fraction of Gas Combusted by Enclosed Combustion Device x Mole Fraction of Methane x Number of Carbon Atoms in Methane) + ... + (Enclosed Combustion Device Pilot Gas Usage (mcf/d) x 1,000 x 365 x Fraction of Gas Combusted by Enclosed Combustion Device x Mole Fraction of Pentanes-plus x Number of Carbon Atoms in Pentanes-plus)) x .0526 (kg/ft3) CO₂ x .001 x 1.102 tons/tonnes

$$E_{a,CH_4}(un-combusted) = V_a * (1-\eta) * X_{CH_4}$$
 (Eq. W-19)

$$E_{a,CO_2}(un-combusted) = V_a * X_{CO_2}$$
 (Eq. W-20)

$$E_{a,CO_2}(combusted) = \sum_{j=1}^5 (\eta * V_a * Y_j * R_j)$$
 (Eq. W-21)

Where:

Ea,CH4(un-combusted) = Contribution of annual un-combusted CH4 emissions from Enclosed Combustion Device stack in cubic feet, under actual conditions.

Ea,CO2(un-combusted) = Contribution of annual un-combusted CO2 emissions from Enclosed Combustion Device stack in cubic feet, under actual conditions.

Ea,CO2(combusted) = Contribution of annual combusted CO2 emissions from Enclosed Combustion Device stack in cubic feet, under actual conditions.

Va = Volume of gas sent to Enclosed Combustion Device in cubic feet, during the year.

η = Fraction of gas combusted by a burning Enclosed Combustion Device (default is 0.98). For gas sent to an unlit Enclosed Combustion Device, η is zero.

XCH4 = Mole fraction of CH4 in gas to the Enclosed Combustion Device.

XCO2 = Mole fraction of CO2 in gas to the Enclosed Combustion Device.

Yj = Mole fraction of gas hydrocarbon constituents j (such as methane, ethane, propane, butane, and pentanes-plus).

Rj = Number of carbon atoms in the gas hydrocarbon constituent j: 1 for methane, 2 for ethane, 3 for propane, 4 for butane, and 5 for pentanes plus).

Fugitive Emissions from Unpaved Haul Roads

| Constant | Industrial Roads | | |
|------------|------------------|-------|--------|
| | PM | PM-10 | PM-2.5 |
| k (lb/VMT) | 4.9 | 1.5 | 0.15 |
| a | 0.7 | 0.9 | 0.9 |
| b | 0.45 | 0.45 | 0.45 |

where

| | | |
|---|-----|--|
| k | | Particle size multiplier ¹ |
| s | 4.8 | Silt content of road surface material (%) |
| p | 150 | Number of days per year with precipitation |

| Item Number | Description | Number of Wheels | W | Mean Vehicle Speed (mph) | Miles per Trip | Maximum Trips per Hour | Maximum Trips per Year | Control Device ID Number | Control Efficiency (%) | PM Emissions (lbs/hr) | PM Emissions (tons/yr) | PM-10 Emissions (lbs/hr) | PM-10 Emissions (tons/yr) | PM-2.5 Emissions (lbs/hr) | PM-2.5 Emissions (tons/yr) |
|-------------|-------------------|------------------|----------------------------|--------------------------|----------------|------------------------|------------------------|--------------------------|------------------------|-----------------------|------------------------|--------------------------|---------------------------|---------------------------|----------------------------|
| | | | Mean Vehicle Weight (tons) | | | | | | | | | | | | |
| 1 | Liquids Hauling | 14 | 30 | 10 | 1.10 | 1 | 1,174 | NA | NA | 4.71 | 2.76 | 1.20 | 0.70 | 0.12 | 0.07 |
| 2 | Employee Vehicles | 4 | 3 | 10 | 1.10 | 1 | 200 | NA | NA | 1.67 | 0.17 | 0.43 | 0.04 | 0.04 | 0.004 |
| Totals: | | | | | | | | | | 6.37 | 2.93 | 1.62 | 0.75 | 0.16 | 0.07 |

Notes:

- ¹ - Particle Size Multiplier used from AP-42 13.2.2 - Final Version 11/2006
- ² - Silt Content of Road Surface uses Sand and Gravel Processing Plant Road from AP-42 13.2.2 - Final Version 11/2006
- ³ - Number of days per year with precipitation >0.01 in3 found using AP-42 13.2.2 Figure 13.2.2-1 - Final Version 11/2006

Example Calculations:

Emissions (lb/Vehicle Mile Traveled) - $E = k \times (s/12)^a \times (W/3)^b$ Equation 1a from AP-42 13.2.2 - Final Version 11/2006

Size Specific Emissions (lb/VMT) - $E_{ext} = E[(365-p)/365]$ Equation 2 from AP-42 13.2.2 - Final Version 11/2006

Fugitive Leaks

| Default Average Component Counts for Major Onshore Natural Gas Production Equipment ¹ | | | | |
|--|--------|------------|------------------|------------------------|
| Facility Equipment Type | Valves | Connectors | Open-ended Lines | Pressure Relief Valves |
| Wellheads | 8 | 38 | 0.5 | 0 |
| Separators | 1 | 6 | 0 | 0 |
| Meters/Piping | 12 | 45 | 0 | 0 |
| Compressors | 12 | 57 | 0 | 0 |
| In-line Heaters | 14 | 65 | 2 | 1 |
| Dehydrators | 24 | 90 | 2 | 2 |

¹- Table W-1B to 40CFR98 Subpart W

| Well Specific Equipment Counts | |
|--------------------------------|---------------|
| Facility Equipment Type | Count on Site |
| Wellheads | 4 |
| Separators | 4 |
| Meters/Piping | 4 |
| Compressors | 3 |
| In-line Heaters | 8 |
| Dehydrators | 0 |

| Gas Composition | | | | | | |
|-----------------|---------|--------|----------|--------|-----------------|-----------------|
| | Propane | Butane | Pentanes | Hexane | CO ₂ | CH ₄ |
| Mole % | 3.62 | 1.12 | 0.28 | 0.12 | 0.14 | 80.73 |
| MW | 44.00 | 58.00 | 72.00 | 86.00 | 44.00 | 16.00 |

| Fugitive Emissions | | | | | | | | | | | | | |
|-------------------------|-------------|---|--------------------|---------------|----------------|---------------|----------------|--------------------------|---------------------------|--------------------------|---------------------------|----------------------------------|-----------------------------------|
| Facility Equipment Type | Total Count | Emission Rate (scf/hr/component) ² | Hours of Operation | VOCs (lbs/hr) | VOCs (tons/yr) | HAPs (lbs/hr) | HAPs (tons/yr) | CO ₂ (lbs/hr) | CO ₂ (tons/yr) | CH ₄ (lbs/hr) | CH ₄ (tons/yr) | Total CO ₂ e (lbs/hr) | Total CO ₂ e (tons/yr) |
| Valves | 196 | 0.027 | 8760 | 0.03 | 0.15 | 0.001 | 0.01 | <0.001 | 0.004 | 0.18 | 0.78 | 4.43 | 19.42 |
| Connectors | 876 | 0.003 | 8760 | 0.02 | 0.08 | <0.001 | 0.003 | <0.001 | 0.002 | 0.09 | 0.39 | 2.20 | 9.64 |
| Open-ended Lines | 18 | 0.06 | 8760 | 0.01 | 0.03 | <0.001 | 0.001 | <0.001 | <0.001 | 0.04 | 0.16 | 0.92 | 4.03 |
| Pressure Relief Valves | 8 | 0.04 | 8760 | 0.002 | 0.009 | <0.001 | <0.001 | <0.001 | <0.001 | 0.01 | 0.05 | 0.27 | 1.17 |
| Total Emissions: | | | | 0.06 | 0.27 | 0.003 | 0.01 | 0.001 | 0.01 | 0.31 | 1.37 | 7.82 | 34.27 |

²- Table W-1A to 40CFR98 Subpart W

Example Equations:
Fugitive Emissions (lb/hr) = Count x Emission Rate x Hours of Operation ÷ 385.5 scf/lbmol x mol VOC's

Total Mary Miller GRT Site Emission Levels

| | VOCs | | HAPs | | CO | | NO _x | | PM | | SO ₂ | | CO ₂ | | CH ₄ | | N ₂ O | | CO ₂ e | |
|--|--------|---------|--------|---------|-------|---------|-----------------|---------|-------|---------|-----------------|---------|-----------------|-----------|-----------------|---------|------------------|---------|-------------------|-----------|
| Emission Sources | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr | lb/hr | tons/yr |
| GPU (S001) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| GPU (S002) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| GPU (S003) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| GPU (S004) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| Line Heater (S005) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| Line Heater (S006) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| Line Heater (S007) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| Line Heater (S008) | 0.006 | 0.03 | 0.002 | 0.01 | 0.10 | 0.43 | 0.12 | 0.51 | 0.009 | 0.04 | <0.001 | 0.003 | 175.47 | 768.54 | 0.003 | 0.01 | <0.001 | 0.001 | 175.65 | 769.33 |
| Flash Separator (S009) | 0.004 | 0.02 | 0.001 | 0.01 | 0.07 | 0.29 | 0.08 | 0.34 | 0.006 | 0.03 | <0.001 | 0.002 | 116.98 | 512.36 | 0.002 | 0.01 | <0.001 | <0.001 | 117.10 | 512.89 |
| Generator (S022) | 0.37 | 1.63 | 0.03 | 0.12 | 0.61 | 2.68 | 0.37 | 1.63 | 0.005 | 0.02 | <0.001 | 0.001 | 57.77 | 253.03 | 0.001 | 0.00 | <0.001 | <0.001 | 57.83 | 253.30 |
| Natural Gas Compressor 1501 (S017) | 0.05 | 0.24 | 0.12 | 0.51 | 1.78 | 7.80 | 0.89 | 3.90 | 0.02 | 0.08 | 0.001 | 0.005 | 204.96 | 897.71 | 0.004 | 0.02 | <0.001 | 0.002 | 205.17 | 898.63 |
| Natural Gas Compressor 1940 (S018) | 0.05 | 0.22 | 0.07 | 0.31 | 0.16 | 0.71 | 1.49 | 6.52 | 0.02 | 0.07 | 0.001 | 0.005 | 199.37 | 873.22 | 0.004 | 0.02 | <0.001 | 0.002 | 199.57 | 874.12 |
| Condensate Stabilizer (S010) | 0.003 | 0.01 | 0.001 | 0.005 | 0.05 | 0.21 | 0.06 | 0.26 | 0.004 | 0.02 | <0.001 | 0.002 | 87.73 | 384.27 | 0.002 | 0.01 | <0.001 | <0.001 | 87.82 | 384.67 |
| Enclosed Vapor Combustor (S019) | 1.13 | 4.96 | 0.05 | 0.23 | 1.21 | 5.28 | 1.43 | 6.28 | 0.11 | 0.48 | 0.009 | 0.04 | 2,082.95 | 9,123.31 | 0.05 | 0.20 | 0.004 | 0.016 | 2,085.21 | 9,133.22 |
| Liquid Unloading - Condensate (S020) | 0.55 | 2.42 | 0.01 | 0.06 | -- | -- | -- | -- | -- | -- | -- | -- | <0.001 | <0.001 | 0.02 | 0.07 | -- | -- | 0.39 | 1.69 |
| Liquid Unloading - Produced Water (S021) | <0.001 | 0.002 | <0.001 | <0.001 | -- | -- | -- | -- | -- | -- | -- | -- | <0.001 | <0.001 | 0.001 | <0.001 | -- | -- | 0.003 | 0.01 |
| Haul Roads | -- | -- | -- | -- | -- | -- | -- | -- | 6.37 | 2.93 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Fugitives Leaks | 0.06 | 0.27 | 0.003 | 0.01 | -- | -- | -- | -- | -- | -- | -- | -- | 0.001 | 0.006 | 0.31 | 1.37 | -- | -- | 7.82 | 34.27 |
| Totals | 2.28 | 10.00 | 0.31 | 1.34 | 4.66 | 20.40 | 5.26 | 23.02 | 6.60 | 3.93 | 0.02 | 0.08 | 4,153.48 | 18,192.22 | 0.41 | 1.81 | 0.01 | 0.03 | 4,166.09 | 18,247.47 |



HIPOWER®

RENTAL Gaseous Generator Set

Model: HRGM 30 T6

GM Vortec Series

Specification & Application Data



Photo may depict optional equipment.

Description

HIPOWER® rental generators are an efficient, reliable and versatile source of mobile electrical power. They are designed to operate in the most extreme working conditions. All HIPOWER® Gaseous Rental Generators have a unique combination of innovative design and the use of high quality materials that provide the user with the most dependable power that you can rely on for non-stop power with easy to operate controls.

The generator set is powered by a radiator-cooled, industrial GM Vortec gaseous engine, which meets current Environmental Protection Agency (EPA) non-road exhaust emission regulations, driving a single bearing, four-pole, three-phase alternator, with IP23 protection. The Prime Power kVA rating for generator set is given with a 125 degree C alternator winding temperature rise.

HIPOWER® Features and Benefits

GM Vortec Engine: Long-life, heavy-duty, 4-cycle, gaseous engine from a world renowned manufacturer for economy of operation and maximum reliability and durability. Capable of full rated load acceptance in one step.

Cooling: Radiator with belt driven pusher fan.

Filtration: Heavy-duty replaceable element air-cleaner.

Alternator: Single bearing, rotating field, self-excited, self-ventilated, 12-wire re-connectable, 60Hz brushless alternator with permanent magnetic generator (PMG) for reduced service and maintenance requirements, with Class H insulation. Automatic voltage regulator (AVR) providing close voltage regulation. Has a high skVA starting capability for electric motor loads.

Arrangement: Engine and alternator units are closed coupled together and with mobile style anti-vibration isolators, mounted between the assembly and a heavy-duty steel base. The sturdy base frame has openings allowing for winching, slinging and forklift pockets for ease of handling

60Hz Prime Power Ratings kW & kVA

| Voltage VAC | Phase | PF | LPG | | NG | |
|---------------|-------|-----|------|------|------|------|
| | | | kW | kVA | kW | kVA |
| 120/240 | 1 | 0.8 | 15.6 | 19.5 | 14.3 | 17.9 |
| 120/208 | 3 | 0.8 | 24.0 | 30.0 | 22.0 | 27.5 |
| 120/240 Delta | 3 | 0.8 | N.A | N.A | N.A | N.A |
| 277/480 | 3 | 0.8 | 24.0 | 30.0 | 22.0 | 27.5 |
| 347/600 | 3 | 0.8 | 24.0 | 30.0 | 22.0 | 27.5 |

Rating Definitions: (N.A. = Not available for model designated)

Prime - All Rental Sets are Prime Rated - Prime rating is applicable for supplying power to a varying load in lieu of utility for an unlimited amount of running of amount of running time. (Max. load factor = 80%)
A 10% overload capacity is available for 1 out of every 12 hours.

HIPOWER® Features and Benefits

Enclosure: Fully sound attenuated enclosure, fabricated in 11-gauge steel, powder coated with finish that exceeds 1000-hr salt spray test, curved edges, minimum outside fasteners.

Ample layer of durable sound insulating material placed all around the inside of the container, doors and ducting with metal retainer frames. Can be cleaned by high-pressure water and is oil and fire resistant.

Vertical air discharge for quiet operation.

Wide steel lockable access doors with rubber seals, for easy entrance of all maintenance personnel and any necessary service by technicians, with stainless steel hinges, hardware and fasteners resistant to corrosion.

Exhaust: Effective low noise, steel residential-type exhaust silencer and catalytic converter with rain cap

Controls: Digital control panel to operate all manual and automatic start and stop features. Many programmable automatic functions for local and remote controls with LED lights, tamper proof engine hour recorder with analog meters: voltmeter & switch, three (3) ammeters, Hz meter, fuel gauge and battery charger.

HIPOWER® Rental Options

Voltage Selector Switch: Three-position, manual voltage selector switch. Lockable in three positions for switching set between 120/240V single phase and 120/208 and 277/480V 3-phase. - NOT AVAILABLE AT 600V CONNECTION.

Power Distribution: Consult HIPOWER® regarding the comprehensive range of power distribution accessories available.

Oil field heavy duty rental skid: Heavy duty sub base

(See page 3 for additional options)



Gaseous Generator Set Specification:

LPG/NG Rental Generator Set Model: HRGM 30 T6 PSI - GM Vortec

| | |
|---|---|
| Governor regulation class | ISO 8528 Part 1 Class G3 |
| Voltage regulation, no load to full load | plus or minus 1% |
| Frequency regulation | Ischronous |
| Radio frequency emissions compliance | Meets requirements of most industrial and commercial applications |
| skVA at 480 volts with 30% voltage dip | 76 |
| Main Line Circuit breaker – amps capacity | 105 |

ENGINE

| | |
|---|----------------------------|
| Manufacturer | PSI-General Motors |
| Model | Vortec 3.0L |
| EPA certified | Yes |
| Crankshaft speed | 1,800rpm |
| Type | LPG/NG fueled, 4-stroke |
| Ignition | Spark Plug |
| Aspiration | Natural |
| Number of Cylinders | 4 |
| Cylinder arrangement | In-line |
| Displacement CID (liters) | 181 (3.0) |
| Bore and Stroke ins (mm) | 4 x 3.6 (10.2 x 9.1) |
| Nominal power | LPG 48 hp NG 47 hp |
| Cooling | Liquid |
| Governor | Electronic |
| Starting motor & alternator | 12 volt |
| Compression ratio | 9.3 : 1 |
| Air cleaner type | Dry, replaceable cartridge |
| Exhaust gas flow at full output lb/hr (kg/hr) | 250 (7.1) |
| Exhaust temperature at full load - dry exhaust °F (°C) | 1056 (569) |
| Maximum permitted back pressure - in. HG (kPa) | 3.0 (10.2) |

Cooling System:

| | |
|---|-------------|
| Radiator- cooled cooling air flow - cu. ft./min. (cu. m/min.) | 2500 (72) |
| Alternator cooling flow - cu. ft./min. (cu. m/min.) | 250 (4.5) |
| Combustion air - cu. ft./min. (cu. m/min.) | 64 (1.8) |
| Total cooling air flow (engine + alternator + combustion) | 2814 (78.3) |
| Radiator system capacity, including engine - gallons (L) | 5.0 (18.9) |

Lubrication system:

| | |
|---|------------------------------------|
| Oil pan capacity - quarts (L) | 4.0 (3.8) |
| Oil pan capacity with filter - quarts (L) | 4.3 (4.1) |
| Oil filter - quantity and type | 1, Replaceable Spin-On |
| Recommended lubricating oil grade - above 0 ° F (below 0 ° F) | |
| Oil consumption at full load | Less than 0.1% of fuel consumption |
| Oil pressure – psi (bars) | 46.0 (320.0) |

Engine Electrical System:

| | |
|---|-------------------|
| Starting motor voltage | 12 volt |
| Battery - AH | 1, size BC I# 24F |
| Maximum battery charge alternator output - amps | 70 |
| Cold Cranking Amps - minimum | 600 |

HIPOWER Sound Attenuated Enclosure:**Model - AT1**

| | |
|---|--------------|
| Noise level - dBA at 23 feet (7 meters) | 74 |
| Dimensions - inches | 82 x 36 x 47 |
| Dry weight – lbs. | 1,617 |

Fuel System: (*Measured at gen-set fuel inlet, downstream of any dry fuel or filter accessories.)

| | |
|---|--------------------------------------|
| Fuel type | LPG or Natural Gas, vapor withdrawal |
| Fuel supply line - inlet | 1" NPTF |
| *Natural gas and LPG fuel supply pressure - in. column H ₂ O (kPa) | 7" - 11" (1.74 - 2.74) |

Prime Rating Fuel consumption:

| | |
|---|------------|
| LPG - cu. ft./hour (kg/hour) at 100% standby rating | 168 (4.8) |
| Natural Gas - cu. ft./hour (kg/hour) at 100% standby rating | 400 (11.3) |

Alternator Specification:

| | | |
|--|------------------------|-----------------------------------|
| Manufacturer | | Stamford |
| Alternator model, winding & AVR model | 127/208; 277/480 volts | PI 144 H |
| | 600 volts | PI 144 H |
| Voltages | | 3-phase 120/208, 277/480, 347/600 |
| Alternator Type | | 4-pole, rotating field |
| Excitation System | | Brushless with EBS/AS480 AVR |
| Power factor | | 0.8 |
| Number of leads | | 12 |
| Stator Pitch | | 2/3 |
| Insulation | | Class H |
| Windings – Temperature Rise | | 120° C |
| Enclosure (IEC-34-S) | | IP 23 |
| Bearing | | Single, sealed |
| Coupling | | Flexible disc |
| Amortisseur windings | | Full |
| Voltage regulation – no load to full load with MX341 AVR | | plus or minus 1% |
| TIF | | < 50 |
| Line harmonics | | 5% maximum |

Standard Accessories: (see back-page for control panel details)

| | |
|--|---|
| • Radiator with pusher fan | • All rotating components (i.e. fan) protected with metal guards |
| • Dry air cleaner | • All hot components (i.e. exhaust) protected with metal guards |
| • Heavy-duty engine start batteries in rack with cables | • Ground connection prepared for ground spike (not supplied) |
| • Emergency stop switch | • Main line ABB UL listed circuit breaker for overload protection |
| • Control Panel DSE7310 (See over for details) | • Operation and installation literature |
| • Two dry contacts for auto-start | • CSA certified |
| • Steel base for mounting on firm surface such as concrete | • Control panel DSE 7310 MANUAL & AUTO START MODULE |

Optional Accessories:

| | |
|--|---|
| <input type="checkbox"/> Rotary voltage selector switch (not available with 600V connection) | <input type="checkbox"/> Interior lights |
| <input type="checkbox"/> Alternator anti-condensation heaters | <input type="checkbox"/> Shore power receptacle |
| <input type="checkbox"/> Winterization kit for low ambient temperature | <input type="checkbox"/> Engine Block heater |
| <input type="checkbox"/> Electric actuator and louvers for air intake and exhaust | <input type="checkbox"/> Control panel heater |
| <input type="checkbox"/> Snow hoods for air intake and exhaust | <input type="checkbox"/> Oil fiels heavy duty rental skid |
| <input type="checkbox"/> DOT certified towing trailer | <input type="checkbox"/> Oil Make-up system |

• Distribution power panel *See image RH back-page

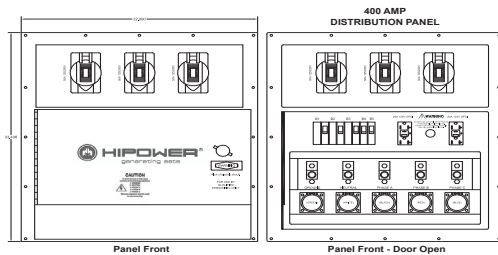
Aluminum 0.090" enclosure black powder coated - covered panel NEMA 3R/IP67rated weather proof assembly – Individual Square-D QOU branch breakers - 2 x 20A 125V NEMA 5-20 GFCI duplex receptacles - 3 x 50A 125/250V CS6369 Twist -lock receptacles & Lexan covers - 50A California Style twist lock (1Φ only) - 1 set Camlock devices rated 400A - Color coded Camlock devices 3Φ - 5W black, red, blue, white & green - Pad lockable 1/4 turn door access with cable trap - Auxiliary bus bars with mechanical lugs - Mechanical lugs up to 250MCM cable

HIPOWER® DSE 7310 Control Panel: The DSE model 7310 digital control panel is back-lit with icon LCD text display, and is PC configurable. It works with the engine electronic governor with PLC functionality, protected front panel editing, and includes: manual, automatic and remote (input) start, PC configurable six inputs and four outputs, configurable timers and alarms, generator voltage and Hz display, battery voltage display, engine speed display, multiple engine parameters are monitored simultaneously, comprehensive shutdown or warning on fault condition, engine preheat, LED and LCD alarm indication, tamper-proof hour counter provides accurate information for monitoring and maintenance periods. The module monitors: engine speed, frequency, voltage and engine run hours and also displays the warning and shutdown status

Engine alarms included: High coolant temperature, low oil pressure, low coolant level, unexpected shutdown, low fuel level, stop failure, low battery voltage, battery charging alternator failure, over-speed, under-speed, start failure and emergency stop.

Alternator alarms included: Overload, unbalanced voltage, over voltage, under voltage, over frequency, under frequency, short circuit, reverse power, and incorrect phase sequence.

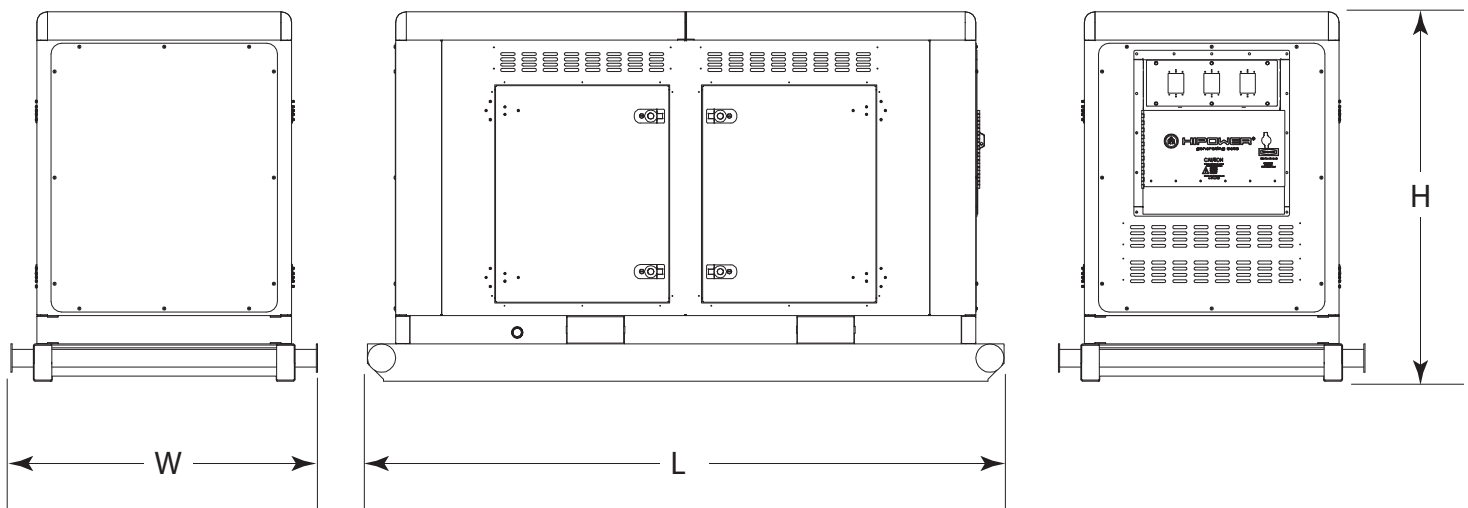
Instrumentation and gauges included: 3 ammeters, frequency meter, voltmeter plus selector, hour meter, fuel gauge, battery charger gauge, oil pressure gauge, water temperature gauge, siren and emergency stop button.



Pictures of Control Panel RH and Distribution Panel LH may include optional equipment and/or accessories

Model HRGM 30 T6

key dimensions and sound levels



| Generator Data (L, W & H dimensions in inches) | | | | | |
|--|------------|-----------|------------|----------------|-----|
| Configuration | L = Length | W = Width | H = Height | Net Weight lbs | dBA |
| Enclosed | 82" | 36" | 47" | 1525 | 73 |
| Enclosed (with oil field heavy duty rental skid) | 90" | 43.5" | 52.5" | 1917 | 73 |

* All measurements are approximate and for estimation purposes only. Sound levels measured at 23ft (7m) and does not account for ambient site conditions.

Codes and Standards Compliances used where applicable



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NFPA 99
NFPA 110
ISO 8528-5
ISO 1708A.5
ISO 3046

BS5514
SAE J1349
DIN6271
IEE C62.41 TESTING
NEMA ICS 1

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Ref# 777-10030R-August 2013



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
2015 MODEL YEAR
CERTIFICATE OF CONFORMITY
WITH THE CLEAN AIR ACT

OFFICE OF TRANSPORTATION
AND AIR QUALITY
ANN ARBOR, MICHIGAN 48105

Certificate Issued To: Power Solutions International, Inc.
(U.S. Manufacturer or Importer)

Certificate Number: FPSIB2.97GLP-001

Effective Date:

10/06/2014

Expiration Date:

12/31/2015

Byron J. Bunker, Division Director
Compliance Division

Issue Date:

10/06/2014

Revision Date:

N/A

Manufacturer: Power Solutions International, Inc.

Engine Family: FPSIB2.97GLP

Certification Type: Mobile and Stationary

Fuel : Gasoline (up to and including 10% Ethanol)

Natural Gas (CNG/LNG)

LPG/Propane

Emission Standards : HC + NO_x (g/kW-hr) : 2.7

CO (g/kW-hr) : 4.4

NMHC + NO_x (g/kW-hr) : 2.7 CO (g/kW-hr) : 4.4

HC + NO_x (g/kW-hr) : 2.7

NMHC + NO_x (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, 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 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 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 1048. 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. 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.

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.



USA Compression Unit 1940 Caterpillar G3306TA Engine Emissions

| | | | | | |
|-------------------------------|------------------|----------------------|------------|-----------------------------|------------------------|
| Date of Manufacture | January 21, 2008 | Engine Serial Number | G6X04059 | Date Modified/Reconstructed | Not Any |
| Driver Rated HP | 203 | Rated Speed in RPM | 1800 | Combustion Type | Spark Ignited 4 Stroke |
| Number of Cylinders | 6 | Compression Ratio | 8:1 | Combustion Setting | Rich Burn |
| Displacement, in ³ | 640 | Fuel Delivery Method | Carburetor | Combustion Air Treatment | T.C./Aftercooled |

Raw Engine Emissions (905 LHV BTU/SCF Fuel Gas with little to no H2S)

Fuel Consumption 8098 LHV BTU/bhp-hr or 8983 HHV BTU/bhp-hr
Altitude 1200 ft
Maximum Air Inlet Temp 105 F

| | <u>g/bhp-hr¹</u> | <u>lb/MMBTU²</u> | <u>lb/hr</u> | <u>TPY</u> |
|---|-----------------------------|-----------------------------|--------------|------------------------|
| Nitrogen Oxides (NOx) | 16.57 | | 7.42 | 32.48 |
| Carbon Monoxide (CO) | 16.57 | | 7.42 | 32.48 |
| Volatile Organic Compounds (VOC or NMNEHC excluding CH2O) | 0.12 | | 0.05 | 0.24 |
| Formaldehyde (CH2O) | 0.25 | | 0.11 | 0.49 |
| Particulate Matter (PM) <small>Filterable+Condensable</small> | | 1.94E-02 | 3.54E-02 | 1.55E-01 |
| Sulfur Dioxide (SO2) | | 5.88E-04 | 1.07E-03 | 4.70E-03 |
| | <u>g/bhp-hr¹</u> | | <u>lb/hr</u> | <u>Metric Tonne/yr</u> |
| Carbon Dioxide (CO2) | 511 | | 229 | 909 |
| Methane (CH4) | 1.02 | | 0.46 | 1.81 |

¹ g/bhp-hr are based on Caterpillar Specifications (GERP) assuming 905 LHV BTU/SCF fuel gas, 1200 ft elevation, and 105 F Max Air Inlet Temperature.
 Note that g/bhp-hr values are based on 100% Load Operation. It is recommended to add a safety margin to emissions for permitting to allow for operational flexibility and fuel gas composition variability.

² Emission Factor obtained from EPA's AP-42, Fifth Edition, Volume I, Chapter 3: Stationary Internal Combustion Sources (Section 3.2 Natural Gas-Fired Reciprocating Engines, Table 3.2-3).

Catalytic Converter Emissions

Catalytic Converter Make and Model: DC47-4
Element Type: 3-Way
Number of Elements in Housing: 1
Air/Fuel Ratio Control AFR-9 or equivalent

| | <u>% Reduction</u> | <u>lb/hr</u> | <u>TPY</u> |
|---|--------------------|--------------|------------------------|
| Nitrogen Oxides (NOx) | 88 < 2 g/hp-hr | 0.90 | 3.92 |
| Carbon Monoxide (CO) | 76 < 4 g/hp-hr | 1.79 | 7.84 |
| Volatile Organic Compounds (VOC or NMNEHC excluding CH2O) | 0 | 0.054 | 0.24 |
| Formaldehyde (CH2O) | 0 | 0.11 | 0.49 |
| Particulate Matter (PM) | 0 | 3.54E-02 | 1.55E-01 |
| Sulfur Dioxide (SO2) | 0 | 1.07E-03 | 4.70E-03 |
| | <u>% Reduction</u> | <u>lb/hr</u> | <u>Metric Tonne/yr</u> |
| Carbon Dioxide (CO2) | 0 | 229 | 909 |
| Methane (CH4) | 0 | 0.46 | 1.81 |



USA Compression Unit 1501 Caterpillar G3306TA Engine Emissions

| | | | | | |
|-------------------------------|----------------|----------------------|------------|-----------------------------|------------------------|
| Date of Manufacture | August 8, 2005 | Engine Serial Number | G6X01660 | Date Modified/Reconstructed | Not Any |
| Driver Rated HP | 203 | Rated Speed in RPM | 1800 | Combustion Type | Spark Ignited 4 Stroke |
| Number of Cylinders | 6 | Compression Ratio | 8:1 | Combustion Setting | Rich Burn |
| Displacement, in ³ | 640 | Fuel Delivery Method | Carburetor | Combustion Air Treatment | T.C./Aftercooled |

Raw Engine Emissions (905 LHV BTU/SCF Fuel Gas with little to no H2S)

Fuel Consumption 8098 LHV BTU/bhp-hr or 8983 HHV BTU/bhp-hr
Altitude 1200 ft
Maximum Air Inlet Temp 105 F

| | <u>g/bhp-hr¹</u> | <u>lb/MMBTU²</u> | <u>lb/hr</u> | <u>TPY</u> |
|---|-----------------------------|-----------------------------|--------------|------------------------|
| Nitrogen Oxides (NOx) | 16.57 | | 7.42 | 32.48 |
| Carbon Monoxide (CO) | 16.57 | | 7.42 | 32.48 |
| Volatile Organic Compounds (VOC or NMNEHC excluding CH2O) | 0.12 | | 0.05 | 0.24 |
| Formaldehyde (CH2O) | 0.25 | | 0.11 | 0.49 |
| Particulate Matter (PM) <small>Filterable+Condensable</small> | | 1.94E-02 | 3.54E-02 | 1.55E-01 |
| Sulfur Dioxide (SO2) | | 5.88E-04 | 1.07E-03 | 4.70E-03 |
| | <u>g/bhp-hr¹</u> | | <u>lb/hr</u> | <u>Metric Tonne/yr</u> |
| Carbon Dioxide (CO2) | 511 | | 229 | 909 |
| Methane (CH4) | 1.02 | | 0.46 | 1.81 |

¹ g/bhp-hr are based on Caterpillar Specifications (GERP) assuming 905 LHV BTU/SCF fuel gas, 1200 ft elevation, and 105 F Max Air Inlet Temperature.
 Note that g/bhp-hr values are based on 100% Load Operation. It is recommended to add a safety margin to emissions for permitting to allow for operational flexibility and fuel gas composition variability.

² Emission Factor obtained from EPA's AP-42, Fifth Edition, Volume I, Chapter 3: Stationary Internal Combustion Sources (Section 3.2 Natural Gas-Fired Reciprocating Engines, Table 3.2-3).

Catalytic Converter Emissions

Catalytic Converter Make and Model: RCS-1816-06
Element Type: 3-Way
Number of Elements in Housing: 1
Air/Fuel Ratio Control AFR-9

| | <u>% Reduction</u> | | <u>lb/hr</u> | <u>TPY</u> |
|---|--------------------|-------------|--------------|------------------------|
| Nitrogen Oxides (NOx) | 88 | < 2 g/hp-hr | 0.90 | 3.92 |
| Carbon Monoxide (CO) | 76 | < 4 g/hp-hr | 1.79 | 7.84 |
| Volatile Organic Compounds (VOC or NMNEHC excluding CH2O) | 0 | | 0.054 | 0.24 |
| Formaldehyde (CH2O) | 0 | | 0.11 | 0.49 |
| Particulate Matter (PM) | 0 | | 3.54E-02 | 1.55E-01 |
| Sulfur Dioxide (SO2) | 0 | | 1.07E-03 | 4.70E-03 |
| | <u>% Reduction</u> | | <u>lb/hr</u> | <u>Metric Tonne/yr</u> |
| Carbon Dioxide (CO2) | 0 | | 229 | 909 |
| Methane (CH4) | 0 | | 0.46 | 1.81 |

**LAFAYETTE AREA LABORATORY**

4790 N.E. EVANGELINE THRUWAY
CARENCRO, LA 70520
PHONE (337) 896-3055
FAX (337) 896-3077

Certificate of Analysis : 13090042-002A

Company: Gas Analytical Services
Well: 404 Flash Separator
Field: HG Energy
Sample of: Liquid-Spot
Conditions: 30 psi @ N.G.° F
Sampled by: RB-GAS
Sample date: 8/28/2013
Remarks: Cylinder No.: GAS
Remarks:

For: Gas Analytical Services
Alan Ball
PO Box 1028

Bridgeport, WV, 26330

Report Date: 9/12/2013

Analysis: (GPA 2186M)

| | Mol. % | MW | Wt. % | Sp. Gravity | L.V. % |
|------------------------|---------------|-----------|--------------|--------------------|---------------|
| Nitrogen | 0.000 | 28.013 | 0.000 | 0.8094 | 0.000 |
| Methane | 0.180 | 16.043 | 0.031 | 0.3000 | 0.072 |
| Carbon Dioxide | 0.000 | 44.010 | 0.000 | 0.8180 | 0.000 |
| Ethane | 1.911 | 30.070 | 0.623 | 0.3562 | 1.206 |
| Propane | 5.848 | 44.097 | 2.797 | 0.5070 | 3.802 |
| Iso-butane | 2.865 | 58.123 | 1.806 | 0.5629 | 2.213 |
| N-butane | 7.746 | 58.123 | 4.884 | 0.5840 | 5.766 |
| Iso-pentane | 5.891 | 72.150 | 4.611 | 0.6244 | 5.090 |
| N-pentane | 6.320 | 72.150 | 4.946 | 0.6311 | 5.405 |
| i-Hexanes | 9.062 | 86.177 | 8.370 | 0.6795 | 8.701 |
| n-Hexane | 6.983 | 85.648 | 6.537 | 0.6640 | 6.749 |
| 2,2,4 trimethylpentane | 0.034 | 114.231 | 0.043 | 0.6967 | 0.041 |
| Benzene | 0.179 | 78.114 | 0.114 | 0.8846 | 0.119 |
| Heptanes | 21.295 | 98.604 | 22.849 | 0.6986 | 22.548 |
| Toluene | 1.049 | 92.141 | 0.787 | 0.8719 | 0.831 |
| Octanes | 15.900 | 107.724 | 19.019 | 0.7525 | 17.319 |
| E-benzene | 0.115 | 106.167 | 0.080 | 0.8718 | 0.104 |
| M-,O-,P-xylene | 1.226 | 106.167 | 1.411 | 0.8731 | 1.124 |
| Nonanes | 4.317 | 119.706 | 5.856 | 0.7800 | 5.267 |
| Decanes Plus | 9.079 | 154.702 | 15.236 | 0.7701 | 13.643 |
| | 100.000 | | 100.000 | | 100.000 |

Calculated Values

Specific Gravity at 60 °F
Api Gravity at 60 °F
Molecular Weight
Pounds per Gallon (in Vacuum)
Pounds per Gallon (in Air)
Cu. Ft. Vapor per Gallon @ 15.025 psia

Total Sample

0.6896
73.705
92.186
5.749
5.743
24.196

Decanes Plus

0.7701
52.238
154.702
6.421
6.414
15.405

Southern Petroleum Laboratories, Inc.

**LAFAYETTE AREA LABORATORY**

4790 N.E. EVANGELINE THRUWAY
CARENCRO, LA 70520
PHONE (337) 896-3055
FAX (337) 896-3077

Certificate of Analysis : 13090042-002A

Company: Gas Analytical Services
Well: 404 Flash Separator
Field: HG Energy
Sample of: Liquid-Spot
Conditions: 30 psi @ N.G. ° F
Sampled by: RB-GAS
Sample date: 8/28/2013
Remarks: Cylinder No.: GAS
Remarks:

For: Gas Analytical Services
Alan Ball
PO Box 1028

Bridgeport, WV, 26330

Report Date: 9/12/2013

| Analysis: (GPA 2103M) | Mol. % | MW | Wt. % | Sp. Gravity | L.V. % |
|--------------------------------|---------------|-----------|--------------|--------------------|---------------|
| Nitrogen | 0.000 | 28.013 | 0.000 | 0.8094 | 0.000 |
| Methane | 0.180 | 16.043 | 0.031 | 0.3000 | 0.072 |
| Carbon Dioxide | 0.000 | 44.010 | 0.000 | 0.8180 | 0.000 |
| Ethane | 1.911 | 30.070 | 0.623 | 0.3562 | 1.206 |
| Propane | 5.848 | 44.097 | 2.797 | 0.5070 | 3.802 |
| Iso-butane | 2.865 | 58.123 | 1.806 | 0.5629 | 2.213 |
| N-butane | 7.746 | 58.123 | 4.884 | 0.5840 | 5.766 |
| Iso-pentane | 5.891 | 72.150 | 4.611 | 0.6244 | 5.090 |
| N-pentane | 6.320 | 72.150 | 4.946 | 0.6311 | 5.405 |
| Hexanes | 16.045 | 85.648 | 14.907 | 0.6653 | 15.450 |
| Heptanes Plus | 53.194 | 98.604 | 65.395 | 0.6986 | 60.996 |
| | ----- | | ----- | | ----- |
| | 100.000 | | 100.000 | | 100.000 |

Calculated Values**Total Sample****Heptanes Plus**

| | | |
|--|--------|---------|
| Specific Gravity at 60 °F | 0.6896 | 0.7407 |
| Api Gravity at 60 °F | 73.705 | 59.525 |
| Molecular Weight | 92.186 | 113.329 |
| Pounds per Gallon (in Vacuum) | 5.749 | 6.176 |
| Pounds per Gallon (in Air) | 5.743 | 6.169 |
| Cu. Ft. Vapor per Gallon @ 15.025 psia | 24.196 | 21.143 |
| Standing-Katz Density (lb. / ft ³) | | |

Southern Petroleum Laboratories, Inc.



Certificate of Analysis
Number: 2030-13090042-002A

Carencro Laboratory
4790 NE Evangeline Thruway
Carencro, LA 70520

Alan Ball
Gas Analytical Services
PO Box 1028
Bridgeport, WV 26330

Sep. 12, 2013

Field: HG Energy
Station Name: 404 Flash Separator
Station Location:
Cylinder No: GAS

Sampled By: RB-GAS
Sample Of: Liquid Spot
Sample Date: 08/28/2013 11:00
Sample Conditions: 30 psig

Analytical Data

| Test | Method | Result | Units | Detection Limit | Lab Tech. | Analysis Date |
|-----------------------------|-------------|---------|------------------|-----------------|-----------|---------------|
| Color Visual | Proprietary | STRAW | | | AR | 09/12/2013 |
| API Gravity @ 60° F | ASTM D-5002 | 70.31 | ° | | AR | 09/12/2013 |
| Specific Gravity @ 60/60° F | ASTM D-5002 | 0.7012 | | | AR | 09/12/2013 |
| Density @ 60° F | ASTM D-5002 | 0.7005 | g/ml | | AR | 09/12/2013 |
| Shrinkage Factor | Proprietary | 0.9700 | | | AR | 09/12/2013 |
| Flash Factor | Proprietary | 51.1707 | Cu. Ft./S.T. Bbl | | AR | 09/12/2013 |

Hydrocarbon Laboratory Manager

Quality Assurance:

The above analyses are performed in accordance with ASTM, UOP, GPA guidelines for quality assurance, unless otherwise stated.

Attachment I - E&P Tanks Condensate Report.txt

* Project Setup Information *

Project File : F:\Projects\A\American Energy Partners\0292624 - AEP Air Permitting\6.0
Plans and Reports\Mary Miller GRT\Attachment I - Supporting Documents - E&P Tanks - Condensate.ept
Flowsheet Selection : Oil Tank with Separator
Calculation Method : RVP Distillation
Control Efficiency : 100.0%
Known Separator Stream : High Pressure Oil
Entering Air Composition : No

Date : 4/3/2015

* Data Input *

Separator Pressure : 25.00[psi g]
Separator Temperature : 80.00[F]
Ambient Pressure : 14.70[psi a]
Ambient Temperature : 70.00[F]
C10+ SG : 0.7701
C10+ MW : 154.702

-- High Pressure Oil -----

| No. | Component | mol % |
|-----|----------------|---------|
| 1 | H2S | 0.0000 |
| 2 | O2 | 0.0000 |
| 3 | CO2 | 0.0000 |
| 4 | N2 | 0.0000 |
| 5 | C1 | 0.1800 |
| 6 | C2 | 1.9110 |
| 7 | C3 | 5.8480 |
| 8 | i-C4 | 2.8650 |
| 9 | n-C4 | 7.7460 |
| 10 | i-C5 | 5.8910 |
| 11 | n-C5 | 6.3200 |
| 12 | C6 | 9.0620 |
| 13 | C7 | 21.2950 |
| 14 | C8 | 15.9000 |
| 15 | C9 | 4.3170 |
| 16 | C10+ | 9.0790 |
| 17 | Benzene | 0.1790 |
| 18 | Toluene | 1.0490 |
| 19 | E-Benzene | 0.1150 |
| 20 | Xylenes | 1.2260 |
| 21 | n-C6 | 6.9830 |
| 22 | 224Trimethyl p | 0.0340 |

Attachment I - E&P Tanks Condensate Report.txt

```
-- Sales Oil -----
Production Rate      : 125[bbl/day]
Days of Annual Operation : 365 [days/year]
API Gravity          : 73.7
Reid Vapor Pressure  : 12.50[psi a]
```

```
*****
*      Calculation Results      *
*****
```

```
-- Emission Summary -----
Item      Uncontrolled      Uncontrolled
           [ton/yr]          [lb/hr]
Total HAPs      5.590        1.276
Total HC        258.010      58.906
VOCs, C2+       256.255      58.506
Page 1----- E&P TANK
```

```
VOCs, C3+      221.739      50.625

Uncontrolled Recovery Info.
    Vapor      11.0700      [MSCFD]
    HC Vapor   11.0700      [MSCFD]
    GOR        88.56       [SCF/bbl]
```

```
-- Emission Composition -----
No  Component      Uncontrolled      Uncontrolled
           [ton/yr]          [lb/hr]
1   H2S            0.000            0.000
2   O2             0.000            0.000
3   CO2            0.000            0.000
4   N2             0.000            0.000
5   C1             1.756            0.401
6   C2             34.516            7.880
7   C3             93.666            21.385
8   i-C4           25.063            5.722
9   n-C4           47.632            10.875
10  i-C5           17.637            4.027
11  n-C5           13.931            3.181
12  C6             8.413            1.921
13  C7             7.506            1.714
14  C8             1.995            0.455
15  C9             0.212            0.048
16  C10+           0.090            0.021
17  Benzene        0.112            0.026
18  Toluene        0.213            0.049
19  E-Benzene      0.009            0.002
20  Xylenes        0.081            0.018
21  n-C6           5.169            1.180
22  2,2,4-Tri methyl p 0.011            0.003
```

Attachment I - E&P Tanks Condensate Report.txt

Total

258.012

58.907

| -- Stream Data ----- | | | | | | | | |
|----------------------|----------------------|-----------|-----------------|--------------------|-------------------|--------------------|------------------|--------------------------|
| No. | Component | MW | LP Oil mol % | Flash Oil mol % | Sale Oil mol % | Flash Gas mol % | W&S Gas mol % | Total Emissions mol % |
| 1 | H2S | 34.80 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | O2 | 32.00 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | CO2 | 44.01 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | N2 | 28.01 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | C1 | 16.04 | 0.1800 | 0.0250 | 0.0000 | 4.1412 | 0.4803 | 2.0526 |
| 6 | C2 | 30.07 | 1.9110 | 0.9572 | 0.0255 | 26.2809 | 17.9484 | 21.5272 |
| 7 | C3 | 44.10 | 5.8480 | 4.7156 | 2.5811 | 34.7822 | 43.6408 | 39.8361 |
| 8 | i-C4 | 58.12 | 2.8650 | 2.6807 | 2.3631 | 7.5735 | 8.4733 | 8.0868 |
| 9 | n-C4 | 58.12 | 7.7460 | 7.4779 | 7.0133 | 14.5965 | 15.9508 | 15.3691 |
| 10 | i-C5 | 72.15 | 5.8910 | 5.9487 | 6.0166 | 4.4163 | 4.7110 | 4.5844 |
| 11 | n-C5 | 72.15 | 6.3200 | 6.4308 | 6.5794 | 3.4888 | 3.7207 | 3.6211 |
| 12 | C6 | 86.16 | 9.0620 | 9.3459 | 9.7525 | 1.8072 | 1.9320 | 1.8784 |
| 13 | C7 | 100.20 | 21.2950 | 22.0741 | 23.2024 | 1.3890 | 1.4981 | 1.4513 |
| 14 | C8 | 114.23 | 15.9000 | 16.5097 | 17.3959 | 0.3205 | 0.3496 | 0.3371 |
| 15 | C9 | 128.28 | 4.3170 | 4.4848 | 4.7288 | 0.0294 | 0.0345 | 0.0323 |
| 16 | C10+ | 154.70 | 9.0790 | 9.4339 | 9.9506 | 0.0101 | 0.0115 | 0.0109 |
| 17 | Benzene | 78.11 | 0.1790 | 0.1850 | 0.1936 | 0.0257 | 0.0276 | 0.0268 |
| 18 | Toluene | 92.13 | 1.0490 | 1.0884 | 1.1457 | 0.0414 | 0.0449 | 0.0434 |
| 19 | E-Benzene | 106.17 | 0.1150 | 0.1194 | 0.1259 | 0.0015 | 0.0016 | 0.0015 |
| 20 | Xylenes | 106.17 | 1.2260 | 1.2735 | 1.3425 | 0.0135 | 0.0149 | 0.0143 |
| 21 | n-C6 | 86.18 | 6.9830 | 7.2140 | 7.5461 | 1.0805 | 1.1582 | 1.1249 |
| 22 | 2,2,4-Trimethyl p | 114.24 | 0.0340 | 0.0353 | 0.0371 | 0.0018 | 0.0019 | 0.0018 |
| | MW | | 92.05 | 93.82 | 96.24 | 46.77 | 49.60 | 48.39 |
| | Stream Mole Ratio | | 1.0000 | 0.9623 | 0.9123 | 0.0377 | 0.0500 | 0.0877 |
| | Heating Value | [BTU/SCF] | | | | 2655.57 | 2806.48 | 2741.67 |
| | Gas Gravity | [Gas/Air] | | | | 1.61 | 1.71 | 1.67 |
| | Bubble Pt. @ 100F | [psi a] | 35.59 | 23.66 | 13.71 | | | |
| | RVP @ 100F | [psi a] | 24.68 | 18.85 | 12.48 | | | |
| | Spec. Gravity @ 100F | | 0.660 | 0.663 | 0.667 | | | |

Attachment I - E&P Tanks PW Report.txt

* Project Setup Information *

Project File : F:\Projects\AAmerican Energy Partners\0292624 - AEP Air Permitting\6.0
Plans and Reports\Mary Miller GRT\Attachment I - Supporting Documents - E&P Tanks PW.ept
Flowsheet Selection : Oil Tank with Separator
Calculation Method : RVP Distillation
Control Efficiency : 100.0%
Known Separator Stream : High Pressure Oil
Entering Air Composition : No

Date : 4/3/2015

* Data Input *

Separator Pressure : 25.00[psi g]
Separator Temperature : 80.00[F]
Ambient Pressure : 14.70[psi a]
Ambient Temperature : 70.00[F]
C10+ SG : 0.7701
C10+ MW : 154.702

-- High Pressure Oil -----

| No. | Component | mol % |
|-----|----------------|---------|
| 1 | H2S | 0.0000 |
| 2 | O2 | 0.0000 |
| 3 | CO2 | 0.0000 |
| 4 | N2 | 0.0000 |
| 5 | C1 | 0.1800 |
| 6 | C2 | 1.9110 |
| 7 | C3 | 5.8480 |
| 8 | i-C4 | 2.8650 |
| 9 | n-C4 | 7.7460 |
| 10 | i-C5 | 5.8910 |
| 11 | n-C5 | 6.3200 |
| 12 | C6 | 9.0620 |
| 13 | C7 | 21.2950 |
| 14 | C8 | 15.9000 |
| 15 | C9 | 4.3170 |
| 16 | C10+ | 9.0790 |
| 17 | Benzene | 0.1790 |
| 18 | Toluene | 1.0490 |
| 19 | E-Benzene | 0.1150 |
| 20 | Xylenes | 1.2260 |
| 21 | n-C6 | 6.9830 |
| 22 | 224Trimethyl p | 0.0340 |

Attachment I - E&P Tanks PW Report.txt

```
-- Sales Oil -----
Production Rate      : 2[bbl/day]
Days of Annual Operation : 365 [days/year]
API Gravity          : 73.7
Reid Vapor Pressure  : 12.50[psi a]
```

```
*****
*      Calculation Results      *
*****
```

```
-- Emission Summary -----
Item      Uncontrolled      Uncontrolled
           [ton/yr]          [lb/hr]
Total HAPs      0.090        0.021
Total HC        4.128        0.942
VOCs, C2+      4.100        0.936
Page 1----- E&P TANK
```

```
VOCs, C3+      3.548        0.810
```

```
Uncontrolled Recovery Info.
Vapor      177.1700 x1E-3 [MSCFD]
HC Vapor   177.1700 x1E-3 [MSCFD]
GOR        88.58         [SCF/bbl]
```

```
-- Emission Composition -----
No  Component      Uncontrolled      Uncontrolled
           [ton/yr]          [lb/hr]
1   H2S            0.000            0.000
2   O2             0.000            0.000
3   CO2            0.000            0.000
4   N2             0.000            0.000
5   C1             0.028            0.006
6   C2             0.552            0.126
7   C3             1.499            0.342
8   i-C4           0.401            0.092
9   n-C4           0.762            0.174
10  i-C5           0.282            0.064
11  n-C5           0.223            0.051
12  C6             0.135            0.031
13  C7             0.120            0.027
14  C8             0.032            0.007
15  C9             0.003            0.001
16  C10+          0.001            0.000
17  Benzene       0.002            0.000
18  Toluene       0.003            0.001
19  E-Benzene     0.000            0.000
20  Xylenes       0.001            0.000
21  n-C6          0.083            0.019
22  224Tri methyl p 0.000            0.000
```

Attachment I - E&P Tanks PW Report.txt

Total 4.127

0.942

| -- Stream Data ----- | | | | | | | | |
|----------------------|-------------------|-----------|-----------------|--------------------|-------------------|--------------------|------------------|--------------------------|
| No. | Component | MW | LP Oil mol % | Flash Oil mol % | Sale Oil mol % | Flash Gas mol % | W&S Gas mol % | Total Emissions mol % |
| 1 | H2S | 34.80 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | O2 | 32.00 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | CO2 | 44.01 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | N2 | 28.01 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | C1 | 16.04 | 0.1800 | 0.0250 | 0.0000 | 4.1412 | 0.4803 | 2.0526 |
| 6 | C2 | 30.07 | 1.9110 | 0.9572 | 0.0255 | 26.2809 | 17.9484 | 21.5272 |
| 7 | C3 | 44.10 | 5.8480 | 4.7156 | 2.5811 | 34.7822 | 43.6408 | 39.8361 |
| 8 | i-C4 | 58.12 | 2.8650 | 2.6807 | 2.3631 | 7.5735 | 8.4733 | 8.0868 |
| 9 | n-C4 | 58.12 | 7.7460 | 7.4779 | 7.0133 | 14.5965 | 15.9508 | 15.3691 |
| 10 | i-C5 | 72.15 | 5.8910 | 5.9487 | 6.0166 | 4.4163 | 4.7110 | 4.5844 |
| 11 | n-C5 | 72.15 | 6.3200 | 6.4308 | 6.5794 | 3.4888 | 3.7207 | 3.6211 |
| 12 | C6 | 86.16 | 9.0620 | 9.3459 | 9.7525 | 1.8072 | 1.9320 | 1.8784 |
| 13 | C7 | 100.20 | 21.2950 | 22.0741 | 23.2024 | 1.3890 | 1.4981 | 1.4513 |
| 14 | C8 | 114.23 | 15.9000 | 16.5097 | 17.3959 | 0.3205 | 0.3496 | 0.3371 |
| 15 | C9 | 128.28 | 4.3170 | 4.4848 | 4.7288 | 0.0294 | 0.0345 | 0.0323 |
| 16 | C10+ | 154.70 | 9.0790 | 9.4339 | 9.9506 | 0.0101 | 0.0115 | 0.0109 |
| 17 | Benzene | 78.11 | 0.1790 | 0.1850 | 0.1936 | 0.0257 | 0.0276 | 0.0268 |
| 18 | Toluene | 92.13 | 1.0490 | 1.0884 | 1.1457 | 0.0414 | 0.0449 | 0.0434 |
| 19 | E-Benzene | 106.17 | 0.1150 | 0.1194 | 0.1259 | 0.0015 | 0.0016 | 0.0015 |
| 20 | Xylenes | 106.17 | 1.2260 | 1.2735 | 1.3425 | 0.0135 | 0.0149 | 0.0143 |
| 21 | n-C6 | 86.18 | 6.9830 | 7.2140 | 7.5461 | 1.0805 | 1.1582 | 1.1249 |
| 22 | 2,2,4-Trimethyl p | 114.24 | 0.0340 | 0.0353 | 0.0371 | 0.0018 | 0.0019 | 0.0018 |
| MW | | | 92.05 | 93.82 | 96.24 | 46.77 | 49.60 | 48.39 |
| Stream Mole Ratio | | | 1.0000 | 0.9623 | 0.9123 | 0.0377 | 0.0500 | 0.0877 |
| Heating Value | | [BTU/SCF] | | | | 2655.57 | 2806.48 | 2741.67 |
| Gas Gravity | | [Gas/Air] | | | | 1.61 | 1.71 | 1.67 |
| Bubble Pt. @ 100F | | [psi a] | 35.59 | 23.66 | 13.71 | | | |
| RVP @ 100F | | [psi a] | 24.68 | 18.85 | 12.48 | | | |
| Spec. Gravity @ 100F | | | 0.660 | 0.663 | 0.667 | | | |

Attachment J

Attachment J

AIR QUALITY PERMIT NOTICE Notice of Application

Notice is given that American Energy – Marcellus, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a General Permit G70-A Permit Application for a natural gas production operation located on Hoyt Ridge Road, Wileyville, in Wetzel County, West Virginia. The latitude and longitude coordinates are: 39.6149, -80.6138.

The applicant estimates the potential to discharge the following regulated air pollutants on a facility-wide basis will be:

Volatile Organic Compounds (VOCs) = 10.00 tpy
Hazardous Air Pollutants (HAPs) = 1.34 tpy
Carbon Monoxide (CO) = 20.40 tpy
Nitrogen Oxides (NO_x) = 23.02 tpy
Particulate Matter (PM) = 3.93 tpy
Sulfur Dioxide (SO₂) = 0.08 tpy
Carbon Dioxide Equivalents (CO₂e) = 18,247 tpy

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 XX day of April, 2015.

By: American Energy – Marcellus, LLC
Tim Cummings
Director – Operations, AEM
301 NW 63rd St. Suite 600
Oklahoma City, OK 73116

Attachment K

Attachment K
G70-A General Permit Electronic Submittal

American Energy – Marcellus, LLC has chosen not to submit this G70-A General Permit Application electronically. One (1) original copy and two (2) complete PDF versions on CD-ROM of this application have been delivered to the WVDEP Division of Air Quality.

Attachment L

Attachment L
G70-A General Permit Application Fee

An application fee of \$4000 is being submitted by American Energy – Marcellus, LLC with this G70-A General Permit Application.

Attachment M

Attachment M
G70-A General Permit Siting Criteria Waiver

There are no dwellings within 300 feet of the proposed natural gas production facility.

Attachment N



AMERICAN ENERGY
PARTNERS

Natural Gas Liquids

Safety Data Sheet

Section 1: Identification of the substance or mixture and of the supplier

Product Name: Natural Gas Liquids
SDS Number: 786340

Synonyms/Other Means of Identification: Natural Gas Liquids, Raw
Natural Gas Liquids, Ethane Free
Plant Condensate
Raw NGL
EPBC Mix
PBC Mix
Y-Grade
Gas Liquids

MARPOL Annex I Category: Naphthas and Condensates
Intended Use: Feedstock

Manufacturer: American Energy Partners
301 N.W. 63rd
Oklahoma City, OK 73116

Emergency Health and Safety Number: Chemtrec: 800-424-9300 (24 Hours)

SDS Information: Phone: 844-210-6000
URL: www.americanenergypartners.com

Section 2: Hazard(s) Identification

Classification

H224 -- Flammable liquids -- Category 1
H315 -- Skin corrosion/irritation -- Category 2
H304 -- Aspiration Hazard -- Category 1
H336 -- Specific target organ toxicity (single exposure) -- Category 3
H350 -- Carcinogenicity -- Category 1B
H411 -- Hazardous to the aquatic environment, chronic toxicity -- Category 2

Hazards not Otherwise Classified

May contain or release poisonous hydrogen sulfide gas

Label Elements



DANGER

Extremely flammable liquid and vapor. (H224)*

Causes skin irritation. (H315)*

May contain or release poisonous hydrogen sulfide gas

May be fatal if swallowed and enters airways. (H304)*

May cause drowsiness or dizziness. (H336)*

May cause cancer. (H350)*

Toxic to aquatic life with long lasting effects. (H411)*

Precautionary Statement(s):

Obtain special instructions before use. (P201)*
Do not handle until all safety precautions have been read and understood. (P202)*
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. (P210)*
Keep container tightly closed. (P233)*
Ground/bond container and receiving equipment. (P240)*
Use with explosion-proof equipment. (P241)*
Use only non-sparking tools. (P242)*
Take precautionary measures against static discharge. (P243)*
Avoid breathing dust/fume/gas/mist/vapours/spray. (P261)*
Wash thoroughly after handling. (P264)*
Use only outdoors or in a well-ventilated area. (P271)*
Wear protective gloves / protective clothing / eye protection / face protection. (P280)*
IF ON SKIN: Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. (P303+P361+P353)*
In case of fire: Use dry chemical, carbon dioxide, or foam for extinction.(P370+P378)*
If skin irritation occurs: Get medical advice/attention. (P313)*
Take off contaminated clothing and wash before reuse. (P362)*
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. (P301+P310)*
Do NOT induce vomiting. (P331)*
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. (P304+P340)*
Call a POISON CENTER or doctor/physician if you feel unwell. (P312)*
In case of fire: Use dry chemical, carbon dioxide, or foam for extinction.(P370+P378)*
Store in a well-ventilated place. Keep cool.(P403+P235)*
Store locked up. (P405)*
Dispose of contents/container to approved disposal facility. (P501)*

* (Applicable GHS hazard code.)

Section 3: Composition / Information on Ingredients

| Component | CASRN | Concentration ¹ |
|---------------------------------------|------------|----------------------------|
| Natural gas (petroleum), raw liq. mix | 64741-48-6 | 100 |
| n-Hexane | 110-54-3 | 5-25 |
| Benzene | 71-43-2 | 0.1-5 |
| Hydrogen Sulfide | 7783-06-4 | <1 |

Total Sulfur: > 0.5 wt%

¹ All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Section 4: First Aid Measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing, and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops, seek medical attention. Wash contaminated clothing before reuse.

Inhalation (Breathing): If respiratory symptoms or other symptoms of exposure develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If symptoms persist, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

Most important symptoms and effects

Acute: Headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue.

Delayed: Dry skin and possible irritation with repeated or prolonged exposure.

Notes to Physician: At high concentrations hydrogen sulfide may produce pulmonary edema, respiratory depression, and/or respiratory paralysis. The first priority in treatment should be the establishment of adequate ventilation and the administration of 100% oxygen. Animal studies suggest that nitrites are a useful antidote, however, documentation of the efficacy of nitrites in humans is lacking. If the diagnosis of hydrogen sulfide poisoning is confirmed and if the patient does not respond rapidly to supportive care, the use of nitrites may be an effective antidote if delivered within the first few minutes of exposure. For adults the dose is 10 mL of a 3% NaNO₂ solution (0.5 gm NaNO₂ in 15 mL water) I.V. over 2-4 minutes. The dosage should be adjusted in children or in the presence of anemia, and methemoglobin levels, arterial blood gases, and electrolytes should be monitored closely.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

Federal regulations (29 CFR 1910.1028) specify medical surveillance programs for certain exposures to benzene above the action level or PEL (specified in Section (i)(1)(i) of the Standard). In addition, employees exposed in an emergency situation shall, as described in Section (i)(4)(i), provide a urine sample at the end of the shift for measurement of urine phenol.

Other Comments: Before attempting rescue, first responders should be alert to the possible presence of hydrogen sulfide, a poisonous gas with the smell of rotten eggs, and should consider the need for respiratory protection (see Section 8). Remove casualty to fresh air as quickly as possible. Immediately begin artificial respiration if breathing has ceased. Consider whether oxygen administration is needed. Obtain medical advice for further treatment.

Section 5: Fire-Fighting Measures



NFPA 704 Hazard Class

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

Unusual Fire & Explosion Hazards: Extremely flammable. This material can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. This product will float and can be reignited on surface water. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire. Hazardous combustion/decomposition products, including hydrogen sulfide, may be released by this material when exposed to heat or fire. Use caution and wear protective clothing, including respiratory protection.

Extinguishing Media: Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Hydrogen sulfide and oxides of nitrogen and sulfur may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

Personal Precautions: Extremely flammable. Spillages of liquid product will create a fire hazard and may form an explosive atmosphere. Keep all sources of ignition and hot metal surfaces away from spill/release if safe to do so. The use of explosion-proof electrical equipment is recommended. May contain or release poisonous hydrogen sulfide gas. If the presence of dangerous amounts of H₂S around the spilled product is suspected, additional or special actions may be warranted, including access restrictions and use of protective equipment. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use foam on spills to minimize vapors. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

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

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

Section 7: Handling and Storage

Precautions for safe handling: Keep away from ignition sources such as heat/sparks/open flame – No smoking. Take precautionary measures against static discharge. Nonsparking tools should be used. May contain or release dangerous levels of hydrogen sulfide. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid breathing vapors or mists. Use only outdoors or in well-ventilated area. Wear protective gloves/clothing and eye/face protection. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Extremely Flammable. May vaporize easily at ambient temperatures. The vapor is heavier than air and may create an explosive mixture of vapor and air. Beware of accumulation in confined spaces and low lying areas. Open container slowly to relieve any pressure. Electrostatic charge may accumulate and create a hazardous condition when handling or processing this material. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-70 and/or API RP 2003 for specific bonding/grounding requirements. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames.

Static Accumulation Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding of tanks, transfer piping, and storage tank level floats are necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. Special care should be given to ensure that special slow load procedures for "switch loading" are followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil or diesel) is loaded into tanks previously containing low flash point products (such as gasoline or naphtha). For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.

Conditions for safe storage: This material may contain or release poisonous hydrogen sulfide gas. In a tank, barge, or other closed container, the vapor space above this material may accumulate hazardous concentrations of hydrogen sulfide. Check atmosphere for oxygen content, H₂S, and flammability prior to entry. Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Store only in approved containers. Post area "No Smoking or Open Flame." Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Section 8: Exposure Controls / Personal Protection

| Component | ACGIH | OSHA | Other |
|---------------------------------------|---------------------------------------|--|--|
| Natural gas (petroleum), raw liq. mix | TWA: 300 ppm (as Gasoline) | TWA: 400 mg/m ³ TWA: 100 ppm | 0.5 ppm TWA8hr (as benzene) 0.25 ppm TWA12hr (as benzene) 2.5 ppm STEL (as benzene) (American Energy Guidelines) |
| n-Hexane | TWA: 50 ppm Skin | TWA: 500 ppm TWA: 1800 mg/m ³ | --- |
| Benzene | STEL: 2.5 ppm TWA: 0.5 ppm Skin | Ceiling: 25 ppm STEL: 5 ppm TWA: 10 ppm TWA: 1 ppm | --- |
| Hydrogen Sulfide | STEL: 5 ppm TWA: 1 ppm | Ceiling: 20 ppm | TWA: 5 ppm 8hr TWA: 2.5 ppm 12hr STEL: 15 ppm (American Energy Guidelines) |

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

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

Eye/Face Protection: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Depending on exposure and use conditions, additional protection may be necessary to prevent skin contact including use of items such as chemical resistant boots, aprons, arm covers, hoods, coveralls, or encapsulated suits. Suggested protective materials: Nitrile

Respiratory Protection: A NIOSH approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode should be used in situations of oxygen deficiency (oxygen content less than 19.5 percent), unknown exposure concentrations, or situations that are immediately dangerous to life or health (IDLH).

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use.

If benzene concentrations equal or exceed applicable exposure limits, OSHA requirements for personal protective equipment, exposure monitoring, and training may apply (29CFR1910.1028 - Benzene).

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

| | |
|---|---|
| Appearance: | Colorless |
| Physical Form: | Liquid |
| Odor: | Gasoline; Rotten egg / sulfurous |
| Odor Threshold: | No data |
| pH: | Not applicable |
| Vapor Pressure: | 150 - 200 psia (Reid VP) @ 100°F / 37.8°C |
| Vapor Density (air=1): | >1 |
| Initial Boiling Point/Range: | No data |
| Melting/Freezing Point: | No data |
| Solubility in Water: | Negligible |
| Partition Coefficient (n-octanol/water) (Kow): | No data |
| Specific Gravity (water=1): | (estimated) 0.5 - 0.7 @ 68°F / 20°C |
| Percent Volatile: | 100% |
| Evaporation Rate (nBuAc=1): | No data |
| Flash Point: | < -99 °F / < -73 °C |
| Test Method: | (estimate) |
| Lower Explosive Limits (vol % in air): | No data |
| Upper Explosive Limits (vol % in air): | No data |
| Auto-ignition Temperature: | No data |

Section 10: Stability and Reactivity

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Avoid high temperatures and all sources of ignition. Prevent vapor accumulation.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

| <u>Acute Toxicity</u> | <u>Hazard</u> | <u>Additional Information</u> | <u>LC50/LD50 Data</u> |
|------------------------|---|--|-----------------------|
| Inhalation | Expected to have a low degree of toxicity by inhalation | May contain or release poisonous hydrogen sulfide gas - see Other Comments. | > 5.2 mg/L (vapor) |
| Skin Absorption | Unlikely to be harmful | | > 2 g/kg |
| Ingestion (Swallowing) | Unlikely to be harmful | | > 5 g/kg |

Aspiration Hazard: May be fatal if swallowed and enters airways.

Skin Corrosion/Irritation: Causes skin irritation. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Causes mild eye irritation. .

Signs and Symptoms: Effects of overexposure can include slight irritation of the respiratory tract, nausea, vomiting, and signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue). Continued exposure to high concentrations can result in vomiting, cardiac irregularities and sudden loss of consciousness.

Skin Sensitization: Not expected to be a skin sensitizer.

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): May cause drowsiness and dizziness.

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: May cause cancer Based on component information.

Germ Cell Mutagenicity: Not expected to cause heritable genetic effects.

Reproductive Toxicity: Not expected to cause reproductive toxicity.

Other Comments: This material may contain or liberate hydrogen sulfide, a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (sensitivity to light), and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats, convulsions, respiratory failure, and death.

Information on Toxicological Effects of Components

Natural gas (petroleum), raw liq. mix

Carcinogenicity: Two year inhalation studies of vaporized unleaded gasoline produced an increased incidence of kidney tumors in male rats and liver tumors in female mice. Repeated skin application of various petroleum naphthas in mice for two years resulted in an increased incidence of skin tumors but only in the presence of severe skin irritation. Follow-up mechanistic studies suggest that the occurrence of these tumors may be the consequence of promotional processes and not relevant to human risk assessment. Epidemiology data collected from a study of more than 18,000 petroleum marketing and distribution workers showed no increased risk of leukemia, multiple myeloma, or kidney cancer from gasoline exposure. Unleaded gasoline has been identified as a possible carcinogen by the International Agency for Research on Cancer.

Target Organs: Two year inhalation studies of wholly vaporized unleaded gasoline, and 90 days studies of various petroleum naphthas, did not produce significant target organ toxicity in laboratory animals. Nephropathy in male rats, characterized by the accumulation of alpha-2-u globulin in epithelial cells of the proximal tubules was observed, however follow-up studies suggest that these changes are unique to the male rat.

Reproductive Toxicity: No evidence of developmental toxicity was found in pregnant laboratory animals (rats and mice) exposed to high vapor concentrations of unleaded gasoline and petroleum naphthas via inhalation. A two-generation reproductive toxicity study of vapor recovery gasoline did not adversely affect reproductive function or offspring survival and development.

n-Hexane

Target Organs: Excessive exposure to n-hexane can result in peripheral neuropathies. The initial symptoms are symmetrical sensory numbness and paresthesias of distal portions of the extremities. Motor weakness is typically observed in muscles of the toes and fingers but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane are potentiated by exposure to methyl ethyl ketone and methyl isobutyl ketone.

Reproductive Toxicity: Prolonged exposure to high concentrations of n-hexane (>1,000 ppm) resulted in decreased sperm count and degenerative changes in the testes of rats but not those of mice.

Benzene

Carcinogenicity: Benzene is an animal carcinogen and is known to produce acute myelogenous leukemia (a form of cancer) in humans. Benzene has been identified as a human carcinogen by IARC, the US National Toxicology Program and the US-Occupational Safety and Health Administration.

Target Organs: Prolonged or repeated exposures to benzene vapors can cause damage to the blood and blood forming organs, including disorders like leukopenia, thrombocytopenia, and aplastic anemia.

Reproductive Toxicity: Some studies in occupationally exposed women have suggested benzene exposure increased risk of miscarriage and stillbirth and decreased birth weight and gestational age. The size of the effects detected in these studies was small, and ascertainment of exposure and outcome in some cases relied on self-reports, which may limit the reliability of these results.

Germ Cell Mutagenicity: Benzene exposure has resulted in chromosomal aberrations in human lymphocytes and animal bone marrow cells. Exposure has also been associated with chromosomal aberrations in sperm cells in human and animal studies.

Toluene

Carcinogenicity: Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC.

Target Organs: Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances.

Reproductive Toxicity: Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.

Cyclohexane

Reproductive Toxicity: Two-generation reproduction and developmental toxicity studies using rats and rabbits exposed (whole-body) to atmospheric concentrations up to 7000 ppm cyclohexane did not detect evidence of developmental toxicity in either species.

Section 12: Ecological Information

Toxicity: Acute aquatic toxicity studies on samples of gasoline and naphtha streams show acute toxicity values greater than 1 mg/L and mostly in the range 1-100 mg/L. These tests were carried out on water accommodated fractions, in closed systems to prevent evaporative loss. Results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon composition. These substances should be regarded as toxic to aquatic organisms, with the potential to cause long term adverse effects in the aquatic environment. Classification: H411; Chronic Cat 2.

Persistence and Degradability: The hydrocarbons in this material are not readily biodegradable but are regarded as inherently biodegradable since their hydrocarbon components can be degraded by microorganisms.

Persistence per IOPC Fund definition: Non-Persistent

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon components of this material range from 3 to greater than 6 and therefore are regarded as having the potential to bioaccumulate. In practice, metabolic processes or physical properties may prevent this effect or limit bioavailability.

Mobility in Soil: On release to water, hydrocarbons will float on the surface and since they are sparingly soluble, the only significant loss is volatilization to air. In air, these hydrocarbons are photodegraded by reaction with hydroxyl radicals with half lives varying from 6.5 days for benzene to 0.5 days for n-dodecane.

Other Adverse Effects: None anticipated.

Section 13: Disposal Considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste. However, it would likely be identified as a federally regulated RCRA hazardous waste for the following characteristic(s) shown below. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

Container contents should be completely used and containers should be emptied prior to discard. Container residues and rinseates could be considered to be hazardous wastes.

EPA Waste Number(s)

- D001 - Ignitability characteristic
- D018 - Toxicity characteristic (Benzene)

Section 14: Transport Information

U.S. Department of Transportation (DOT)

| | |
|--|---|
| Shipping Description: | <i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) shipping description is:</i> UN1965, Hydrocarbon gas mixture, liquefied, n.o.s., 2.1; ; <i>If vapor pressure is <= 300 kPa (43.5 psia) at 50° C (122° F) shipping description is:</i> UN3295, Hydrocarbons, liquid, n.o.s., 3, I or II [I if BP < 95° F (35° C); II if BP > 95° F] |
| Non-Bulk Package Marking: | <i>Must be consistent with shipping description, either:</i> Hydrocarbon gas mixture, liquefied, n.o.s., UN1965 or Hydrocarbons, liquid, n.o.s., UN3295 |
| Non-Bulk Package Labeling: | <i>For UN1965:</i> Flammable gas <i>For UN3295:</i> Flammable liquid |
| Bulk Package/Placard Marking: | <i>For UN1965:</i> Flammable gas / 1965 <i>For UN3295:</i> Flammable / 3295 |
| Packaging - References: | <i>For UN1965:</i> 49 CFR: 173.306; 173.304; 173.314 & .315 <i>For UN3295:</i> 49 CFR 173.150; 173.201; 173.243 [PG I] -or- 49 CFR 173.150; 173.202; 173.242 [PG II] (Exceptions; Non-bulk; Bulk) |
| Hazardous Substance: Emergency Response Guide: Note: | See Section 15 for RQ's UN1965 - 115; UN3295 - 128; <i>The following alternate shipping description order may be used until January 1, 2013:</i> Proper Shipping name, Hazard Class or Division, (Subsidiary Hazard if any), UN or NA number, Packing Group <i>Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable</i> <i>Other shipping description elements may be required for DOT compliance.</i> |

International Maritime Dangerous Goods (IMDG)

| | |
|---------------------------|---|
| Shipping Description: | <i>If boiling point is < 20° C shipping description is:</i> UN1965, Hydrocarbon gas mixture, liquefied, n.o.s., (Propane , Butane), 2.1 <i>If vapor pressure is <= 300 kPa (43.5 psia) at 50° C (122° F) shipping description is:</i> UN3295, Hydrocarbons, liquid, n.o.s., 3, I or II (FP° C cc), [where FP is the material's flash point in degrees C cc.] [I if BP < 95° F (35° C); II if BP > 95° F]; |
| Non-Bulk Package Marking: | <i>Must be consistent with shipping description, either:</i> Hydrocarbon gas mixture, liquefied, n.o.s., (Propane, Butane), UN1965 or Hydrocarbons, liquid, n.o.s., UN3295 |
| Labels: | <i>For UN1965:</i> Flammable gas <i>For UN3295:</i> Flammable liquid |
| Placards/Marking (Bulk): | <i>For UN1965:</i> Flammable gas / 1965 <i>For UN3295:</i> Flammable / 3295 |
| Packaging - Non-Bulk: | <i>For UN1965:</i> P200 <i>For UN3295:</i> P001 |
| EMS: | <i>For UN1965:</i> F-D, S-U <i>For UN3295:</i> F-E, S-D |
| Note: | <i>If transported in bulk by marine vessel in international waters, product is being carried under the scope of MARPOL Annex I.</i> |

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #: UN1965 or UN3295

Proper Shipping Name: For UN1965: Hydrocarbon gas mixture, liquefied, n.o.s. (Propane, Butane)
For UN3295: Hydrocarbons, liquid, n.o.s.

Hazard Class/Division: For UN1965: 2.1
For UN3295: 3

Subsidiary risk: None
Packing Group: For UN1965: None
For UN3295: I or II [**Determined by IATA 3.3.2**]

Non-Bulk Package Marking: For UN1965: Hydrocarbon gas mixture, liquefied, n.o.s. (Propane, Butane), UN1965
For UN3295: Hydrocarbons, liquid, n.o.s., UN3295

Labels: For UN1965: Flammable gas , Cargo Aircraft Only
For UN3295: Flammable liquid

ERG Code: For UN1965: 10L or For UN3295: 3H

| | LTD. QTY | Passenger Aircraft | Cargo Aircraft Only |
|-----------------------------------|--|--|---|
| Packaging Instruction #: | UN1965 - Forbidden UN3295 - Forbidden - [PG I] Y341 - [PG II] | UN1965 - Forbidden UN3295 - 351 - [PG I] 353 - [PG II] | UN1965 - 200 UN3295 - 361 - [PG I] 364 - [PG II] |
| Max. Net Qty. Per Package: | UN3295 - Forbidden - [PG I] 1L - [PG II] | UN3295 - 1L - [PG I] 5 L - [PG II] | UN1965 - 150 kg UN3295 - 30 L - [PG I] 60 L - [PG II] |

Section 15: Regulatory Information

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

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

| Component | TPQ | EPCRA RQ |
|------------------|--------|----------|
| Hydrogen Sulfide | 500 lb | 100 lb |

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: Yes
Fire Hazard: Yes
Pressure Hazard: No
Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

| Component | Concentration ¹ | de minimis |
|-------------|----------------------------|------------|
| n-Hexane | 5-25 | 1.0% |
| Toluene | 1-5 | 1.0% |
| Benzene | 0.1-5 | 0.1% |
| Cyclohexane | 0-3 | 1.0% |

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

California Proposition 65:

Warning: This material may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects or other reproductive harm, and which may be subject to the warning requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

| Component | Type of Toxicity |
|-----------|--|
| Toluene | Developmental Toxicant Female Reproductive Toxicant |
| Benzene | Cancer Developmental Toxicant Male Reproductive Toxicant |

International Hazard Classification

Canada:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:

B2 - Flammable Liquids
D2A
D2B

National Chemical Inventories

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA
All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: EAR99

Section 16: Other Information

| | |
|--|--|
| Date of Issue: | 20-Sep-2014 |
| Status: | FINAL |
| Previous Issue Date: | 20-Sep-2014 |
| Revised Sections or Basis for Revision: | Identified Hazards (Section 2) Precautionary Statement(s) (Section 2) First Aid (Section 4)Exposure limits (Section 8) Shipping information (Section 14) Regulatory information (Section 15) |
| SDS Number: | 786340 |

Guide to Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Section 1: Identification of the substance or mixture and of the supplier

| | |
|---|--|
| Product Name: | Crude Condensate |
| SDS Number: | 730370 |
| Synonyms/Other Means of Identification: | Natural Gas Condensates, Petroleum Crude Oil Condensate Gas Drips |
| MARPOL Annex I Category: | Naphthas and Condensates |
| Intended Use: | Feedstock |
| Manufacturer: | American Energy Partners 301 N.W. 63rd Oklahoma City, OK 73116 |
| Emergency Health and Safety Number: | Chemtrec: 800-424-9300 (24 Hours) |
| SDS Information: | Phone: 844-210-6000 URL: www.americanenergypartners.com |

Section 2: Hazard(s) Identification

Classification

H224 -- Flammable liquids -- Category 1
H304 -- Aspiration Hazard -- Category 1
H315 -- Skin corrosion/irritation -- Category 2
H332 -- Acute toxicity, Inhalation -- Category 4
H336 -- Specific target organ toxicity (single exposure) -- Category 3
H350 -- Carcinogenicity -- Category 1B
H411 -- Hazardous to the aquatic environment, chronic toxicity -- Category 2

Hazards not Otherwise Classified

May contain or release poisonous hydrogen sulfide gas

Label Elements



DANGER

Extremely flammable liquid and vapor. (H224)*
Causes skin irritation. (H315)*
May be fatal if swallowed and enters airways. (H304)*
Contains poisonous hydrogen sulfide gas
Harmful if inhaled. (H332)*
May cause drowsiness or dizziness. (H336)*
May cause cancer. (H350)*
Toxic to aquatic life with long lasting effects. (H411)*

Precautionary Statement(s):

Obtain special instructions before use. (P201)*
Do not handle until all safety precautions have been read and understood. (P202)*
Keep away from heat/sparks/open flames/hot surfaces. - No smoking. (P210)*
Keep container tightly closed. (P233)*
Keep cool. (P235)*
Ground/bond container and receiving equipment. (P240)*
Use with explosion-proof equipment. (P241)*
Use only non-sparking tools. (P242)*
Take precautionary measures against static discharge. (P243)*
Avoid breathing dust/fume/gas/mist/vapours/spray. (P261)*
Wash thoroughly after handling. (P264)*
Use only outdoors or in a well-ventilated area. (P271)*
Avoid release to the environment. (P273)*
Wear protective gloves / protective clothing / eye protection / face protection. (P280)*
IF ON SKIN: Remove/Take off immediately all contaminated clothing. (P361)* Wash with plenty of soap and water. (P352)*
If skin irritation occurs: Get medical advice/attention. (P313)*
Take off contaminated clothing and wash before reuse. (P362)*
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. (P340)*
Call a POISON CENTER or doctor/physician if you feel unwell. (P312)*
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. (P301+P310)*
Do NOT induce vomiting. (P331)*
In case of fire: Use dry chemical, carbon dioxide, or foam for extinction. (P370+P378)*
Collect spillage. (P391)*
Store locked up. (P405)*
Store in a well-ventilated place. Keep container tightly closed. (P403+P233)*
Dispose of contents/container to approved disposal facility. (P501)*

*(Applicable GHS hazard code.)

Section 3: Composition / Information on Ingredients

| Component | CASRN | Concentration ¹ |
|--------------------------------|------------|----------------------------|
| Natural Gas Condensate ..C2-20 | 64741-47-5 | 100 |
| Toluene | 108-88-3 | 1-7 |
| Hydrogen Sulfide | 7783-06-4 | 0.1-5 |
| Benzene | 71-43-2 | <5 |

¹ All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Crude oil, natural gas and natural gas condensate can contain minor amounts of sulfur, nitrogen and oxygen containing organic compounds as well as trace amounts of heavy metals like mercury, arsenic, nickel, and vanadium. Composition can vary depending on the source of crude.

Section 4: First Aid Measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing, and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops, seek medical attention. Wash contaminated clothing before reuse.

Inhalation (Breathing): Immediately move victim away from exposure and into fresh air in a position comfortable for breathing. If respiratory symptoms or other symptoms of exposure develop, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

Most important symptoms and effects

Acute: Headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue.

Delayed: Dry skin and possible irritation with repeated or prolonged exposure.

Notes to Physician: At high concentrations hydrogen sulfide may produce pulmonary edema, respiratory depression, and/or respiratory paralysis. The first priority in treatment should be the establishment of adequate ventilation and the administration of 100% oxygen. Animal studies suggest that nitrites are a useful antidote, however, documentation of the efficacy of nitrites in humans is lacking. If the diagnosis of hydrogen sulfide poisoning is confirmed and if the patient does not respond rapidly to supportive care, the use of nitrites may be an effective antidote if delivered within the first few minutes of exposure. For adults the dose is 10 mL of a 3% NaNO₂ solution (0.5 gm NaNO₂ in 15 mL water) I.V. over 2-4 minutes. The dosage should be adjusted in children or in the presence of anemia, and methemoglobin levels, arterial blood gases, and electrolytes should be monitored closely.

Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in persons exposed to high concentrations of hydrocarbon solvents (e.g., in enclosed spaces or with deliberate abuse). The use of other drugs with less arrhythmogenic potential should be considered. If sympathomimetic drugs are administered, observe for the development of cardiac arrhythmias.

Federal regulations (29 CFR 1910.1028) specify medical surveillance programs for certain exposures to benzene above the action level or PEL (specified in Section (i)(1)(i) of the Standard). In addition, employees exposed in an emergency situation shall, as described in Section (i)(4)(i), provide a urine sample at the end of the shift for measurement of urine phenol.

Other Comments: Before attempting rescue, first responders should be alert to the possible presence of hydrogen sulfide, a poisonous gas with the smell of rotten eggs, and should consider the need for respiratory protection (see Section 8). Remove casualty to fresh air as quickly as possible. Immediately begin artificial respiration if breathing has ceased. Consider whether oxygen administration is needed. Obtain medical advice for further treatment.

Section 5: Fire-Fighting Measures



NFPA 704 Hazard Class

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

Unusual Fire & Explosion Hazards: Extremely flammable. This material can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. This product will float and can be reignited on surface water. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire. Hazardous combustion/decomposition products, including hydrogen sulfide, may be released by this material when exposed to heat or fire. Use caution and wear protective clothing, including respiratory protection.

Extinguishing Media: Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Hydrogen sulfide and oxides of nitrogen and sulfur may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

Personal Precautions: Extremely flammable. Spillages of liquid product will create a fire hazard and may form an explosive atmosphere. Keep all sources of ignition and hot metal surfaces away from spill/release if safe to do so. The use of explosion-proof electrical equipment is recommended. Contains poisonous hydrogen sulfide gas. If the presence of dangerous amounts of H₂S around the spilled product is suspected, additional or special actions may be warranted, including access restrictions and use of protective equipment. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use foam on spills to minimize vapors. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

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

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

Section 7: Handling and Storage

Precautions for safe handling: Keep away from ignition sources such as heat/sparks/open flame – No smoking. Take precautionary measures against static discharge. Nonsparking tools should be used. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Wear protective gloves/clothing and eye/face protection. May contain or release dangerous levels of hydrogen sulfide. Use only outdoors or in well-ventilated area. Avoid breathing vapors or mists. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

Extremely Flammable. May vaporize easily at ambient temperatures. The vapor is heavier than air and may create an explosive mixture of vapor and air. Beware of accumulation in confined spaces and low lying areas. Open container slowly to relieve any pressure. Electrostatic charge may accumulate and create a hazardous condition when handling or processing this material. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. The use of explosion-proof electrical equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-70 and/or API RP 2003 for specific bonding/grounding requirements. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames.

Mercury and other heavy metals may be present in trace quantities in crude oil, raw natural gas, and condensates. Production and processing of these materials can lead to "drop-out" of elemental mercury in enclosed vessels and pipe work, typically at the low point of any process equipment because of its density. Mercury may also occur in other process system deposits such as sludges, sands, scales, waxes, and filter media. Personnel engaged in work with equipment where mercury deposits might occur (confined space entry, sampling, opening drain valves, draining process lines, etc), may be exposed to a mercury hazard (see sections 3 and 8).

Static Accumulation Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding of tanks, transfer piping, and storage tank level floats are necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. Special care should be given to ensure that special slow load procedures for "switch loading" are followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil or diesel) is loaded into tanks previously containing low flash point products (such as gasoline or naphtha). For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.

Conditions for safe storage: This material may contain or release poisonous hydrogen sulfide gas. In a tank, barge, or other closed container, the vapor space above this material may accumulate hazardous concentrations of hydrogen sulfide. Check atmosphere for oxygen content, H₂S, and flammability prior to entry. Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Store only in approved containers. Post area "No Smoking or Open Flame." Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Section 8: Exposure Controls / Personal Protection

| Component | ACGIH | OSHA | Other |
|--------------------------------|---------------------------------------|--|--|
| Natural Gas Condensate ..C2-20 | TWA: 300 ppm (as Gasoline) | TWA: 400 mg/m ³ TWA: 100 ppm | 0.5 ppm TWA8hr (as benzene) 0.25 ppm TWA12hr (as benzene) 2.5 ppm STEL (as benzene) (American Energy Guidelines) |
| Toluene | TWA: 20 ppm | Ceiling: 300 ppm TWA: 200 ppm | --- |
| Hydrogen Sulfide | STEL: 5 ppm TWA: 1 ppm | Ceiling: 20 ppm | TWA: 5 ppm 8hr TWA: 2.5 ppm 12hr STEL: 15 ppm (American Energy Guidelines) |
| Benzene | STEL: 2.5 ppm TWA: 0.5 ppm Skin | Ceiling: 25 ppm STEL: 5 ppm TWA: 10 ppm TWA: 1 ppm | --- |

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

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

Eye/Face Protection: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Depending on exposure and use conditions, additional protection may be necessary to prevent skin contact including use of items such as chemical resistant boots, aprons, arm covers, hoods, coveralls, or encapsulated suits. Suggested protective materials: Nitrile

Respiratory Protection: A NIOSH approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode should be used in situations of oxygen deficiency (oxygen content less than 19.5 percent), unknown exposure concentrations, or situations that are immediately dangerous to life or health (IDLH).

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use.

If benzene concentrations equal or exceed applicable exposure limits, OSHA requirements for personal protective equipment, exposure monitoring, and training may apply (29CFR1910.1028 - Benzene).

Workplace monitoring plans should consider the possibility that heavy metals such as mercury may concentrate in processing vessels and equipment presenting the possibility of exposure during various sampling and maintenance operations. Implement appropriate respiratory protection and the use of other protective equipment as dictated by monitoring results (See Sections 2 and 7).

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

| | |
|---|--|
| Appearance: | Amber to dark brown |
| Physical Form: | Liquid |
| Odor: | Rotten egg / sulfurous; Petroleum. |
| Odor Threshold: | No data |
| pH: | Not applicable |
| Vapor Pressure: | 5-15 psia (Reid VP) @ 100°F / 37.8°C |
| Vapor Density (air=1): | 1 |
| Initial Boiling Point/Range: | -20 to 800 °F / -29 to 427 °C |
| Melting/Freezing Point: | No data |
| Solubility in Water: | Negligible |
| Partition Coefficient (n-octanol/water) (Kow): | No data |
| Specific Gravity (water=1): | 0.6 - 0.8 @ 60°F (15.6°C) |
| Bulk Density: | 6.25 lbs/gal |
| VOC Content(%): | 50 |
| Evaporation Rate (nBuAc=1): | 1 |
| Flash Point: | -51 °F / -46 °C |
| Test Method: | Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010 |
| Lower Explosive Limits (vol % in air): | 1.1 |
| Upper Explosive Limits (vol % in air): | 6.0 |
| Auto-ignition Temperature: | 590 °F / 310 °C |

Section 10: Stability and Reactivity

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Avoid high temperatures and all sources of ignition. Prevent vapor accumulation.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

| <u>Acute Toxicity</u> | <u>Hazard</u> | <u>Additional Information</u> | <u>LC50/LD50 Data</u> |
|------------------------|------------------------|--|----------------------------|
| Inhalation | Harmful if inhaled | Contains poisonous hydrogen sulfide gas. See Signs and Symptoms. | 10 mg/L (vapor, estimated) |
| Skin Absorption | Unlikely to be harmful | | > 2 g/kg |
| Ingestion (Swallowing) | Unlikely to be harmful | | > 5 g/kg |

Aspiration Hazard: May be fatal if swallowed and enters airways.

Skin Corrosion/Irritation: Causes skin irritation. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Causes mild eye irritation. .

Signs and Symptoms: Effects of overexposure can include slight irritation of the respiratory tract, nausea, vomiting, and signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue). Continued exposure to high concentrations can result in vomiting, cardiac irregularities and sudden loss of consciousness.

This material contains hydrogen sulfide, a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (sensitivity to light), and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats, convulsions, respiratory failure, and death.

Skin Sensitization: Not expected to be a skin sensitizer.

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): May cause drowsiness and dizziness.

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: May cause cancer

Germ Cell Mutagenicity: Not expected to cause heritable genetic effects.

Reproductive Toxicity: Not expected to cause reproductive toxicity.

Information on Toxicological Effects of Components

Natural Gas Condensate ..C2-20

Carcinogenicity: Two year inhalation studies of vaporized unleaded gasoline produced an increased incidence of kidney tumors in male rats and liver tumors in female mice. Repeated skin application of various petroleum naphthas in mice for two years resulted in an increased incidence of skin tumors but only in the presence of severe skin irritation. Follow-up mechanistic studies suggest that the occurrence of these tumors may be the consequence of promotional processes and not relevant to human risk assessment. Epidemiology data collected from a study of more than 18,000 petroleum marketing and distribution workers showed no increased risk of leukemia, multiple myeloma, or kidney cancer from gasoline exposure. Unleaded gasoline has been identified as a possible carcinogen by the International Agency for Research on Cancer.

Target Organs: Two year inhalation studies of wholly vaporized unleaded gasoline, and 90 days studies of various petroleum naphthas, did not produce significant target organ toxicity in laboratory animals. Nephropathy in male rats, characterized by the accumulation of alpha-2-u- globulin in epithelial cells of the proximal tubules was observed, however follow-up studies suggest that these changes are unique to the male rat.

Reproductive Toxicity: No evidence of developmental toxicity was found in pregnant laboratory animals (rats and mice) exposed to high vapor concentrations of unleaded gasoline and petroleum naphthas via inhalation. A two-generation reproductive toxicity study of vapor recovery gasoline did not adversely affect reproductive function or offspring survival and development.

Xylenes

Target Organs: Rats exposed to xylenes at 800, 1000 or 1200 ppm 14 hours daily for 6 weeks demonstrated high frequency hearing loss. Another study in rats exposed to 1800 ppm 8 hours daily for 5 days demonstrated middle frequency hearing loss.

Reproductive Toxicity: Both mixed xylenes and the individual isomers produced limited evidence of developmental toxicity in laboratory animals. Inhalation and oral administration of xylene resulted in decreased fetal weight, increased incidences of delayed ossification, skeletal variations and resorptions, but no evidence of teratogenicity.

Toluene

Carcinogenicity: Exposure of rats and mice to toluene at concentrations ranging from 120-1200 ppm for two years did not demonstrate evidence of carcinogenicity. Toluene has not been listed as a carcinogen by IARC.

Target Organs: Epidemiology studies suggest that chronic occupational overexposure to toluene may damage color vision. Subchronic and chronic inhalation studies with toluene produced kidney and liver damage, hearing loss and central nervous system (brain) damage in laboratory animals. Intentional misuse by deliberate inhalation of high concentrations of toluene has been shown to cause liver, kidney, and central nervous system damage, including hearing loss and visual disturbances.

Reproductive Toxicity: Exposure to toluene during pregnancy has demonstrated limited evidence of developmental toxicity in laboratory animals. Decreased fetal body weight and increased skeletal variations in both inhalation and oral studies, but only at doses that were maternally toxic. No fetal toxicity was seen at doses that were not maternally toxic. Decreased sperm counts have been observed in male rats in the absence of a reduction in fertility. Toluene has been reported to cause mental or growth retardation in the children of solvent abusers who directly inhale toluene during pregnancy.

Cyclohexane

Reproductive Toxicity: Two-generation reproduction and developmental toxicity studies using rats and rabbits exposed (whole-body) to atmospheric concentrations up to 7000 ppm cyclohexane did not detect evidence of developmental toxicity in either species.

Benzene

Carcinogenicity: Benzene is an animal carcinogen and is known to produce acute myelogenous leukemia (a form of cancer) in humans. Benzene has been identified as a human carcinogen by IARC, the US National Toxicology Program and the US-Occupational Safety and Health Administration.

Target Organs: Prolonged or repeated exposures to benzene vapors can cause damage to the blood and blood forming organs, including disorders like leukopenia, thrombocytopenia, and aplastic anemia.

Reproductive Toxicity: Some studies in occupationally exposed women have suggested benzene exposure increased risk of miscarriage and stillbirth and decreased birth weight and gestational age. The size of the effects detected in these studies was small, and ascertainment of exposure and outcome in some cases relied on self-reports, which may limit the reliability of these results.

Germ Cell Mutagenicity: Benzene exposure has resulted in chromosomal aberrations in human lymphocytes and animal bone marrow cells. Exposure has also been associated with chromosomal aberrations in sperm cells in human and animal studies.

n-Hexane

Target Organs: Excessive exposure to n-hexane can result in peripheral neuropathies. The initial symptoms are symmetrical sensory numbness and paresthesias of distal portions of the extremities. Motor weakness is typically observed in muscles of the toes and fingers but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. The neurotoxic properties of n-hexane are potentiated by exposure to methyl ethyl ketone and methyl isobutyl ketone.

Reproductive Toxicity: Prolonged exposure to high concentrations of n-hexane (>1,000 ppm) resulted in decreased sperm count and degenerative changes in the testes of rats but not those of mice.

Ethyl Benzene

Carcinogenicity: Rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study demonstrated limited evidence of kidney, liver, and lung cancer. Ethyl benzene has been listed as a possible human carcinogen by IARC.

Target Organs: In rats and mice exposed to 0, 75, 250, or 750 ppm ethyl benzene in a two year inhalation study there was mild damage to the kidney (tubular hyperplasia), liver (eosinophilic foci, hypertrophy, necrosis), lung (alveolar epithelium metaplasia), thyroid (hyperplasia), thyroid (hyperplasia) and pituitary (hyperplasia). In animal models (particularly rats), ethyl benzene affects the auditory function mainly in the cochlear mid-frequency range and ototoxicity was observed after combined exposure to noise and ethyl benzene. There is no evidence of either ethyl benzene-induced hearing losses or ototoxicity with combined exposure to ethyl benzene and noise in workers.

Section 12: Ecological Information

Toxicity: Acute aquatic toxicity studies on samples of gasoline and naphtha streams show acute toxicity values greater than 1 mg/L and mostly in the range 1-100 mg/L. These tests were carried out on water accommodated fractions, in closed systems to prevent evaporative loss. Results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon composition. These substances should be regarded as toxic to aquatic organisms, with the potential to cause long term adverse effects in the aquatic environment. Classification: H411; Chronic Cat 2.

Persistence and Degradability: The hydrocarbons in this material are not readily biodegradable but are regarded as inherently biodegradable since their hydrocarbon components can be degraded by microorganisms.

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon components of this material range from 3 to greater than 6 and therefore are regarded as having the potential to bioaccumulate. In practice, metabolic processes or physical properties may prevent this effect or limit bioavailability.

Mobility in Soil: On release to water, hydrocarbons will float on the surface and since they are sparingly soluble, the only significant loss is volatilization to air. In air, these hydrocarbons are photodegraded by reaction with hydroxyl radicals with half lives varying from 6.5 days for benzene to 0.5 days for n-dodecane.

Other Adverse Effects: None anticipated.

Section 13: Disposal Considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste. However, it would likely be identified as a federally regulated RCRA hazardous waste for the following characteristic(s) shown below. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

Container contents should be completely used and containers should be emptied prior to discard. Container residues and rinseates could be considered to be hazardous wastes.

EPA Waste Number(s)

- D001 - Ignitability characteristic
- D018 - Toxicity characteristic (Benzene)

Section 14: Transport Information

U.S. Department of Transportation (DOT)

| | |
|------------------------------------|---|
| Shipping Description: | <p><i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) and H2S is > 8.8 molar % shipping description is:</i> UN3160, Liquefied gas, toxic, flammable, n.o.s., (Hydrogen sulfide; ; Liquefied Petroleum Gas), 2.3; , (2.1), Inhalation Hazard Zone X <i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) and H2S is < 8.8 molar % shipping description is:</i> UN1965, Hydrocarbon gas mixture, liquefied, n.o.s., 2.1 <i>If vapor pressure is ≤ 300 kPa (43.5 psia) at 50° C (122° F) and H2S is < 8.8 molar % shipping description is:</i> UN1267, Petroleum crude oil, 3, I or II [I if BP < 35° C (95° F); II if BP > 35° C]</p> |
| Non-Bulk Package Marking: | <p><i>Must be consistent with shipping description, either:</i> Liquefied gas, toxic, flammable, n.o.s., (Hydrogen sulfide, Liquefied petroleum gas), UN3160 <i>or</i> Hydrocarbon gas mixture, liquefied, n.o.s., UN1965 <i>or</i> Petroleum crude oil, UN1267</p> |
| Non-Bulk Package Labeling: | <p><i>For UN3160:</i> Poison gas and Flammable gas <i>For UN1965:</i> Flammable gas <i>For UN1267:</i> Flammable liquid</p> |
| Bulk Package/Placard Marking: | <p><i>For UN3160:</i> Poison gas / 3160 and Flammable gas <i>For UN1965:</i> Flammable gas / 1965 <i>For UN1267:</i> Flammable / 1267</p> |
| Packaging - References: | <p><i>For UN3160:</i> None; 49 CFR 173.304; 173.314 & .315 <i>For UN1965:</i> 49 CFR: 173.306; 173.304; 173.314 & .315 <i>For UN1267:</i> 49 CFR 173.150; 173.201; 173.243 [PG I] <i>-or-</i> 49 CFR 173.150; 173.202; 173.242 [PG II] <i>(Exceptions; Non-bulk; Bulk)</i></p> |
| Hazardous Substance: | <p>The EPA's Petroleum Exclusion applies to Section 2 and/or 15 components which are listed in 49 CFR 172.101, Table 1 to Appendix A.</p> |
| Emergency Response Guide: Note: | <p>UN3160 - 119; UN1965 - 115; UN1267 - 128; Replace X in shipping description with: D if Molar % H2S is from 8.8% to 14.8% C if Molar % H2S is from 14.9% to 44.4% B if Molar % H2S is from 44.5% to 100.0% <i>Container(s) greater than 5 liters (liquids) or 5 kilograms (solids), shipped by water mode and ALL bulk shipments may require the shipping description to contain the "Marine Pollutant" notation [49 CFR 172.203(I)] and the container(s) to display the [Marine Pollutant Mark] [49 CFR 172.322].</i> <i>The following alternate shipping description order may be used until January 1, 2013:</i> Proper Shipping name, Hazard Class or Division, (Subsidiary Hazard if any), UN or NA number, Packing Group <i>Other shipping description elements may be required for DOT compliance.</i> <i>Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable</i></p> |

International Maritime Dangerous Goods (IMDG)

| | | | |
|--|--|--------------------|---------------------|
| Shipping Description: | <i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) and H2S is > 8.8 molar % shipping description is:</i> UN3160, Liquefied gas, toxic, flammable, n.o.s. (Hydrogen sulphide , Liquefied Petroleum Gas), 2.3;; , (2.1) <i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) and H2S is < 8.8 molar % shipping description is:</i> UN1965, Hydrocarbon gas mixture, liquefied, n.o.s., (Hydrogen sulphide, Liquefied petroleum gas), 2.1; <i>If vapor pressure is <= 300 kPa (43.5 psia) at 50° C (122° F) and H2S is < 8.8 molar % shipping description is:</i> UN1267, Petroleum crude oil, 3, I or II [I if IBP < 35° C (95° F); II if IBP > 35° C] (-46° C); | | |
| Non-Bulk Package Marking: | <i>Must be consistent with shipping description, either:</i> Liquefied gas, toxic, flammable, n.o.s., (Hydrogen sulphide, Liquefied petroleum gas), UN3160 <i>or</i> Hydrocarbon gas mixture, liquefied, n.o.s., (Hydrogen sulphide, Liquefied petroleum gas), UN1965 <i>or</i> Petroleum crude oil, UN1267 | | |
| Labels: | <i>For UN3160:</i> Toxic gas and Flammable gas <i>For UN1965:</i> Flammable gas <i>For UN1267:</i> Flammable liquid | | |
| Placards/Marking (Bulk): | <i>For UN3160:</i> Toxic gas / 3160 and Flammable gas <i>For UN1965:</i> Flammable gas / 1965 <i>For UN1267:</i> Flammable / 1267 | | |
| Packaging - Non-Bulk: | <i>For UN3160 & UN1965:</i> P200 <i>For UN1267:</i> P001 | | |
| EMS: | <i>For UN3160 & UN1965:</i> F-D, S-U <i>For UN1267:</i> F-E, S-E | | |
| Note: | <i>If container(s) is greater than 5 liters (liquids) or 5 kilograms (solids), shipment may require the shipping description to contain the "Marine Pollutant" description [IMDG 5.4.1.4.3.5] and the container(s) to display the Marine Pollutant mark [IMDG 5.2.1.6]. U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 25. If transported in bulk by marine vessel in international waters, product is being carried under the scope of MARPOL Annex I.</i> | | |
| <u>International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)</u> | | | |
| UN/ID #: | UN3160 - <i>Forbidden</i> UN1965 <i>or</i> UN1267 | | |
| Proper Shipping Name: | <i>For UN1965:</i> Hydrocarbon gas mixture, liquefied, n.o.s. (Liquefied petroleum gas, Hydrogen sulphide) <i>For UN1267:</i> Petroleum crude oil | | |
| Hazard Class/Division: | <i>For UN1965:</i> 2.1 <i>For UN1267:</i> 3 | | |
| Subsidiary risk: | None | | |
| Packing Group: | <i>For UN1965:</i> None <i>For UN1267:</i> I or II [<i>Determined by IATA 3.3.2</i>] | | |
| Non-Bulk Package Marking: | <i>For UN1965:</i> Hydrocarbon gas mixture, liquefied, n.o.s. (Liquefied petroleum gas, Hydrogen sulphide), UN1965 <i>For UN1267:</i> Petroleum crude oil, UN1267 | | |
| Labels: | <i>For UN1965:</i> Flammable gas , Cargo Aircraft Only <i>For UN1267:</i> Flammable liquid | | |
| ERG Code: | <i>For UN1965:</i> 10L <i>or For UN1267:</i> 3L | | |
| | LTD. QTY | Passenger Aircraft | Cargo Aircraft Only |

| | | | |
|-----------------------------------|--|--|---|
| Packaging Instruction #: | UN1965 - Forbidden UN1267 - Forbidden - [PG I] Y341 - [PG II] | UN1965 - Forbidden UN1267 - 351 - [PG I] 353 - [PG II] | UN1965 - 200 UN1267 - 361 - [PG I] 364 - [PG II] |
| Max. Net Qty. Per Package: | UN1267 - None (PG I); 1L (PG II) | UN1267 - 1L - [PG I] 5 L - [PG II] | UN1965 - 150 kg UN1267 - 30 L - [PG I] 60 L - [PG II] |

Section 15: Regulatory Information

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

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

| Component | TPQ | EPCRA RQ |
|------------------|--------|----------|
| Hydrogen Sulfide | 500 lb | 100 lb |

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

| | |
|------------------|-----|
| Acute Health: | Yes |
| Chronic Health: | Yes |
| Fire Hazard: | Yes |
| Pressure Hazard: | No |
| Reactive Hazard: | No |

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

| Component | Concentration ¹ | de minimis |
|---------------|----------------------------|------------|
| Xylenes | 1-8 | 1.0% |
| Toluene | 1-7 | 1.0% |
| Cyclohexane | 1-5 | 1.0% |
| Benzene | <5 | 0.1% |
| n-Hexane | 2-4 | 1.0% |
| Ethyl Benzene | 1-3 | 0.1% |

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

California Proposition 65:

Warning: This material may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects or other reproductive harm, and which may be subject to the warning requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

| Component | Type of Toxicity |
|---------------|--|
| Toluene | Developmental Toxicant Female Reproductive Toxicant |
| Benzene | Cancer Developmental Toxicant Male Reproductive Toxicant |
| Ethyl Benzene | Cancer |

International Hazard Classification

Canada:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:

B2 - Flammable Liquids
D2A
D2B

| | | | |
|---|--|--------------------|---------------------|
| Shipping Description: | <i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) and H2S is > 8.8 molar % shipping description is:</i> UN3160, Liquefied gas, toxic, flammable, n.o.s. (Hydrogen sulphide , Liquefied Petroleum Gas), 2.3,; , (2.1) <i>If vapor pressure is > 300 kPa (43.5 psia) at 50° C (122° F) and H2S is < 8.8 molar % shipping description is:</i> UN1965, Hydrocarbon gas mixture, liquefied, n.o.s., (Hydrogen sulphide, Liquefied petroleum gas), 2.1; <i>If vapor pressure is <= 300 kPa (43.5 psia) at 50° C (122° F) and H2S is < 8.8 molar % shipping description is:</i> UN1267, Petroleum crude oil, 3, I or II [I if IBP < 35° C (95° F); II if IBP > 35° C] (-46° C); | | |
| Non-Bulk Package Marking: | <i>Must be consistent with shipping description, either:</i> Liquefied gas, toxic, flammable, n.o.s., (Hydrogen sulphide, Liquefied petroleum gas), UN3160 or Hydrocarbon gas mixture, liquefied, n.o.s., (Hydrogen sulphide, Liquefied petroleum gas), UN1965 or Petroleum crude oil, UN1267 | | |
| Labels: | <i>For UN3160:</i> Toxic gas and Flammable gas <i>For UN1965:</i> Flammable gas <i>For UN1267:</i> Flammable liquid | | |
| Placards/Marking (Bulk): | <i>For UN3160:</i> Toxic gas / 3160 and Flammable gas <i>For UN1965:</i> Flammable gas / 1965 <i>For UN1267:</i> Flammable / 1267 | | |
| Packaging - Non-Bulk: | <i>For UN3160 & UN1965:</i> P200 <i>For UN1267:</i> P001 | | |
| EMS: | <i>For UN3160 & UN1965:</i> F-D, S-U <i>For UN1267:</i> F-E, S-E | | |
| Note: | <i>If container(s) is greater than 5 liters (liquids) or 5 kilograms (solids), shipment may require the shipping description to contain the "Marine Pollutant" description [IMDG 5.4.1.4.3.5] and the container(s) to display the Marine Pollutant mark [IMDG 5.2.1.6]. U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 25. If transported in bulk by marine vessel in international waters, product is being carried under the scope of MARPOL Annex I.</i> | | |
| <u>International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)</u> | | | |
| UN/ID #: | UN3160 - Forbidden UN1965 or UN1267 | | |
| Proper Shipping Name: | <i>For UN1965:</i> Hydrocarbon gas mixture, liquefied, n.o.s. (Liquefied petroleum gas, Hydrogen sulphide) <i>For UN1267:</i> Petroleum crude oil | | |
| Hazard Class/Division: | <i>For UN1965:</i> 2.1 <i>For UN1267:</i> 3 | | |
| Subsidiary risk: | None | | |
| Packing Group: | <i>For UN1965:</i> None <i>For UN1267:</i> I or II [Determined by IATA 3.3.2] | | |
| Non-Bulk Package Marking: | <i>For UN1965:</i> Hydrocarbon gas mixture, liquefied, n.o.s. (Liquefied petroleum gas, Hydrogen sulphide), UN1965 <i>For UN1267:</i> Petroleum crude oil, UN1267 | | |
| Labels: | <i>For UN1965:</i> Flammable gas , Cargo Aircraft Only <i>For UN1267:</i> Flammable liquid | | |
| ERG Code: | <i>For UN1965:</i> 10L or <i>For UN1267:</i> 3L | | |
| | LTD. QTY | Passenger Aircraft | Cargo Aircraft Only |

| | | | |
|-----------------------------------|--|--|---|
| Packaging Instruction #: | UN1965 - Forbidden UN1267 - Forbidden - [PG I] Y341 - [PG II] | UN1965 - Forbidden UN1267 - 351 - [PG I] 353 - [PG II] | UN1965 - 200 UN1267 - 361 - [PG I] 364 - [PG II] |
| Max. Net Qty. Per Package: | UN1267 - None (PG I); 1L (PG II) | UN1267 - 1L - [PG I] 5 L - [PG II] | UN1965 - 150 kg UN1267 - 30 L - [PG I] 60 L - [PG II] |

Section 15: Regulatory Information

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

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

| Component | TPQ | EPCRA RQ |
|------------------|--------|----------|
| Hydrogen Sulfide | 500 lb | 100 lb |

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

| | |
|------------------|-----|
| Acute Health: | Yes |
| Chronic Health: | Yes |
| Fire Hazard: | Yes |
| Pressure Hazard: | No |
| Reactive Hazard: | No |

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

| Component | Concentration ¹ | de minimis |
|---------------|----------------------------|------------|
| Xylenes | 1-8 | 1.0% |
| Toluene | 1-7 | 1.0% |
| Cyclohexane | 1-5 | 1.0% |
| Benzene | <5 | 0.1% |
| n-Hexane | 2-4 | 1.0% |
| Ethyl Benzene | 1-3 | 0.1% |

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

California Proposition 65:

Warning: This material may contain detectable quantities of the following chemicals, known to the State of California to cause cancer, birth defects or other reproductive harm, and which may be subject to the warning requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

| Component | Type of Toxicity |
|---------------|--|
| Toluene | Developmental Toxicant Female Reproductive Toxicant |
| Benzene | Cancer Developmental Toxicant Male Reproductive Toxicant |
| Ethyl Benzene | Cancer |

International Hazard Classification

Canada:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:

B2 - Flammable Liquids
D2A
D2B

National Chemical Inventories

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA
All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: 1C981

Section 16: Other Information

| | |
|--|--|
| Date of Issue: | 20-Sep-2014 |
| Status: | FINAL |
| Previous Issue Date: | 20-Sep-2014 |
| Revised Sections or Basis for Revision: | Identified Hazards (Section 2) Precautionary Statement(s) (Section 2) First Aid (Section 4) Exposure limits (Section 8) Shipping information (Section 14) Regulatory information (Section 15) |
| SDS Number: | 730370 |

Guide to Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.



AMERICAN ENERGY
PARTNERS

Produced Brine Water

Safety Data Sheet

Section 1: Identification of the substance or mixture and of the supplier

| | |
|-------------------------------------|--|
| Product Name: | Produced Brine Water |
| SDS Number: | 401320 |
| Intended Use: | Process Water |
| Manufacturer: | American Energy Partners 301 N.W. 63rd Oklahoma City, OK 73116 |
| Emergency Health and Safety Number: | Chemtrec: 800-424-9300 (24 Hours) |
| SDS Information: | Phone: 844-210-6000 URL: www.americanenergypartners.com |

Section 2: Hazard(s) Identification

Classification

H302 -- Harmful if swallowed -- Category 1
H319 -- Eye damage/irritation -- Category 2
H316 -- Causes mild skin irritation -- Category 1
H332 -- Harmful if inhaled -- Category 1
H350 -- Carcinogenicity -- Category 1A
H412 -- May cause chronic harmful effects to aquatic life -- Category 2

Label Elements



DANGER

Causes serious eye irritation. (H319)*
Harmful if swallowed. (H302)*
Harmful if inhaled. (H332)*
May cause cancer. (H350)*
Toxic to aquatic life with long lasting effects. (H412)*

Precautionary Statement(s):

Obtain special instructions before use. (P201)*
Do not handle until all safety precautions have been read and understood. (P202)*
Do not breathe dust/fume/gas/mist/vapours/spray. (P261)
Wash thoroughly after handling. (P264)*
Do not eat, drink, or smoke when using this product. (P270)*
Avoid release to the environment. (P273)*
Use outdoors in a well ventilated space (P271)
Wear protective gloves / protective clothing / eye protection. (P281)*
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. (P305+P351+P338*)
If eye irritation persists: Get medical advice/attention. (P313)*
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. (P301+P312)*
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. (P304 + P340)*
Get medical advice/attention if you feel unwell. (P314)*
Collect spillage. (P391)*
Store locked up. (P405)*
Store in a well-ventilated place. Keep container tightly closed. (P403+P233)*
Dispose of contents/container to approved disposal facility. (P501)*

**(Applicable GHS hazard code.)*

Section 3: Composition / Information on Ingredients

| Component | CAS# | Concentration ¹ |
|-----------------|-----------|----------------------------|
| Water | 7732-18-5 | 80-100% |
| Sodium chloride | 91-20-3 | <20% |
| Benzene | 71-43-2 | <2% |

All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

Section 4: First Aid Measures

Eye Contact: For direct contact, remove contact lenses if present and easy to do. Immediately hold eyelids apart and flush the affected eye(s) with clean water for at least 20 minutes. Seek immediate medical attention.

Skin Contact: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention.

Inhalation (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If breathing is difficult, oxygen or artificial respiration should be administered by qualified personnel. If symptoms persist, seek medical attention.

Ingestion (Swallowing): First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects

Acute: Headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue.

Delayed: Dry skin and possible irritation with repeated or prolonged exposure.

Notes to Physician: Federal regulations (29 CFR 1910.1028) specify medical surveillance programs for certain exposures to benzene above the action level or PEL (specified in Section (i)(1)(i) of the Standard). In addition, employees exposed in an emergency situation shall, as described in Section (i)(4)(i), provide a urine sample at the end of the shift for measurement of urine phenol.

Section 5: Fire-Fighting Measures



NFPA 704 Hazard Class

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

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of nitrogen and sulfur may also be formed.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

Section 6: Accidental Release Measures

Personal Precautions: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

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

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

Section 7: Handling and Storage

Precautions for safe handling: Keep away from flames and hot surfaces. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe vapors or mists. Wear protective gloves/clothing and eye/face protection. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

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

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. This material may contain or release poisonous hydrogen sulfide gas. In a tank, barge, or other closed container, the vapor space above this material may accumulate hazardous concentrations of hydrogen sulfide. Check atmosphere for oxygen content, H₂S, and flammability prior to entry. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Section 8: Exposure Controls / Personal Protection

| Component | ACGIH | OSHA | NIOSH |
|-----------------------------|---|--|-----------------------------|
| Water (7732-18-5) | Not established | Not established | Not established |
| Sodium chloride (7647-14-5) | Not established | Not established | Not established |
| Benzene (71-43-2) | STEL: 2.5 ppm TWA: 0.5 ppm Skin | Ceiling: 25 ppm STEL: 5 ppm TWA: 1 ppm | STEL: 5 ppm TWA: 0.1 ppm |

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

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

Eye/Face Protection: The use of eye protection (such as splash goggles) that meets or exceeds ANSI Z.87.1 is recommended when there is potential liquid contact to the eye. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Suggested protective materials: Nitrile

Respiratory Protection: Where there is potential for airborne exposure above the exposure limit a NIOSH certified air purifying respirator equipped with organic vapor cartridges/canisters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health (IDLH).

If benzene concentrations equal or exceed applicable exposure limits, OSHA requirements for personal protective equipment, exposure monitoring, and training may apply (29CFR1910.1028 - Benzene).

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

Section 9: Physical and Chemical Properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

| | |
|---|--------------------------------|
| Appearance: | Varies (clear / amber / brown) |
| Physical Form: | Liquid |
| Odor: | Petroleum |
| Odor Threshold: | No data |
| pH: | 4.9-8.5 |
| Vapor Pressure: | No data available |
| Vapor Density (air=1): | >1 |
| Initial Boiling Point/Range: | 212 °F / 100 °C |
| Melting/Freezing Point: | 32 °F / 0 °C |
| Pour Point: | No data |
| Solubility in Water: | Infinintely |
| Partition Coefficient (n-octanol/water) (Kow): | >10 |
| Specific Gravity (water=1): | 1.0 -1.1 °API |
| Viscosity: | No data available |
| Evaporation Rate (nBuAc=1): | No data available |
| Flash Point: | No data available |
| Test Method: | Not applicable |
| Lower Explosive Limits (vol % in air): | 1% |
| Upper Explosive Limits (vol % in air): | 46% |
| Auto-ignition Temperature: | No data available |

Section 10: Stability and Reactivity

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Avoid all possible sources of ignition. Prevent vapor accumulation.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing and reducing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

Section 11: Toxicological Information

Information on Toxicological Effects of Substance/Mixture

| <u>Acute Toxicity</u> | <u>Hazard</u> | <u>Additional Information</u> | <u>LC50/LD50 Data</u> |
|------------------------|---|-------------------------------|-----------------------|
| Inhalation | Expected to have a low degree of toxicity by inhalation | | No data |
| Skin Absorption | Unlikely to be harmful | | No data |
| Ingestion (Swallowing) | Unlikely to be harmful | | No data |

Aspiration Hazard: Not expected to be an aspiration hazard.

Skin Corrosion/Irritation: Causes mild skin irritation. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Causes serious eye irritation.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract, irritation of the respiratory tract, nausea, vomiting, diarrhea and signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue).

Skin Sensitization: Not expected to be a skin sensitizer.

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): May cause drowsiness and dizziness.

Specific Target Organ Toxicity (Repeated Exposure): May cause damage to organs through prolonged or repeated exposure. Laboratory animal studies of hydrocarbon products by the dermal and inhalation exposure routes have demonstrated toxicity to the liver, blood, spleen and thymus

Carcinogenicity: May cause cancer, based on component information.

Germ Cell Mutagenicity: Inadequate information available.

Reproductive Toxicity: Inadequate information available.

Other Comments: This material may contain varying concentrations of polycyclic aromatic hydrocarbons (PAHs) which have been known to produce a phototoxic reaction when contaminated skin is exposed to sunlight. The effect is similar in appearance to an exaggerated sunburn, and is temporary in duration if exposure is discontinued. Continued exposure to sunlight can result in more serious skin problems including pigmentation (discoloration), skin eruptions (pimples), and possible skin cancers.

Information on Toxicological Effects of Components

Water

Carcinogenicity: No data available

Target Organs: No data available

Reproductive Toxicity: No data available

Germ Cell Mutagenicity: No data available

Sodium chloride

Carcinogenicity: No data available but sodium chloride has not been identified as a human carcinogen by IARC, the US National Toxicology Program and the US-Occupational Safety and Health Administration.

Target Organs: Eyes, respiratory system, central nervous system

Reproductive Toxicity: No data available

Germ Cell Mutagenicity: No data available

Benzene

Carcinogenicity: Benzene is an animal carcinogen and is known to produce acute myelogenous leukemia (a form of cancer) in humans. Benzene has been identified as a human carcinogen by IARC, the US National Toxicology Program and the US-Occupational Safety and Health Administration.

Target Organs: Prolonged or repeated exposures to benzene vapors can cause damage to the blood and blood forming organs, including disorders like leukopenia, thrombocytopenia, and aplastic anemia.

Reproductive Toxicity: Some studies in occupationally exposed women have suggested benzene exposure increased risk of miscarriage and stillbirth and decreased birth weight and gestational age. The size of the effects detected in these studies was small, and ascertainment of exposure and outcome in some cases relied on self-reports, which may limit the reliability of these results.

Germ Cell Mutagenicity: Benzene exposure has resulted in chromosomal aberrations in human lymphocytes and animal bone marrow cells. Exposure has also been associated with chromosomal aberrations in sperm cells in human and animal studies.

Section 12: Ecological Information

Toxicity: Not evaluated

Persistence and Degradability: Not evaluated

Persistence per IOPC Fund definition: Not evaluated

Bioaccumulative Potential: Not evaluated although the solubility and log KOW would indicate it has little bioaccumulative potential.

Mobility in Soil: Not evaluated although the solubility properties indicate produced water would be highly mobile throughout a system.

Other Adverse Effects: None anticipated.

Section 13: Disposal Considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste. However, it would likely be identified as a federally regulated RCRA hazardous waste for the following characteristic(s) shown below. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

Container contents should be completely used and containers should be emptied prior to discard. Container residues and rinseates could be considered to be hazardous wastes.

EPA Waste Number(s)

- D018 - Toxicity characteristic (Benzene)

Section 14: Transport Information

U.S. Department of Transportation (DOT)

Shipping name: *Not regulated*

Note: Some states may require specific shipping labels. Contact each jurisdiction for more information.

Section 15: Regulatory Information

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

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

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: Yes
Fire Hazard: No
Pressure Hazard: No
Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

| Component | Concentration ¹ | de minimis |
|-----------|----------------------------|------------|
| Benzene | <2 | 0.1% |

EPA (CERCLA) Reportable Quantity (in pounds):

EPA's Petroleum Exclusion applies to this material - (CERCLA 101(14)).

Warning: This material may contain detectable quantities of the following chemicals identified on federal and individual state hazardous substances list. Contact each jurisdiction for more information.

| Component | Type of Toxicity |
|-----------|--|
| Benzene | Cancer Developmental Toxicant Male Reproductive Toxicant |

International Hazard Classification:

Canada:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:

D2A
D2B

National Chemical Inventories

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA
All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: 1C981

Section 16: Other Information

Date of Issue:
Status:

20-Sep-2014
FINAL

Revised Sections or Basis for Revision:

Identified Hazards (Section 2)
Precautionary Statement(s) (Section 2)
First Aid (Section 4)
Shipping information (Section 14)
Regulatory information (Section 15)
401320

SDS Number:

Guide to Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:

The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Attachment O

Attachment O
G70-A EMISSION SUMMARY SHEET

| Emission Point ID No. (Must match Emission Units Table & Plot Plan) | Emission Point Type ¹ | Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan) | | Air Pollution Control Device (Must match Emission Units Table & Plot Plan) | | All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS) | Maximum Potential Uncontrolled Emissions ⁴ | | Maximum Potential Controlled Emissions ⁵ | | Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor) | Est. Method Used ⁶ |
|--|----------------------------------|--|-------------|---|-------------|---|---|--------|---|--------|--|-------------------------------|
| | | ID No. | Source | ID No. | Device Type | | lb/hr | ton/yr | lb/hr | ton/yr | | |
| E001 | Upward Vertical Stack | S001 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO _{2e} | 175.65 | 769.33 | 175.65 | 769.33 | | |
| E002 | Upward Vertical Stack | S002 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO _{2e} | 175.65 | 769.33 | 175.65 | 769.33 | | |

| Emission Point ID No. (Must match Emission Units Table & Plot Plan) | Emission Point Type ¹ | Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan) | | Air Pollution Control Device (Must match Emission Units Table & Plot Plan) | | All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS) | Maximum Potential Uncontrolled Emissions ⁴ | | Maximum Potential Controlled Emissions ⁵ | | Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor) | Est. Method Used ⁶ |
|--|----------------------------------|--|-------------|---|-------------|---|---|--------|---|--------|--|-------------------------------|
| | | ID No. | Source | ID No. | Device Type | | lb/hr | ton/yr | lb/hr | ton/yr | | |
| E003 | Upward Vertical Stack | S003 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO ₂ e | 175.65 | 769.33 | 175.65 | 769.33 | | |
| E004 | Upward Vertical Stack | S004 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO ₂ e | 175.65 | 769.33 | 175.65 | 769.33 | | |
| E005 | Upward Vertical Stack | S005 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO ₂ e | 175.65 | 769.33 | 175.65 | 769.33 | | |

| Emission Point ID No. (Must match Emission Units Table & Plot Plan) | Emission Point Type ¹ | Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan) | | Air Pollution Control Device (Must match Emission Units Table & Plot Plan) | | All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS) | Maximum Potential Uncontrolled Emissions ⁴ | | Maximum Potential Controlled Emissions ⁵ | | Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor) | Est. Method Used ⁶ |
|--|----------------------------------|--|-------------|---|-------------|---|---|--------|---|--------|--|-------------------------------|
| | | ID No. | Source | ID No. | Device Type | | lb/hr | ton/yr | lb/hr | ton/yr | | |
| E006 | Upward Vertical Stack | S006 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO ₂ e | 175.65 | 769.33 | 175.65 | 769.33 | | |
| E007 | Upward Vertical Stack | S007 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO ₂ e | 175.65 | 769.33 | 175.65 | 769.33 | | |
| E008 | Upward Vertical Stack | S008 | Line Heater | N/A | N/A | Total VOCs | 0.006 | 0.03 | 0.006 | 0.03 | Gas/Vapor | AP-42 |
| | | | | | | NO _x | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | CO | 0.10 | 0.43 | 0.10 | 0.43 | | |
| | | | | | | PM ₁₀ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | SO ₂ | <0.001 | 0.003 | <0.001 | 0.003 | | |
| | | | | | | Pb | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Total HAPs | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.002 | 0.009 | 0.002 | 0.009 | | |
| | | | | | | CO ₂ | 175.47 | 768.54 | 175.47 | 768.54 | | |
| | | | | | | CH ₄ | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | 0.001 | <0.001 | 0.001 | | |
| | | | | | | CO ₂ e | 175.65 | 769.33 | 175.65 | 769.33 | | |

| Emission Point ID No. (Must match Emission Units Table & Plot Plan) | Emission Point Type ¹ | Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan) | | Air Pollution Control Device (Must match Emission Units Table & Plot Plan) | | All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS) | Maximum Potential Uncontrolled Emissions ⁴ | | Maximum Potential Controlled Emissions ⁵ | | Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor) | Est. Method Used ⁶ |
|--|----------------------------------|--|-------------------------------|---|-------------|---|---|--------|---|--------|--|-------------------------------|
| | | ID No. | Source | ID No. | Device Type | | lb/hr | ton/yr | lb/hr | ton/yr | | |
| E009 | Upward Vertical Stacks | S009 | Flash Separator | N/A | None | Total VOCs | 0.004 | 0.02 | 0.004 | 0.02 | Gas/Vapor | AP-42 / EPA Cert. |
| | | | | | | NO _x | 0.08 | 0.34 | 0.08 | 0.34 | | |
| | | | | | | CO | 0.07 | 0.29 | 0.07 | 0.29 | | |
| | | | | | | PM ₁₀ | 0.006 | 0.03 | 0.006 | 0.03 | | |
| | | | | | | SO ₂ | <0.001 | 0.002 | <0.001 | 0.002 | | |
| | | | | | | Total HAPs | 0.001 | 0.006 | 0.001 | 0.006 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | 0.12 | <0.001 | 0.12 | | |
| | | | | | | Hexane | 0.001 | 0.006 | 0.001 | 0.006 | | |
| | | | | | | CO ₂ | 116.98 | 512.36 | 116.98 | 512.36 | | |
| | | | | | | CH ₄ | 0.002 | 0.01 | 0.002 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | CO _{2e} | 117.10 | 512.89 | 117.10 | 512.89 | | |
| E010 | Upward Vertical Stacks | S010 | Condensate Stabilizer | N/A | None | Total VOCs | 0.003 | 0.01 | 0.003 | 0.01 | Gas/Vapor | AP-42 / EPA Cert. |
| | | | | | | NO _x | 0.06 | 0.26 | 0.06 | 0.26 | | |
| | | | | | | CO | 0.05 | 0.21 | 0.05 | 0.21 | | |
| | | | | | | PM ₁₀ | 0.004 | 0.02 | 0.004 | 0.02 | | |
| | | | | | | SO ₂ | <0.001 | 0.002 | <0.001 | 0.002 | | |
| | | | | | | Total HAPs | 0.001 | 0.005 | 0.001 | 0.005 | | |
| | | | | | | Benzene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Toluene | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Formaldehyde | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | Hexane | 0.001 | 0.005 | 0.001 | 0.005 | | |
| | | | | | | CO ₂ | 87.73 | 384.27 | 87.73 | 384.27 | | |
| | | | | | | CH ₄ | 0.002 | 0.01 | 0.002 | 0.01 | | |
| | | | | | | N ₂ O | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | CO _{2e} | 87.82 | 384.67 | 87.82 | 384.67 | | |
| E017 | Upward Vertical Stacks | S017 | Natural Gas Compressor Engine | N/A | None | Total VOCs | 0.05 | 0.24 | 0.05 | 0.24 | Gas/Vapor | AP-42 / EPA Cert. |
| | | | | | | NO _x | 0.89 | 3.90 | 0.89 | 3.90 | | |
| | | | | | | CO | 1.78 | 7.80 | 1.78 | 7.80 | | |
| | | | | | | PM ₁₀ | 0.02 | 0.08 | 0.02 | 0.08 | | |
| | | | | | | SO ₂ | 0.001 | 0.005 | 0.001 | 0.005 | | |
| | | | | | | Total HAPs | 0.12 | 0.51 | 0.12 | 0.51 | | |
| | | | | | | Benzene | 0.003 | 0.013 | 0.003 | 0.013 | | |
| | | | | | | Toluene | 0.001 | 0.004 | 0.001 | 0.004 | | |
| | | | | | | Formaldehyde | 0.11 | 0.49 | 0.11 | 0.49 | | |
| | | | | | | CO ₂ | 204.96 | 897.71 | 204.96 | 897.71 | | |
| | | | | | | CH ₄ | 0.004 | 0.02 | 0.004 | 0.02 | | |
| | | | | | | N ₂ O | <0.001 | 0.002 | <0.001 | 0.002 | | |
| | | | | | | CO _{2e} | 205.17 | 898.63 | 205.17 | 898.63 | | |

| Emission Point ID No. (Must match Emission Units Table & Plot Plan) | Emission Point Type ¹ | Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan) | | Air Pollution Control Device (Must match Emission Units Table & Plot Plan) | | All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS) | Maximum Potential Uncontrolled Emissions ⁴ | | Maximum Potential Controlled Emissions ⁵ | | Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor) | Est. Method Used ⁶ |
|--|----------------------------------|--|--------------------------------|---|-------------|---|---|----------|---|----------|--|-------------------------------|
| | | ID No. | Source | ID No. | Device Type | | lb/hr | ton/yr | lb/hr | ton/yr | | |
| E018 | Upward Vertical Stacks | S018 | Natural Gas Compressor Engine | N/A | None | Total VOCs | 0.05 | 0.22 | 0.05 | 0.22 | Gas/Vapor | AP-42 / EPA Cert. |
| | | | | | | NO _x | 1.49 | 6.52 | 1.49 | 6.52 | | |
| | | | | | | CO | 0.16 | 0.71 | 0.16 | 0.71 | | |
| | | | | | | PM ₁₀ | 0.02 | 0.07 | 0.02 | 0.07 | | |
| | | | | | | SO ₂ | 0.001 | 0.005 | 0.001 | 0.005 | | |
| | | | | | | Total HAPs | 0.07 | 0.31 | 0.07 | 0.31 | | |
| | | | | | | Benzene | 0.003 | 0.01 | 0.003 | 0.01 | | |
| | | | | | | Toluene | <0.001 | 0.004 | <0.001 | 0.004 | | |
| | | | | | | Formaldehyde | 0.07 | 0.29 | 0.07 | 0.29 | | |
| | | | | | | CO ₂ | 199.37 | 873.22 | 199.37 | 873.22 | | |
| | | | | | | CH ₄ | 0.004 | 0.02 | 0.004 | 0.02 | | |
| | | | | | | N ₂ O | <0.001 | 0.002 | <0.001 | 0.002 | | |
| | | | | | | CO ₂ e | 199.57 | 874.12 | 199.57 | 874.12 | | |
| E019 | Upward Vertical Stacks | S019 | Enclosed Vapor Combustor | N/A | None | Total VOCs | 1.13 | 4.96 | 1.13 | 4.96 | Gas/Vapor | AP-42 / EPA Cert. |
| | | | | | | NO _x | 1.43 | 6.28 | 1.43 | 6.28 | | |
| | | | | | | CO | 1.21 | 5.28 | 1.21 | 5.28 | | |
| | | | | | | PM ₁₀ | 0.11 | 0.48 | 0.11 | 0.48 | | |
| | | | | | | SO ₂ | 0.009 | 0.04 | 0.009 | 0.04 | | |
| | | | | | | Total HAPs | 0.05 | 0.23 | 0.05 | 0.23 | | |
| | | | | | | CO ₂ | 2,082.95 | 9,123.31 | 2,082.95 | 9,123.31 | | |
| | | | | | | CH ₄ | 0.046 | 0.20 | 0.046 | 0.20 | | |
| | | | | | | N ₂ O | 0.004 | 0.016 | 0.004 | 0.016 | | |
| | | | | | | CO ₂ e | 2,085.21 | 9,133.22 | 2,085.21 | 9,133.22 | | |
| E020 | Upward Vertical Stacks | S020 | Condensate - Truck Loading | N/A | N/A | Total VOCs | 0.55 | 2.42 | 0.55 | 2.42 | Gas/Vapor | AP-42 |
| | | | | | | Total HAPs | 0.01 | 0.06 | 0.01 | 0.06 | | |
| | | | | | | CO ₂ | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | CH ₄ | 0.02 | 0.07 | 0.02 | 0.07 | | |
| | | | | | | CO ₂ e | 0.39 | 1.69 | 0.39 | 1.69 | | |
| E021 | Upward Vertical Stacks | S021 | Produced Water - Truck Loading | N/A | N/A | Total VOCs | <0.001 | 0.002 | <0.001 | 0.002 | Gas/Vapor | AP-42 |
| | | | | | | Total HAPs | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | CO ₂ | <0.001 | <0.001 | <0.001 | <0.001 | | |
| | | | | | | CH ₄ | 0.001 | <0.001 | 0.001 | <0.001 | | |
| | | | | | | CO ₂ e | 0.003 | 0.01 | 0.003 | 0.01 | | |

| Emission Point ID No. (Must match Emission Units Table & Plot Plan) | Emission Point Type ¹ | Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan) | | Air Pollution Control Device (Must match Emission Units Table & Plot Plan) | | All Regulated Pollutants - Chemical Name/CAS ³ (Speciate VOCs & HAPS) | Maximum Potential Uncontrolled Emissions ⁴ | | Maximum Potential Controlled Emissions ⁵ | | Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor) | Est. Method Used ⁶ |
|--|----------------------------------|--|-----------|---|-------------|---|---|---|---|---|--|-------------------------------|
| | | ID No. | Source | ID No. | Device Type | | lb/hr | ton/yr | lb/hr | ton/yr | | |
| E022 | Upward Vertical Stacks | S022 | Generator | N/A | None | Total VOCs NO _x CO PM ₁₀ SO ₂ Total HAPs Benzene Toluene Formaldehyde Hexane CO ₂ CH ₄ N ₂ O CO ₂ e | 0.37 0.37 0.61 0.01 <0.001 0.03 <0.001 <0.001 0.03 <0.001 72.78 0.001 <0.001 72.85 | 1.63 1.63 2.68 0.02 0.001 0.12 <0.001 <0.001 0.20 0.002 318.77 0.006 <0.001 319.10 | 0.37 0.37 0.61 0.01 <0.001 0.03 <0.001 <0.001 0.03 <0.001 72.78 0.001 <0.001 72.85 | 1.63 1.63 2.68 0.02 0.001 0.12 <0.001 <0.001 0.20 0.002 318.77 0.006 <0.001 319.10 | Gas/Vapor | AP-42 / EPA Cert. |

The EMISSION SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSIONS SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

¹ Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

² 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

³ Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

⁴ Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

⁵ Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; M = modeling; O = other (specify).

G70-A FUGITIVE EMISSIONS 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 | NA | -- | -- | -- | -- | -- |
| Unpaved Haul Roads | PM PM-10 PM-2.5 | 6.38 1.63 0.16 | 2.45 0.62 0.06 | 6.38 1.63 0.16 | 2.45 0.62 0.06 | AP-42 |
| Equipment Leaks | Total VOC Total HAPs CO ₂ CH ₄ CO ₂ e | 0.06 0.003 0.001 0.31 7.82 | 0.27 0.01 0.01 1.37 34.27 | 0.06 0.003 0.001 0.31 7.82 | 0.27 0.01 0.01 1.37 34.27 | 40CFR98 Subpart W |
| Other | NA | NA | NA | NA | NA | NA |

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; M = modeling; O = other (specify).