Compressor Station 118A

Air Permit Application

Tennessee Gas Pipeline Company, L.L.C.
a Kinder Morgan company

Tennessee Gas
Pipeline Company
1001 Louisiana Street
Houston, TX 77002

January 30, 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: NSR Permit Application
Tennessee Gas Pipeline Company, L.L.C.
Compressor Station 118A

Dear Director Durham:

Enclosed are three copies of a New Source Review Permit Application pursuant to WV 45 CSR 13 for the construction of a new greenfield compressor station in Charleston, Station 118A. A legal advertisement will be published in the next few days and proof of publication will be forwarded as soon as it is received. Enclosed is a check in the amount of $4,500.

If you have any questions concerning this permit application, please contact myself at (713) 420-6318 or at Shrishti_Chhabra@kindermorgan.com.

Sincerely,

Shrishti Chhabra
Environmental Engineer III
Kinder Morgan, Inc.

Enclosures

Table of Contents

INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. (TGP), which is owned by Kinder Morgan, Inc., operates a 13,900 mile pipeline that transports natural gas from Louisiana, the Gulf of Mexico and south Texas to the northeast section of the United States (U.S.), including New York City and Boston.

As part of the Broad Run Expansion Project (BRE), TGP is proposing to construct a new green field compressor station (Station 118A) in Charleston, Kanawha County, West Virginia (WV). Station 118A will consist of one new compressor turbine and additional auxiliary equipment, as described below, and will be a minor source with respect to both the Title V Operating Program and Prevention of Significant Deterioration (PSD). Therefore, TGP is submitting this Regulation 13 Construction Permit to request approval to construct and operate Station 118A as a minor source under WV 45CSR 13, and to comply with the air permitting requirements and regulations of the state of WV. Operations at the facility are projected to commence in October 2017.

Attachments A through S include all required application information, figures, and forms, as summarized in the Table of Contents. Please note that an estimate of criteria and hazardous/toxic pollutant emissions is included within this permit application in Attachment N for all of the sources proposed at Station 118A.

FACILITY DESCRIPTION

Station 118A will be used to boost transmission pressures by compressing low pressure transmission gas and directing it into a high pressure transmission line. Natural gas will enter Station 118A from a transmission pipeline where one (1) Solar Turbines Taurus 70-10802S natural gas fired compressor turbine, with a maximum design capacity of 93 million British Thermal Units per hour (MMBtu/hr), higher heating value (HHV) basis, will increase the line pressure. In addition, TGP is proposing to add one (1) new Caterpillar G 3512B LE natural gas-fired emergency generator, one Parker Boiler T-4600LR natural gas fired hydronic heater, and one new pipeline liquids storage tank.

Various support activities will be carried out at Station 118A in order to maintain proper operation of the compressor turbine, the pipeline, and any auxiliary equipment on-site.

Operations at Station 118A will be categorized under the Standard Industrial Classification (SIC) code 4922, *Natural Gas Transmission*, and under the North American Industry Classification System (NAICS) code 486210, *Pipeline Transportation of Natural Gas*.

All proposed combustion equipment at Station 118A will utilize only pipeline quality natural gas. Emissions of concern are primarily products of combustion: nitrogen oxides (NO_X), carbon monoxide (CO), and volatile organic compounds (VOC). TGP will employ good combustion practices on well-maintained engines along with the exclusive use of natural gas in order to minimize air emissions.

EMISSIONS CALCULATION METHODOLOGY

Emissions from the sources proposed at Station 118A will consist primarily of natural gas combustion emissions from the addition of the new Solar turbine. Additional emissions will occur from one new storage tank, natural gas combustion emissions from the new emergency generator and hydronic heater, from additional fugitive components, and from venting/blow downs. Emissions estimates for each of these sources have been calculated using the most appropriate information and the most current methodologies available to determine the facility's potential to emit (PTE), as described in the following sections, and as shown in Attachment N.

Solar Taurus 70-10802S Compressor Turbine

CO, NO_X, VOC, and methane (CH_4) emissions from the new compressor turbine, 118-CT-01, are based on vendor supplied information. Sulfur dioxide (SO_2) and all particulate matter (PM) emissions are based on US EPA's "Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors" (AP-42), Table 3.1-2a, *Emission Factors for Criteria Pollutants and Greenhouse Gases from Stationary Gas Turbines*. Other greenhouse gas (GHG) emissions are based on 40 CFR Part 98, Subpart C, Tables C-1 and C-2, *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and *Default CH_4 and N_2O Emission Factors for Various Types of Fuel*.

All emission calculations have been based on a maximum HHV of 1,020 British thermal units per standard cubic feet (BTU/scf). Also note that VOC and CH_4 emissions have been based on assumed composition percent values of total unburned hydrocarbons (UHC). UHC emissions are assumed to be composed of 20 percent VOC, and 80 percent CH_4.

For a Taurus 70-10802S unit at typical ambient operating temperatures (at 0°F or above), Solar Turbines states that: "*Solar's gas turbine dry low NOx emissions combustion system, known as SoLoNO$_X$, is designed to reduce NOx, CO, and unburned UHC without penalizing stability or transient capabilities*." The new turbine will be equipped with Solar's *SoLoNO$_X$* technology, which uses a "*lean-premixed combustion technology to ensure uniform air/fuel mixture and to prevent formation of regulated pollutants*". For *SoLoNO$_X$* operation at 0°F ambient temperatures or above, Solar Turbines guarantees that the following emission levels will be met:

1) 25.0 ppm NO_X at 15 percent oxygen (O_2).
2) 25.0 ppm CO at 15 percent O_2.
3) 25.0 ppm UHC at 15 percent O_2.

However, at subzero ambient operating temperatures, these emissions increase due to system control modifications required to maintain stable operation at very low temperatures. Since Solar does not provide a warranty for the lower emissions associated with the *SoLoNO$_X$* system at subzero temperatures, the turbine hourly emissions included in Attachment N are shown for operation at -10°F, 0°F, and at 50°F (50°F was chosen as a conservative ambient operating temperature for the majority of the annual emissions as described below) to demonstrate this difference. More

information regarding Solar's *SoLoNO$_X$* emission system can be found in Attachment L (see Solar Turbines' Product Information Letter 167).

Annual emissions for the compressor turbine included in Attachment N take into consideration the emissions variations based on ambient temperatures, and incorporate the potential for subzero ambient temperatures to occur during operation. The annual emissions are therefore based on a conservative maximum of 100 hours of operation per year at ambient temperatures less than 0°F, and remaining hours at a conservative annual average ambient temperature of 50°F. This is a conservative estimate, as the turbine is likely to operate up to 8,760 hours per year at *SoLoNO$_X$* guaranteed emission rates at temperatures above 0°F.

Start-up and shutdown emissions for the compressor turbine have also been included in the annual emission totals. Emission totals for start-up and shutdown operations have been determined based on Solar Turbines' Product Information Letter 170 (see Attachment L). Typical start-up and shutdown times are expected to each be less than 10 minutes.

Caterpillar G 3512B LE Emergency Generator

The new lean-burn natural gas emergency generator (Caterpillar Model G 3512B LE), 118-EG-03, will be used to provide electrical power during interruption of normal service. CO, NO_X, and VOC emissions from the new generator are based on applicable emission standards from 40 CFR 60 Subpart JJJJ, *Standards of Performance for Stationary Spark Ignition Internal Combustion Engines*, *Table 1* for emergency engines. TGP will either purchase a generator engine which will meet the NSPS JJJJ CO, NO_X, and VOC standards and perform emission testing as required, or will purchase an engine certified to meet these limits. CH_4, SO_2 and all PM emissions are based on AP-42, Table 3.2-2, *Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines*, and other GHG emissions are based on 40 CFR Part 98, Subpart C, Tables C-1 and C-2, *Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel* and *Default CH_4 and N_2O Emission Factors for Various Types of Fuel*. Annual emissions estimates are based on a maximum of 500 hours of total operation per year.

Parker Boiler T-4600LR Hydronic Heater

Emissions from the hydronic heater, 118-WH-02, are based on AP-42, Table 1.4-2, *Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion* and on vendor provided data. The heater will be used for fuel gas conditioning purposes.

Fugitive Emissions

Fugitive emissions are expected from new components and piping utilized at the station for the purposes of conveying natural gas and other materials into, within, and out of the facility. Please note that the fugitive component counts represented in the fugitive emission calculations included in Attachment N have been estimated based on design data as well as on component counts at a similar natural gas compressor station. The estimation of fugitive emissions is based on U.S. EPA document, EPA-453/R-95-017 (Protocol for Equipment Leak Emission Estimates, 1995).

Storage Tank and Truck Loading Emissions

One (1) pipeline liquids storage tank, 118-PF-04, will be installed at Station 118A as part of BRE. Tank emissions have been estimated using E&P software, and account for both working losses and breathing losses, as well as flashing losses. Additionally, pipeline liquids truck loading emissions (118-LR-05) have been calculated using AP-42, Section 5.2, Equation 1, *Transportation and Marketing of Petroleum Liquids,* Section 5.2, Equation 1.

Venting/Blow Down Emissions

Station 118A will be equipped with a shutdown system that is able to block natural gas out of the station and blow down the station piping. System blowdown will be directed to natural gas blowdown stacks. The shutdown system will be required to be inspected and tested on an annual basis, and natural gas will be vented from the blowdown stacks during the system tests. Gas venting and blowdown emissions are based on an assumed annual volume of natural gas released, and an estimated natural gas composition.

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF AIR QUALITY

601 57th Street, SE
Charleston, WV 25304
(304) 926-0475
www.dep.wv.gov/daq

APPLICATION FOR NSR PERMIT AND TITLE V PERMIT REVISION (OPTIONAL)

PLEASE CHECK ALL THAT APPLY TO **NSR (45CSR13)** (IF KNOWN):

☒ **CONSTRUCTION** ☐ **MODIFICATION** ☐ **RELOCATION**
☐ **CLASS I ADMINISTRATIVE UPDATE** ☐ **TEMPORARY**
☐ **CLASS II ADMINISTRATIVE UPDATE** ☐ **AFTER-THE-FACT**

PLEASE CHECK TYPE OF **45CSR30 (TITLE V)** REVISION (IF ANY):

☐ **ADMINISTRATIVE AMENDMENT** ☐ **MINOR MODIFICATION**
☐ **SIGNIFICANT MODIFICATION**

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS **ATTACHMENT S** TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant *(as registered with the WV Secretary of State's Office):*
Tennessee Gas Pipeline Company, L.L.C.

2. Federal Employer ID No. ***(FEIN):***
45-3953911

3. Name of facility *(if different from above):*
Compressor Station 118A

4. The applicant is the:
☐ **OWNER** ☐ **OPERATOR** ☒ **BOTH**

5A. Applicant's mailing address:
1001 Louisiana St.
Houston, TX 77002

5B. Facility's present physical address:
From Charleston, WV: Begin on Kanawha Blvd E/US-60 Alt W. Turn slight right onto Patrick St/US-60 E and travel for 0.3 miles. Turn slight left onto 7th Ave/WV-25 and travel for 0.8 miles. Turn right onto 26th St W and travel for 0.05 miles. 26th St W becomes Woodward Dr. Travel for 3.2 miles. Turn left onto Maxine Dr.

6. **West Virginia Business Registration.** Is the applicant a resident of the State of West Virginia? ☐ **YES** ☒ **NO**

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

7. If applicant is a subsidiary corporation, please provide the name of parent corporation: **Kinder Morgan Energy Partners, L.P.**

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

- If **YES,** please explain: **The applicant leases the proposed site.**
- If **NO,** you are not eligible for a permit for this source.

9. Type of plant or facility (stationary source) to be **constructed, modified, relocated, administratively updated** or **temporarily permitted** (e.g., coal preparation plant, primary crusher, etc.):
Natural Gas Transmission Facility

10. North American Industry Classification System **(NAICS)** code for the facility:
486210

11A. DAQ Plant ID No. (for existing facilities only): **N/A**	11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only): **N/A**

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

12A.

- For **Modifications, Administrative Updates** or **Temporary permits** 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 B**.

From Charleston, WV. Begin on Kanawha Blvd E/US-60 Alt W. Turn slight right onto Patrick St/US-60 E and travel for 0.3 miles. Turn slight left onto 7th Ave/WV-25 and travel for 0.8 miles. Turn right onto 26th St W and travel for 0.05 miles. 26th St W becomes Woodward Dr. Travel for 3.2 miles. Turn left onto Maxine Dr. See Attachment B for map.

12.B. New site address (if applicable): **TBD**	12C. Nearest city or town: **Charleston**	12D. County: **Kanawha**
12.E. UTM Northing (KM): **4,252.46**	12F. UTM Easting (KM): **438.13**	12G. UTM Zone: **17**

13. Briefly describe the proposed change(s) at the facility:
Compressor Station 118A is a proposed natural gas transmission station.

14A. Provide the date of anticipated installation or change: **February 2016** – If this is an **After-The-Fact** permit application, provide the date upon which the proposed change did happen: **NA**	14B. Date of anticipated Start-Up if a permit is granted: **October 2017**

14C. Provide a **Schedule** of the planned **Installation** of/**Change** to and **Start-Up** of each of the units proposed in this permit application as **Attachment C** (if more than one unit is involved).

15. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application:
Hours Per Day **24** Days Per Week **7** Weeks Per Year **52**

16. Is demolition or physical renovation at an existing facility involved? ☐ **YES** ☒ **NO**

17**. Risk Management Plans.** If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your **Risk Management Plan (RMP)** to U. S. EPA Region III.

18**. Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process *(if known).* A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance *(if known).* Provide this information as **Attachment D.**

Section II. Additional attachments and supporting documents.

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

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

21. Provide a **Plot Plan,** e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to ***Plot Plan Guidance***) **.**

– Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F.**

23. Provide a **Process Description** as **Attachment G.**

– Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

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

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as **Attachment H.**

– For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the **Emission Units Table** and provide it as **Attachment I.**

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J.**

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K.**

28. Check all applicable **Emissions Unit Data Sheets** listed below:

☒ Bulk Liquid Transfer Operations	☐ Haul Road Emissions	☐ Quarry
☐ Chemical Processes	☐ Hot Mix Asphalt Plant	☐ Solid Materials Sizing, Handling and Storage Facilities
☐ Concrete Batch Plant	☐ Incinerator	☒ Storage Tanks
☐ Grey Iron and Steel Foundry	☐ Indirect Heat Exchanger	

☒ General Emission Unit, specify - **Line Heater, Generator, Turbine**

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L.**

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

☐ Absorption Systems	☐ Baghouse	☐ Flare
☐ Adsorption Systems	☐ Condenser	☐ Mechanical Collector
☐ Afterburner	☐ Electrostatic Precipitator	☐ Wet Collecting System

☐ Other Collectors, specify **N/A**

Fill out and provide the **Air Pollution Control Device Sheet(s)** as **Attachment M.**

30. Provide all **Supporting Emissions Calculations** as **Attachment N,** or attach the calculations directly to the forms listed in Items 28 through 31.

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O.**

➢ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and ***Example Legal Advertisement*** for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33. **Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

☐ **YES** ☒ **NO**

➢ If **YES,** identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's ***"Precautionary Notice – Claims of Confidentiality"*** guidance found in the ***General Instructions*** as **Attachment Q.**

Section III. Certification of Information

34. **Authority/Delegation of Authority.** Only required when someone other than the responsible official signs the application. Check applicable **Authority Form** below:

☐ Authority of Corporation or Other Business Entity	☐ Authority of Partnership
☐ Authority of Governmental Agency	☐ Authority of Limited Partnership

Submit completed and signed **Authority Form** as **Attachment R.**

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

35A. **Certification of Information.** To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned ☒ **Responsible Official** / ☐ **Authorized Representative,** hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE _____ DATE: 1-26-15

(Please use blue ink) *(Please use blue ink)*

35B. Printed name of signee: **Thomas C. Dender**		35C. Title: **Vice President, Eastern Region**
35D. E-mail: **Tom_Dender@kindermorgan.com**	36E. Phone: **713-420-3833**	36F. FAX:
36A. Printed name of contact person (if different from above): **Shrishti Chhabra**		36B. Title: **Environmental Engineer III**
36C. E-mail: **Shrishti_Chhabra@kindermorgan.com**	36D. Phone: **713-420-6318**	36E. FAX:

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

☒ **Attachment A: Business Certificate**
☒ **Attachment B: Map(s)**
☒ **Attachment C: Installation and Start Up Schedule**
☒ **Attachment D: Regulatory Discussion**
☒ **Attachment E: Plot Plan**
☒ **Attachment F: Detailed Process Flow Diagram(s)**
☒ **Attachment G: Process Description**
☒ **Attachment H: Material Safety Data Sheets (MSDS)**
☒ **Attachment I: Emission Units Table**
☒ **Attachment J: Emission Points Data Summary Sheet**
☒ **Attachment K: Fugitive Emissions Data Summary Sheet**
☒ **Attachment L: Emissions Unit Data Sheet(s)**
☒ **Attachment M: Air Pollution Control Device Sheet(s)**
☒ **Attachment N: Supporting Emissions Calculations**
☒ **Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans**
☒ **Attachment P: Public Notice**
☒ **Attachment Q: Business Confidential Claims**
☒ **Attachment R: Authority Forms**
☒ **Attachment S: Title V Permit Revision Information**
☒ **Application Fee**

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

☐ *Forward 1 copy of the application to the Title V Permitting Group and:*
☐ *For Title V Administrative Amendments:*
  ☐ *NSR permit writer should notify Title V permit writer of draft permit,*
☐ *For Title V Minor Modifications:*
  ☐ *Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,*
  ☐ *NSR permit writer should notify Title V permit writer of draft permit.*
☐ *For Title V Significant Modifications processed in parallel with NSR Permit revision:*
  ☐ *NSR permit writer should notify a Title V permit writer of draft permit,*
  ☐ *Public notice should reference both 45CSR13 and Title V permits,*
  ☐ *EPA has 45 day review period of a draft permit.*

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

Attachment A

State of West Virginia

Certificate

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

TENNESSEE GAS PIPELINE COMPANY
(*A DELAWARE Corporation*)

filed Articles of Conversion in my office as required by the provisions of the West Virginia Code and was found to conform to law.

Therefore, I issue this

CERTIFICATE OF CONVERSION

Converting the corporation and changing the name to:

TENNESSEE GAS PIPELINE COMPANY, L.L.C.
(*A DELAWARE Limited Liability Company*)

Given under my hand and the Great Seal of the State of West Virginia on
October 18, 2011

Natalie E Tennant

~~9C 235~~
Secretary of State

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE DO HEREBY CERTIFY THAT THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF CONVERSION OF A DELAWARE CORPORATION UNDER THE NAME OF "TENNESSEE GAS PIPELINE COMPANY" TO A DELAWARE LIMITED LIABILITY COMPANY, CHANGING ITS NAME FROM "TENNESSEE GAS PIPELINE COMPANY" TO "TENNESSEE GAS PIPELINE COMPANY, L.L.C.", FILED IN THIS OFFICE ON THE THIRTIETH DAY OF SEPTEMBER, A.D. 2011, AT 6:46 O'CLOCK P.M.

AND I DO HEREBY FURTHER CERTIFY THAT THE EFFECTIVE DATE OF THE AFORESAID CERTIFICATE OF CONVERSION IS THE FIRST DAY OF OCTOBER, A.D. 2011, AT 8:05 O'CLOCK A.M.

FILED

OCT 18 2011

IN THE OFFICE OF SECRETARY OF STATE

0414109 8100V

111096809

Jeffrey W. Bullock, Secretary of State

AUTHENTICATION: 9089637

DATE: 10-13-11

You may verify this certificate online at corp.delaware.gov/authver.shtml

State of Delaware
Secretary of State
Division of Corporations
Delivered 06:46 PM 09/30/2011
FILED 06:46 PM 09/30/2011
SRV 111066471 - 0414109 FILE

CERTIFICATE OF CONVERSION FROM A CORPORATION TO A LIMITED LIABILITY COMPANY PURSUANT TO SECTION 266 OF THE DELAWARE GENERAL CORPORATION LAW AND SECTION 18-214 OF THE DELAWARE LIMITED LIABILITY COMPANY ACT

This Certificate of Conversion of Tennessee Gas Pipeline Company (the "Corporation") effective on October 1, 2011, is being duly executed and filed by an authorized person of the Corporation to convert the Corporation to a Delaware limited liability company in accordance with Section 266 of the Delaware General Corporation Law (the "DGCL") and Section 18-214 of the Delaware Limited Liability Company Act (the "DLLCA").

1. The name of the Corporation set forth in its original Certificate of Incorporation was:

Tennessee Gas Transmission Company

2. The name of the Corporation immediately prior to filing this Certificate of Conversion was:

Tennessee Gas Pipeline Company

3. The jurisdiction of the Corporation immediately prior to filing this Certificate of Conversion was:

Delaware

FILED
OCT 18 2011
IN THE OFFICE OF
SECRETARY OF STATE

4. The jurisdiction where the Corporation was first created is:

Delaware

5. The date the Certificate of Incorporation of the Corporation was filed is:

June 9, 1947

6. The name of the limited liability company (the "LLC") as set forth in its Certificate of Formation is:

Tennessee Gas Pipeline Company, L.L.C.

7. This conversion has been approved in accordance with the provisions of Section 266 of the DGCL and Section 18-214 of the DLLCA.

8. This Certificate of Conversion shall be effective at 8:05 a.m. Eastern Time on October 1, 2011.

IN WITNESS WHEREOF, this Certificate of Conversion has been executed by an authorized person of the Corporation on the 29th day of September, 2011.

By: Stacy J. James
Stacy J. James
Corporate Secretary

State of Delaware
Secretary of State
Division of Corporations
Delivered 06:46 PM 09/30/2011
FILED 06:46 PM 09/30/2011
SRV 111066471 - 0414109 FILE

CERTIFICATE OF FORMATION
OF
TENNESSEE GAS PIPELINE COMPANY, L.L.C.

This Certificate of Formation of Tennessee Gas Pipeline Company, L.L.C. (the "LLC") dated as of September 29, 2011, is being duly executed and filed by the undersigned, as an authorized person, to form a limited liability company under the Delaware Limited Liability Company Act, 6 Del. C.§§ 18-101, et. seq.

FIRST: The name of the LLC formed hereby is:

Tennessee Gas Pipeline Company, L.L.C.

SECOND: The address of the registered office of the LLC in the State of Delaware is:

Corporation Trust Center
1209 Orange Street
New Castle County
Wilmington, Delaware 19801

THIRD: The name and address of the registered agent for service of process on the LLC in the State of Delaware are:

The Corporation Trust Company
Corporation Trust Center
1209 Orange Street
New Castle County
Wilmington, Delaware 19801

FOURTH: The Certificate of Formation shall be effective at 8:05 a.m. Eastern Time on October 1, 2011.

IN WITNESS WHEREOF, the undersigned has caused this Certificate of Formation to be executed, this 29th day of September, 2011.

Stacy J. James
Authorized Person

Natalie E. Tennant
Secretary of State
1900 Kanawha Blvd E.
Bldg 1, Suite 157-K
Charleston, WV 25305

Penney Barker, Manager
Corporations Division
Tel: (304)558-8000
Fax: (304)558-8381
www.wvsos.com
Hrs: 8:30 a.m. – 5:00 p.m. ET

FILE ONE ORIGINAL
(Two if you want a filed stamped copy returned to you)
FEE: $150

WV APPLICATION FOR CERTIFICATE OF AUTHORITY OF LIMITED LIABILITY COMPANY

Control # _____

****A certificate of existence from your home state of organization, dated during the current tax year, must accompany this application****

1. The **name** of the company as registered in its **home state** is: Tennessee Gas Pipeline Company, L.L.C.
   and the state or country of organization is: Delaware

2. The **name** to be used in **West Virginia** will be:
   [The name must contain one of the required terms such as "limited liability company" or abbreviations such as "LLC" or "PLLC". See instructions for complete list of acceptable terms and requirements for use of trade name]
   ☒ Home State name as listed above, if available in WV
   ☐ DBA name _____ (ONLY if home state name is unavailable in WV)

FILED
OCT 18 2011
IN THE OFFICE OF SECRETARY OF STATE

3. The company will be a: [See instructions for limitations on professions which may form P.L.L.C. in WV. All members must have WV professional license.]
   ☒ regular L.L.C.
   ☐ professional L.L.C. for the profession of _____

4. The **address** of the **designated office** of the company in WV, if any, will be:
   No. & Street: _____
   City/State/Zip: _____

5. The street address of the **principal office** is:
   No. & Street: 1001 Louisiana St.
   City/State/Zip: Houston, TX 77002

   and the mailing address (if different) is:
   Street/Box: _____
   City/State/Zip: _____

6. **Agent of Process:**
   Properly designated person to whom notice of process may be sent, if any:
   Name: C T Corporation System
   Address: 5400 D Big Tyler Road
   City/State/Zip: Charleston, West Virginia 25313

7. E-mail address where business correspondence can be received: esper.jett@elpaso.com

8. The company is:
   - [X] an at-will company, for an indefinite period
   - [ ] a term company, for the term of _____ years, which will expire on _____.

9. The company is:
   - [X] member-managed. [List the names and addresses of all members]
   - [ ] manager-managed. [List the names and addresses of all managers]

List the name(s) of the members/managers of the company (attach additional pages if necessary)

Name	Address	City, State, Zip
El Paso TGPC Investments, L.L.C.	1001 Louisiana St. Houston, TX 77002	

10. All or specified members of a limited liability company are liable in their capacity as members for all or specified debts, obligations or liabilities of the company.
    - [ ] No--All debts, obligations and liabilities are those of the company
    - [X] Yes--Those persons who are liable in their capacity as members for all debts, obligations or liability of the company have consented in writing to the adoption of the provision or to be bound by the provision

11. The **purpose** for which this limited liability company is formed are as follows:
(Describe the type(s) of business activity which will be conducted. for example. "real estate." "construction of residential and commercial buildings." "commercial printing." "professional practice of architecture.")

transport natural gas

12. The number of pages attached and included in this application is: 3

13. The requested date for the establishment of the limited liability company in WV is:
    - [X] the date & time of filing
    - [ ] the following date _____ time _____

14. **Contact and Signature Information:**

a.	Esper Jett (Contact Name)	713-420-1477 (Phone Number)
b.	Stacy J. James (Print or type name of signer)	Corporate Secretary (Title / Capacity of Signer)
c.	Stacy J. James (Signature)	10/13/2011 (Date)

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE DO HEREBY CERTIFY THAT THE ATTACHED IS A TRUE AND CORRECT COPY OF CERTIFICATE OF FORMATION OF "TENNESSEE GAS PIPELINE COMPANY, L.L.C." FILED IN THIS OFFICE ON THE THIRTIETH DAY OF SEPTEMBER, A.D. 2011, AT 6:46 O'CLOCK P.M.

AND I DO HEREBY FURTHER CERTIFY THAT THE EFFECTIVE DATE OF THE AFORESAID CERTIFICATE OF FORMATION IS THE FIRST DAY OF OCTOBER, A.D. 2011, AT 8:05 O'CLOCK A.M.

Jeffrey W. Bullock, Secretary of State

0414109 8100V

111096809

AUTHENTICATION: 9089637

DATE: 10-13-11

You may verify this certificate online at corp.delaware.gov/authver.shtml

Delaware

The First State

I, JEFFREY W. BULLOCK, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY "TENNESSEE GAS PIPELINE COMPANY, L.L.C." IS DULY FORMED UNDER THE LAWS OF THE STATE OF DELAWARE AND IS IN GOOD STANDING AND HAS A LEGAL EXISTENCE SO FAR AS THE RECORDS OF THIS OFFICE SHOW, AS OF THE TWELFTH DAY OF OCTOBER, A.D. 2011.

AND I DO HEREBY FURTHER CERTIFY THAT THE ANNUAL TAXES HAVE BEEN PAID TO DATE.

Jeffrey W. Bullock, Secretary of State

0414109 8300

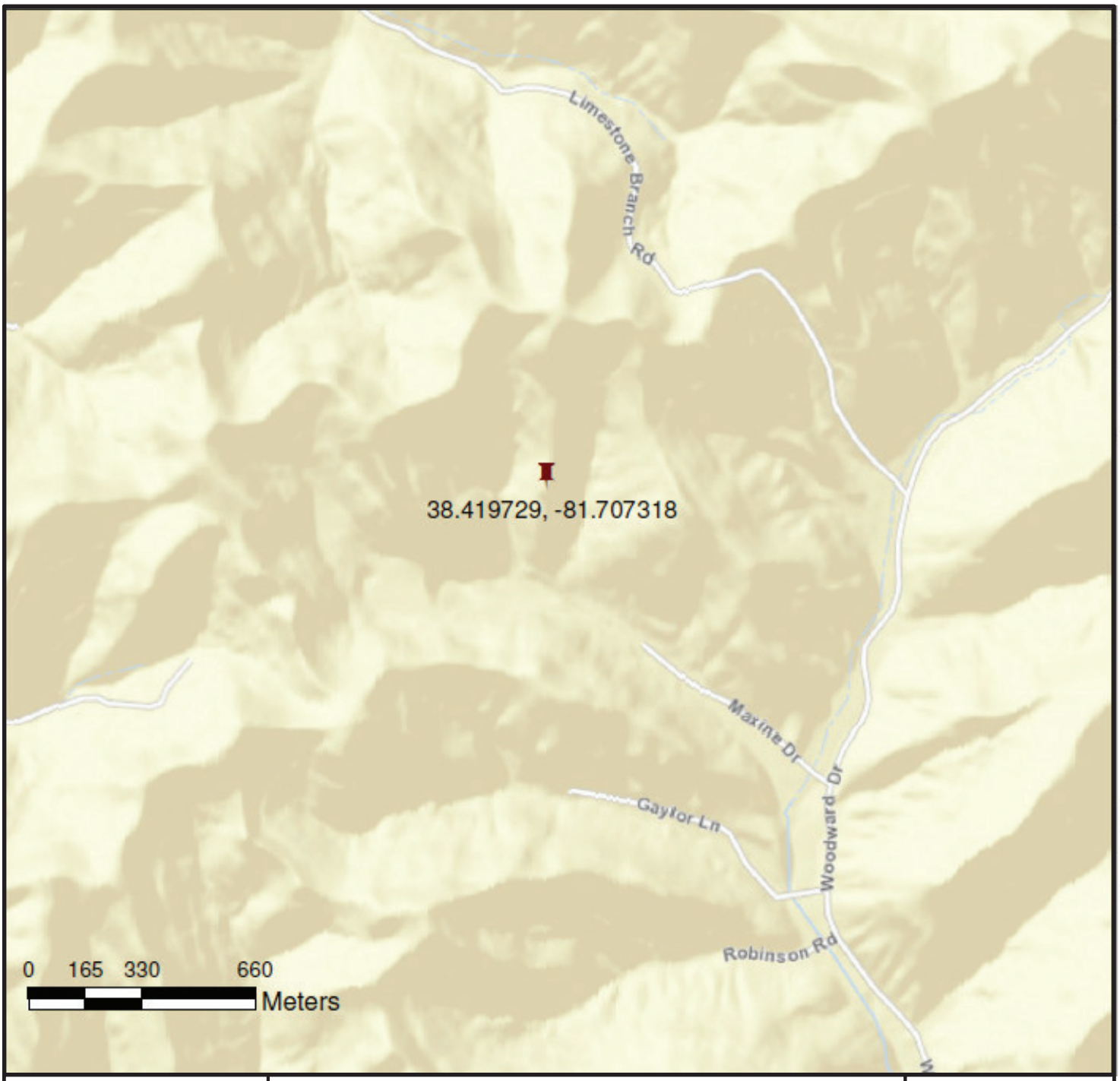
111093206

AUTHENTICATION: 9087127

DATE: 10-12-11

You may verify this certificate online at corp.delaware.gov/authver.shtml

Attachment B



ERM
Environmental
Resources
Management

SITE LOCATION MAP

STATION 118A - BRE

TENNESSEE GAS PIPELINE, L.L.C.

CHARLESTON, KANAWHA COUNTY, WEST VIRGINIA

FIGURE

1

Attachment C

Attachment C

Schedule of Installation

Compressor Station 118A is scheduled to commence construction in February of 2016. The anticipated start-up date is October 2017.

Attachment D

Attachment D - Regulatory Discussion

This section outlines the State's air quality regulations that could be reasonably expected to apply to the proposed greenfield natural gas compressor station (Station 118A) based on activities expected to be conducted at the site and the expected emissions of regulated air pollutants. The West Virginia (WV) State Regulations address federal air quality regulations where WV has delegated authority of enforcement, including Prevention of Significant Deterioration (PSD) permitting, Title V permitting, New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAPs).

I. General State Requirements

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

The hydronic heater, 118-WH-02, proposed at this site is an indirect heat exchanger; however, it is exempt from this requirement since it will have a heat input rating of less than 10 MMBtu/hr.

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 compressor station will be subject to this requirement. Based on the nature of the process at the compressor station, the presence of objectionable odors is unlikely.

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

The compressor turbine, 118-CT-01, proposed at Station 118A will combust natural gas and will be subject to this requirement. The purpose of this rule is to prevent and control air pollution from the emission of sulfur oxides. All fuel burning units will be subject to the weight emission standard for sulfur dioxide (SO_2). Fuel burning units which combust natural gas are exempt from the requirements of 45-10-8 – *Testing, Monitoring, Recordkeeping and Reporting*, per 45-10-10.3. Compressor turbine 118-CT-01 will burn only natural gas and is therefore exempt from the requirements of 45-10-8.

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

This Rule 13 permit application is being submitted for the operational activities proposed for Station 118A.

45 CSR 14 – Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration

Operation of equipment at this compressor station will not exceed the PSD emission thresholds as listed in this regulation. Please see the facility-wide potential to emit (PTE) summaries included in Attachment N.

Station 118A will be located in Kanawha County. The air quality of Kanawha County is designated by the U.S. EPA as either "better than normal standards" or "unclassified/attainment" for all criteria pollutants [40 CFR 81.318], and the county is designated as an ozone maintenance area. As such, new construction or modifications that result in emission increases are potentially subject to the PSD permitting regulations.

PSD applicability depends on the existing status of the facility (i.e. major or minor source) and the net emissions increase associated with the project. The major source threshold for PSD applicability is 250 tpy unless the source is included on a list of 28 specifically defined industrial source categories for which the PSD "major" source threshold is 100 tpy. Since Station 118A is not on the above U.S. EPA list, the PSD major source threshold is 250 tpy of any pollutant regulated by the Clean Air Act (CAA). Potential emissions of each criteria pollutant from the proposed facility will not exceed 250 tpy. The facility and project are therefore not subject to PSD review, as shown in Attachment N.

45 CSR 19 – Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution Which Cause or Contributed to Nonattainment

Operation of equipment at TGP Station 118A will not exceed the major New Source Review (NSR) emission triggers. Operation of equipment at this compressor station will not exceed the PSD emission thresholds as listed in this regulation. Please see the facility-wide PTE summaries included in Attachment N.

45 CSR 25 – Control of Air Pollution from Hazardous Waste Treatment, Storage, and Disposal Facilities

No hazardous waste will be burned at this well site; therefore, it will not be subject to this hazardous waste rule.

45 CSR 30 – Requirements for Operating Permits

Operation of equipment at Station 118A will not require a Title V Operating Permit since potential emissions are below 100 tons per year (tpy) for all qualifying pollutants (see Attachment N).

II. New Source Performance Standards

45 CSR 16 - Standards of Performance for New Stationary Sources

The applicability of the following NSPS regulations to the proposed equipment and operations at TGP Station 118A is addressed below:

40 CFR 60 Subpart Dc (Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units)

This regulation applies to steam generating units for which construction, modification, or reconstruction is commenced after June 9, 1989 and that have a maximum design heat capacity of 100 MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr. The hydronic heater will have a heat input capacity of 4.6 MMBtu/hr and thus will not be subject to this regulation.

40 CFR 60 Subpart K (Standards of Performance for Storage Vessels for Petroleum Liquids)

This regulation applies to petroleum storage vessels with storage capacities greater than 40,000 gallons and constructed, reconstructed, or modified after June 11, 1973, and prior to May 19, 1978. There are no petroleum storage vessels with capacities greater than 40,000 gallons planned at Station 118A, and this regulation is therefore not applicable to the facility.

40 CFR 60 Subpart Ka (Standards of Performance for Storage Vessels for Petroleum Liquids)

This regulation applies to petroleum storage vessels with storage capacities greater than 40,000 gallons and constructed, reconstructed, or modified after May 18, 1978, and prior to June 23, 1984. There are no petroleum storage vessels with capacities greater than 40,000 gallons planned at Station 118A, and this regulation is therefore not applicable to the facility.

40 CFR 60 Subpart Kb (Standards of Performance for Volatile Organic Liquid Storage Vessels)

This regulation applies to volatile organic liquid storage vessels with storage capacities greater than or equal to 75 cubic meters (19,812 gallons) for which construction, reconstruction, or modification commenced after July 23, 1984. There are no petroleum storage vessels with capacities greater than 19,810 gallons planned at Station 118A, and this regulation is therefore not applicable to the facility.

40 CFR 60 Subpart GG (Standards of Performance for Stationary Gas Turbines)

The provisions of this Subpart are applicable to the following affected facilities: all stationary gas turbines with a heat input at peak load equal to or greater than 10.7 gigajoules per hour (10 million British Thermal Units per hour (MMBtu/hr)), based on the lower heating value of the fuel fired, which commence construction, modification, or reconstruction after October 3, 1977 [§60.330(a)-(b)].

However, 40 CFR 60 Subpart KKKK (see previous section) states that stationary combustion turbines regulated under Subpart KKKK are exempt from the requirements of Subpart GG [§60.4305(b)]. As the new compressor turbine, 118-CT-01, will be subject to Subpart KKKK, it is exempt from the requirements of Subpart GG.

40 CFR 60 Subpart KKK (Standards of Performance for Equipment Leaks of Volatile Organic Compound [VOC] from Onshore Natural Gas Processing Plants)

Station 118A will not be a natural gas processing plant as defined in this Subpart, and the facility will not engage in extraction of natural gas liquids from field gas or fractionate mixed natural gas liquids to natural gas products. Therefore, this regulation is not applicable.

40 CFR 60 Subpart LLL (Standards of Performance for Onshore Natural Gas Processing: SO_2 Emissions)

Station 118A will not operate sweetening units or sulfur recovery units, and will not be a natural gas processing plant. Therefore, this regulation is not applicable.

40 CFR 60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines)

This regulation is not applicable to Station 118A because the facility will not operate any stationary compression ignition internal combustion engines.

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

Subpart JJJJ applies to owners and operators of stationary spark ignition (SI) internal combustion engines (ICE) that commence construction after June 12, 2006, depending on engine power and date of manufacture, and to owners and operators of all stationary SI ICE that are modified or reconstructed after June 12, 2006. The new emergency generator engine, 118-EG-03, will be manufactured and installed between 2016 and 2017, will have a 1,035 hp maximum rating, and thus will be subject to Subpart JJJJ.

The new emergency generator will meet the following emission standards from Subpart JJJJ, Table 1 [§60.4233(e)], and compliance will be demonstrated either via EPA certification or by emission testing:

1. NO_X limit of 2.0 g/HP-hr.
2. CO limit of 4.0 g/HP-hr.
3. VOC limit of 1.0 g/HP-hr.

The new emergency generator engine will be equipped with a non-resettable hour meter [§60.4237(a)]. As noted above, TGP will either 1) purchase an engine certified to meet Subpart JJJJ emission standards and will maintain documentation of the certification on site [§60.4245(a)(3)], or 2) purchase an engine which will meet the Subpart JJJJ emission standards, conduct an initial performance test, and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter to demonstrate compliance in accordance with §60.4244 [§60.4243(b)(2)(ii)]. If the engine is not certified, TGP will keep a maintenance plan and records of conducted maintenance and will, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions [§60.4243(b)(2)(ii)].

The unit will be operated as follows in order to maintain its emergency unit status [§60.4243(d)]:

1. There is no time limit on the use of emergency stationary ICE in emergency situations.
2. Non-emergency hours, which include maintenance checks and readiness testing, provided that the tests are recommended by federal, state or local government, the manufacturer, the vendor, or the insurance company associated with the engine, will be limited to 100 hours per year unless records indicating that federal, state, or local standards require maintenance and testing of emergency ICE beyond 100 hours per calendar year are maintained.
3. For non-emergency situations other than maintenance or readiness testing, the emergency stationary ICE may be operated for up to 50 hours per calendar year. The 50 hours of operation in non-emergency situations are counted as part of the 100 hours per calendar year for maintenance and testing.

TGP will maintain all required records as follows [§60.4245]:

1. Maintenance conducted on the engine.
2. Documentation that the engine meets applicable emission standards.

3. Hours of operation.

Reporting requirements include submittal of an initial notification and performance test results, as applicable, and TGP will comply with these requirements.

40 CFR 60 Subpart KKKK (Standards of Performance for Stationary Combustion Turbines)

Stationary combustion turbines with a heat input at peak load equal to or greater than 10 MMBtu per hour, based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005 are subject to this Subpart. The new compressor turbine, 118-CT-01, will have a heat input value of 93 MMBtu/hr based on the higher heating value of the fuel, and will thus be subject to Subpart KKKK.

The new compressor turbine will meet the following limits:

1. NO_x emission limit of 25 ppm at 15 percent O_2 or 150 nanograms per joule (ng/J) of useful output (1.2 pound per megawatt hour (lb/MWh)) [§60.4320]; and either
2. Total potential sulfur emissions limit of 875 ng SO_2/J (0.90 lb SO_2/MWh) [§60.4330(a)(2)], or
3. Fuel sulfur limit of 26 ng SO_2/J (0.060 lb SO_2/MMBtu) heat input

Attachment L includes manufacturer emissions and performance data, which guarantees that the NO_X limit above will be met. The abovementioned sulfur limits will be met through the use of pipeline quality natural gas as fuel. All associated equipment will be operated and maintained in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction [§60.4333(a)].

As compressor turbine 118-CT-01 will be a lean premix stationary combustion turbine, TGP will perform initial and subsequent performance testing to demonstrate compliance with the applicable NO_X emission limit (25 ppm) [§60.4340(a)]. The subsequent testing will be conducted on an either an annual basis, or on a biannual basis if the previous performance test results are less than or equal to 75 percent of the 25 ppm NO_X emission limit for the turbine [§60.4340(a)].

As noted above, the use of natural gas will constitute compliance with SO_2 emission limitations, and initial and ongoing performance testing will not be required. Additionally, the total sulfur content of the compressor turbine's combustion fuel must be monitored, unless one of the exemptions listed in §60.4365 can be met. The exemptions are as follows:

1. The fuel quality characteristics in a valid purchase contract, tariff sheet or transportation contract for the fuel has potential sulfur emissions of less than 0.060 lb SO_2/MMBtu (26 ng SO_2/J) heat input [§60.4365(a)].
2. Fuel sampling data which show that the sulfur content of the fuel does not exceed 0.060 lb SO_2/MMBtu (26 ng SO_2/J) [§60.4365(b)].

For the new compressor turbine, the fuel used for operation is derived from the natural gas transported through TGP's pipeline system, and will meet the exemption criteria listed in #1 above.

A written report of the results of each performance test required under §60.4340(a) must be submitted by the 60th day following the completion of the performance test [§60.4375(b)]. TGP will submit the necessary reports for the new compressor turbine as required by this Subpart.

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

This Subpart establishes emission standards and compliance schedules for the control of volatile organic compounds (VOCs) and SO_2 emissions for affected facilities producing, transmitting, or distributing natural gas. Compressors located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment are subject to this Subpart. Custody transfer is defined as the transfer of natural gas after processing and/or treatment in the producing operations. Station 118A will be located after the point of custody transfer, and thus compressor turbine 118-CT-01 will not be subject to this regulation. Storage vessels located in the natural gas transmission and storage segment that have the potential for VOC emissions equal to or greater than 6 tons per year (tpy) are also subject to this Subpart. The pipeline liquids storage vessel to be located at Station 118A has a VOC PTE less than 6 tpy, and thus will not be subject to this regulation.

III. Emission Standards for Hazardous Air Pollutants

45 CSR 34 – Emission Standards for Hazardous Air Pollutants

NESHAP regulations established in 40 CFR Part 61 and Part 63 regulate emission of air toxics. NESHAP standards primarily apply to major sources of hazardous air pollutants (HAPs), though some Subparts of Part 63 have been revised to include area (non-major) sources. The NESHAP regulations under 40 CFR Part 61 establish emission standards on the pollutant basis whereas 40 CFR Part 63 establishes the standards on a source category basis. Station 118A will not emit any singular HAP in excess of 10 tpy and will not emit combined HAPS in excess of 25 tpy, and will therefore be designated as an area source of HAPs. Please see the facility-wide PTE summaries included in Attachment N.

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

This regulation applies to each new and existing glycol dehydration unit at natural gas transmission and storage facilities which are major sources of HAPs. A glycol dehydration unit is a device in which liquid glycol absorbent directly contacts a natural gas stream and absorbs water. Station 118A will not be a major source of HAPs and will not have a glycol dehydration unit, and thus will not be subject to this Subpart.

40 CFR 63 Subpart YYYY (National Emissions Standards for Hazardous Air Pollutants [HAP] for Stationary Combustion Turbines)

Stationary combustion turbines located at major sources of HAP emissions are subject to this Subpart. As the facility will not be a major source of HAP emissions, it is not subject to this Subpart [§60.6085(a)].

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

Stationary reciprocating internal combustion engines (RICE) located at an area source of HAPs that are new, existing, or reconstructed are subject to this Subpart. Stationary RICE at area sources of HAPs are considered "new" under this Subpart if construction is commenced on or after June 12, 2006. The new emergency generator (engine), 118-EG-03, will be exempt from Subpart ZZZZ because the engine will comply with all applicable requirements under 40 CFR 60 Subpart JJJJ [§60.6590(c)].

40 CFR 63 Subpart DDDDD (National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

Industrial, commercial, or institutional boilers or process heaters located at a major source of HAPs are subject to this Subpart. Station 118A will not be a major source of HAPs and therefore will not be subject to this Subpart.

40 CFR 63 Subpart JJJJJJ (National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources)

This Subpart applies to industrial, commercial, or institutional boilers at area sources of HAPs. Station 118A will be an area source of HAPs; however, the new hydronic heater 118-WH-02 will not meet the definition of a boiler defined in §63.11237, and it will therefore not be subject to any of the requirements of this Subpart.

IV. Other Federal Requirements

Maintenance Emissions and Federal Routing Maintenance, Repair, and Replacement Provisions (RMRR)

As part of normal operations of Station 118A, TGP will routinely conduct activities associated with maintenance and repair of the facility equipment. These maintenance and repair activities will include, but will not be limited to, compressor engine startup/shutdowns, calibrating equipment, changing orifice plates, deadweight testing, and changing equipment filters (e.g., oil filters, separator filters).

Furthermore, in order to ensure the reliability of natural gas deliveries to their customers, TGP may conduct equipment and component replacement activities that conform to the currently applicable federal laws and regulations.

40 CFR Parts 72 through 77 Acid Rain Regulations

Station 118A will not sell electricity and is a non-utility facility. Therefore, Station 118A will not be subject to the federal acid rain regulations found at 40 CFR Parts 72 through 77.

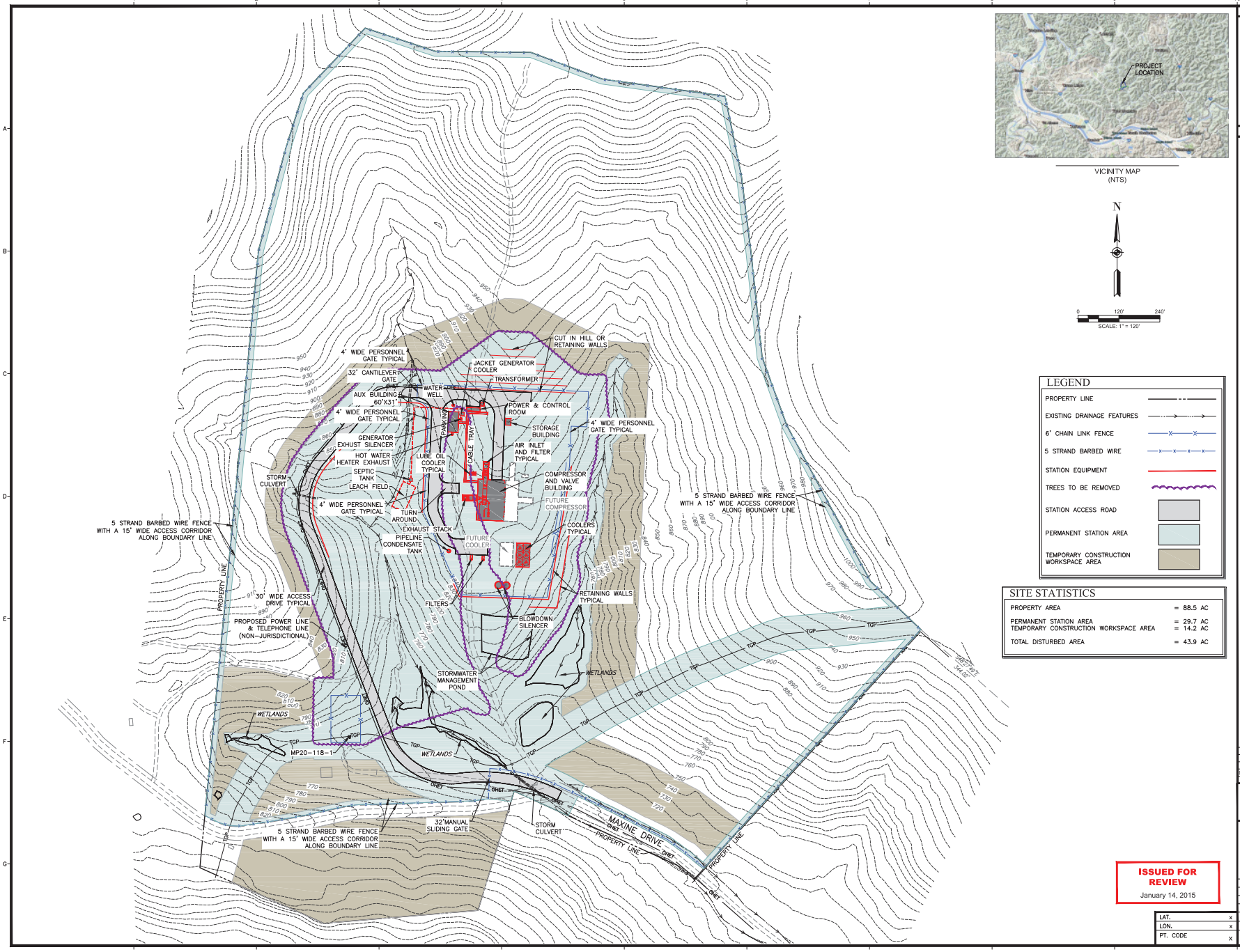
40 CFR 68 Chemical Accident Prevention and Risk Management Programs (RMP)

Station 118A will not be subject to the Chemical Accident Prevention Provisions (40 CFR 68.1). The facility will not be considered a stationary source under 40 CFR 68.3, Chemical Accident Prevention, because it is regulated under 49 CFR 192, U.S. Department of Transportation (DOT). Subpart B of 40 CFR 68 outlines requirements for Risk Management Programs (RMP) pursuant to Section 112(r) of the CAA. Applicability of the Subpart is determined based on the type and quantity of certain potentially hazardous and/or flammable chemicals stored at a facility. The RMP requirements will not apply to Station 118A, which will be operated and maintained in accordance with applicable rules of the DOT's Federal Safety Standards for Transportation of Natural and Other Gas by Pipeline codified at 49 CFR 192.

40 CFR 82 Stratospheric Ozone Protection Regulations

Subpart F, Recycling and Emissions Reductions, of 40 CFR Part 82, Protection of Stratospheric Ozone, generally requires that all repairs, service, and disposal of appliances containing Class I or Class II ozone depleting substances be conducted by properly certified technicians. The facility will comply with this regulation as applicable.

Attachment E



VICINITY MAP
(NTS)

N

0 120' 240'
SCALE: 1" = 120'

LEGEND

- PROPERTY LINE
- EXISTING DRAINAGE FEATURES
- 6' CHAIN LINK FENCE
- 5 STRAND BARBED WIRE
- STATION EQUIPMENT
- TREES TO BE REMOVED
- STATION ACCESS ROAD
- PERMANENT STATION AREA
- TEMPORARY CONSTRUCTION WORKSPACE AREA

SITE STATISTICS

PROPERTY AREA	= 88.5 AC
PERMANENT STATION AREA	= 29.7 AC
TEMPORARY CONSTRUCTION WORKSPACE AREA	= 14.2 AC
TOTAL DISTURBED AREA	= 43.9 AC

ISSUED FOR REVIEW
January 14, 2015

LAT.	x
LON.	x
PT. CODE	x

REFERENCE DRAWINGS

GENERAL NOTES

NO.	DATE	BY	DESCRIPTION	PROJ. ID	APPR.
C	01/14	BLJ	ISSUED FOR REVIEW	–	JFO
B	11/14	BLJ	ISSUED FOR REVIEW	–	JFO
A	10/17	BLJ	ISSUED FOR REVIEW	–	JFO

REVISIONS

Tennessee Gas Pipeline Company, L.L.C.

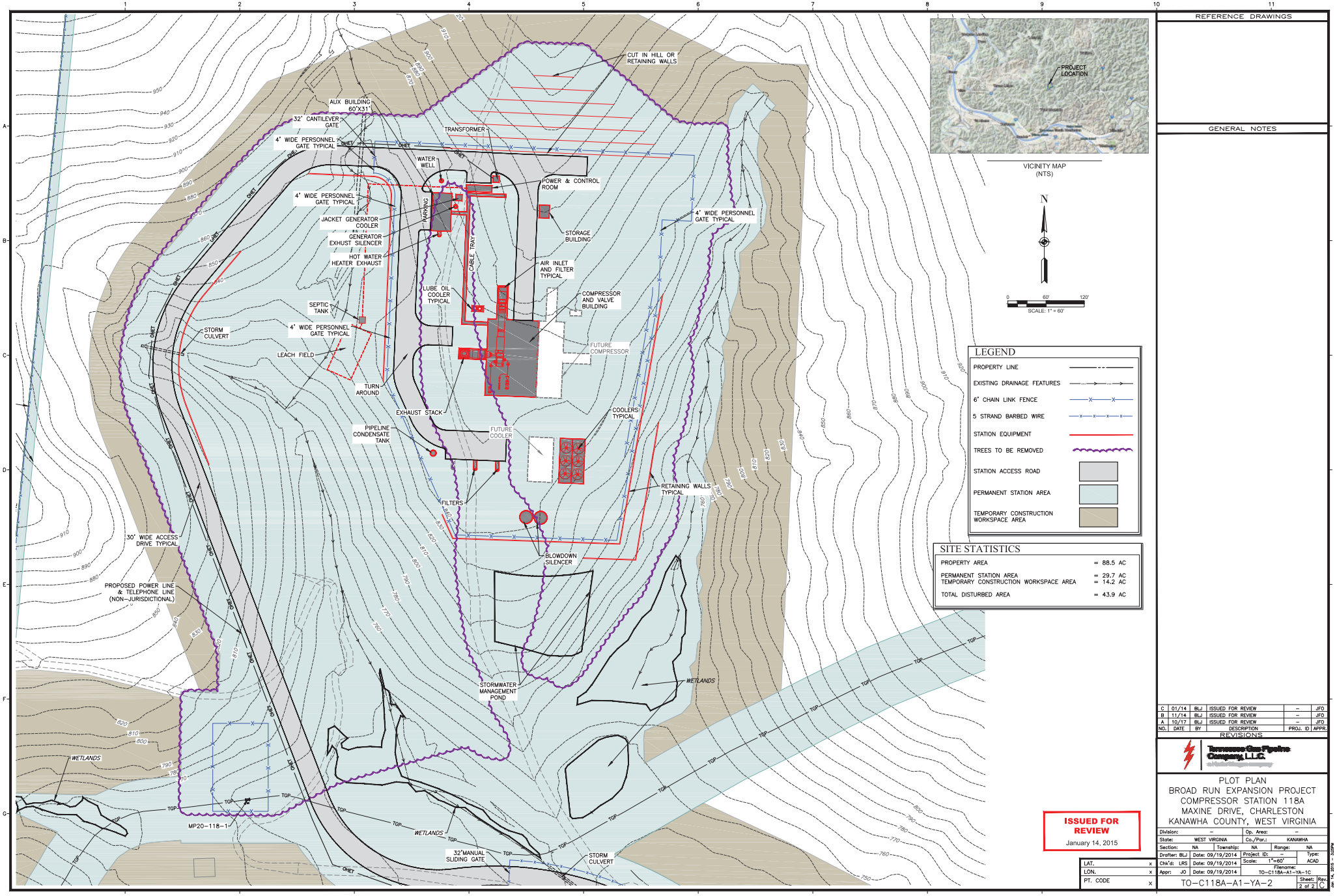
PLOT PLAN
BROAD RUN EXPANSION PROJECT
COMPRESSOR STATION 118A
MAXINE DRIVE, CHARLESTON
KANAWHA COUNTY, WEST VIRGINIA

Division:	–	Op. Area:	–
State:	WEST VIRGINIA	Co./Par.:	KANAWHA
Section:	NA	Township:	NA
Range:	NA		
Drafter: BLJ	Date: 09/19/2014	Project ID:	–
Type:	ACAD		
Chk'd: LRS	Date: 09/19/2014	Scale:	1"=120'
Appr: JO	Date: 09/19/2014	Filename:	TO-C118A-A1-YA-1C

TO-C118A-A1-YA-1

Sheet: 1 of 2 | Rev. C

Jan 14, 2015 - 3:26PM



REFERENCE DRAWINGS

GENERAL NOTES

LEGEND

PROPERTY LINE	
EXISTING DRAINAGE FEATURES	
6' CHAIN LINK FENCE	
5 STRAND BARBED WIRE	
STATION EQUIPMENT	
TREES TO BE REMOVED	
STATION ACCESS ROAD	
PERMANENT STATION AREA	
TEMPORARY CONSTRUCTION WORKSPACE AREA	

SITE STATISTICS

PROPERTY AREA	= 88.5 AC
PERMANENT STATION AREA	= 29.7 AC
TEMPORARY CONSTRUCTION WORKSPACE AREA	= 14.2 AC
TOTAL DISTURBED AREA	= 43.9 AC

ISSUED FOR REVIEW
January 14, 2015

LAT.	x
LON.	x
PT. CODE	x

NO.	DATE	BY	DESCRIPTION	PROJ. ID	APPR.
C	01/14	BLJ	ISSUED FOR REVIEW	–	JFO
B	11/14	BLJ	ISSUED FOR REVIEW	–	JFO
A	10/17	BLJ	ISSUED FOR REVIEW	–	JFO

REVISIONS

Tennessee Gas Pipeline Company, L.L.C.

PLOT PLAN
BROAD RUN EXPANSION PROJECT
COMPRESSOR STATION 118A
MAXINE DRIVE, CHARLESTON
KANAWHA COUNTY, WEST VIRGINIA

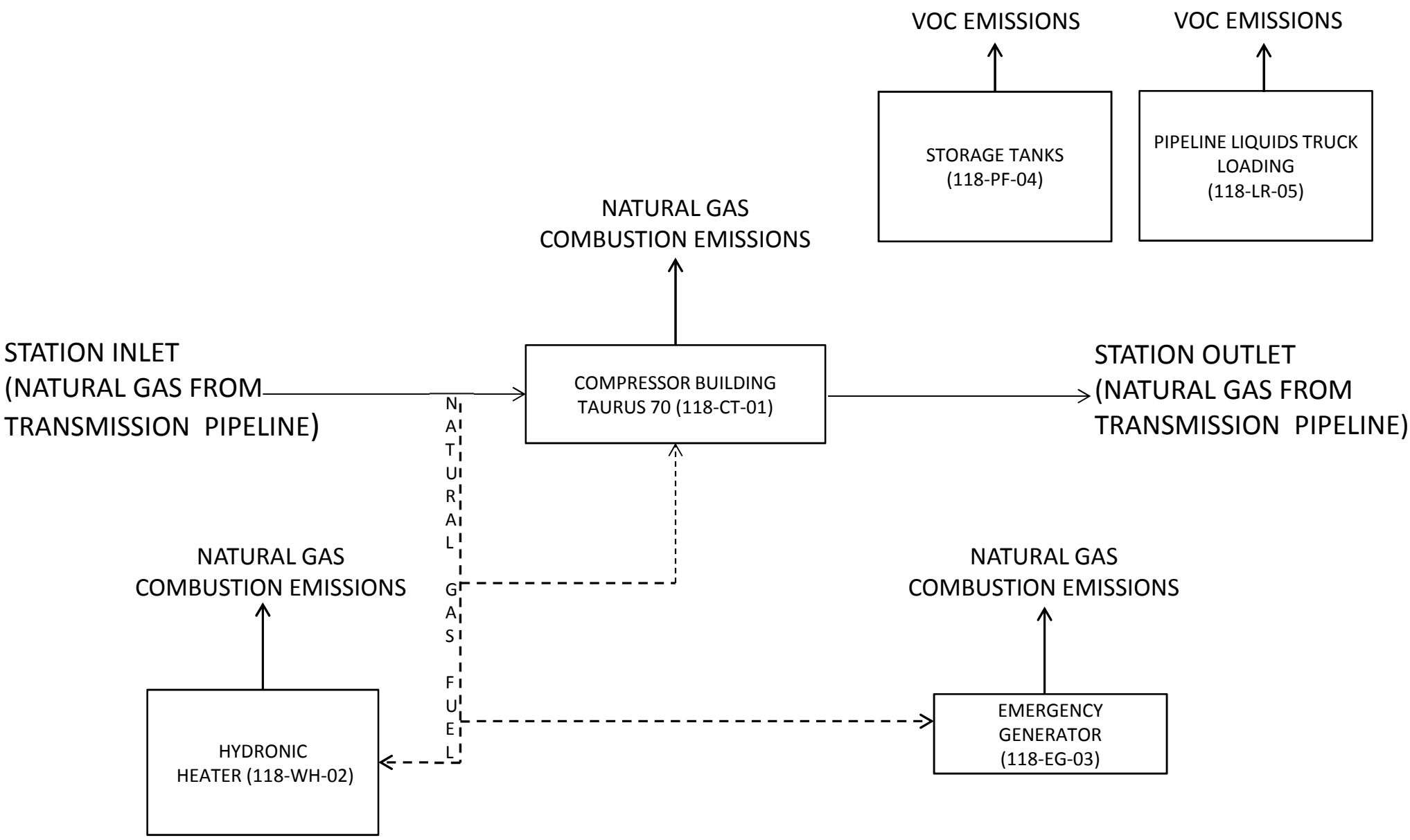
Division:	–	Op. Area:	–
State:	WEST VIRGINIA	Co./Par.:	KANAWHA
Section:	NA	Township:	NA
Range:	NA		
Drafter: BLJ	Date: 09/19/2014	Project ID:	–
Type:	ACAD		
Chk'd: LRS	Date: 09/19/2014	Scale:	1"=60'
Appr: JO	Date: 09/19/2014	Filename:	TO-C118A-A1-YA-1C

TO-C118A-A1-YA-2 | Sheet: 2 of 2 | Rev. C

9C-260

Attachment F

Compressor Station 118A
Simplified Process Flow Diagram



9C-262

1/20/2015

Attachment G

Attachment G

Process Description

Tennessee Gas Pipeline, L.L.C. is submitting this Rule 13 Permit Application for proposed greenfield Compressor Station 118A to comply with the permitting requirements of the state of West Virginia. Natural gas from the transmission pipeline will be routed and compressed through this station. Natural gas will be compressed to a higher pressure and discharged downstream into the sales line. The natural gas fired compressor turbine (118-CT-01) that will be operated at Station 118A is a Solar Taurus 70-10802S turbine with a design capacity of 11,523 brake horsepower. Station 118A will also operate one (1) natural gas fired emergency generator (118-EG-03), one (1) natural gas fired hydronic heater (118-WH-02), and one (1) pipeline liquids storage tank (118-PF-04).

Attachment H

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning PRECAUTIONARY LABEL TEXT: Empty containers may retain residue and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG−Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: AICS, DSL, KECI, PICCS, TSCA

Special Cases:

Inventory	Status
ELINCS	Restrictions Apply

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
DIPHENYLAMINE	122−39−4	5, 9

PHOSPHORODITHOIC ACID, O,O−DI C1−14−ALKYL ESTERS, ZINC SALTS (2:1) (ZDDP)	68649−42−3	15

−−REGULATORY LISTS SEARCHED−−

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
No revision information is available.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. You can contact ExxonMobil to insure that this document is the most current available from ExxonMobil. The information and recommendations are offered for the user's consideration and examination. It is the user's responsibility to satisfy itself that the product is suitable for the intended use. If buyer repackages this product, it is the user's responsibility to insure proper health, safety and other necessary information is included with and/or on the container. Appropriate warnings and safe−handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, re−publication or retransmission of this document, in whole or in part, is not permitted. The term, "ExxonMobil" is used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliates in which they directly or indirectly hold any interest.

Internal Use Only

MHC: 0, 0, 0, 0, 0, 0 PPEC: A

DGN: 7082306XUS (1008352)

Material Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Cat® NGEC™ (Natural Gas Engine Coolant)

Product Use: Antifreeze/Coolant
Product Number(s): CPS227813
Company Identification
Chevron Products Company
Global Lubricants
6001 Bollinger Canyon Road
San Ramon, CA 94583
United States of America

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
email : lubemsds@chevrontexaco.com
Product Information: 800-LUBE-TEK
MSDS Requests: 800-414-6737

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Ethylene Glycol	107-21-1	40 - 55 %weight
Diethylene glycol	111-46-6	1 - 5 %weight

SECTION 3 HAZARDS IDENTIFICATION

****

EMERGENCY OVERVIEW

- HARMFUL OR FATAL IF SWALLOWED
- POSSIBLE BIRTH DEFECT HAZARD - CONTAINS MATERIAL THAT MAY CAUSE BIRTH DEFECTS BASED ON ANIMAL DATA
- MAY CAUSE DAMAGE TO:
- KIDNEY

****

IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Not expected to be harmful to internal organs if absorbed through the skin.

Ingestion: Toxic; may be harmful or fatal if swallowed.
Inhalation: The vapor or fumes from this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing. Breathing this material at concentrations above the recommended exposure limits may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:
Reproduction and Birth Defects: Contains material that may cause birth defects based on animal data.
Target Organs: Contains material that may cause damage to the following organ(s) following repeated ingestion based on animal data: Kidney
See Section 11 for additional information. Risk depends on duration and level of exposure.

SECTION 4 FIRST AID MEASURES

Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.
Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.

SECTION 5 FIRE FIGHTING MEASURES

FIRE CLASSIFICATION:
OSHA Classification (29 CFR 1910.1200): Not classified by OSHA as flammable or combustible.

NFPA RATINGS: Health: 2 Flammability: 0 Reactivity: 0

FLAMMABLE PROPERTIES:
Flashpoint: Not Applicable
Autoignition: No Data Available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

EXTINGUISHING MEDIA: Dry Chemical, CO2, AFFF Foam or alcohol resistant foam.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will not burn.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove

contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Do not breathe vapor or fumes. Wash thoroughly after handling.
General Handling Information: Do not taste or swallow antifreeze or solution. Keep out of the reach of children and animals.
General Storage Information: Do not store in open or unlabeled containers.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: Natural rubber, Neoprene, Nitrile Rubber, Polyvinyl Chloride (PVC or Vinyl).
Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying Respirator for Organic Vapors, Dusts and Mists.
Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.
Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Ethylene Glycol	ACGIH	--	--	100 mg/m3	--

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Purple
Physical State: Liquid
Odor: Faint or Mild
pH: 10 - 11
Vapor Pressure: 0.12 mmHg (Typical) @ 20 °C (68 °F)
Vapor Density (Air = 1): 2.1
Boiling Point: 108.9°C (228°F)
Solubility: Miscible
Freezing Point: -36.7°C (-34°F)
Specific Gravity: 1.13 @ 15.6°C (60.1°F) / 15.6°C (60.1°F)
Viscosity: No data available
Evaporation Rate: No Data Available

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Hazardous Decomposition Products: Aldehydes (Elevated temperatures), Ketones (Elevated temperatures)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS
Eye Irritation: The eye irritation hazard is based on evaluation of data for similar materials or product components.
Skin Irritation: The skin irritation hazard is based on evaluation of data for similar materials or product components.
Skin Sensitization: No product toxicology data available.
Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for similar materials or product components.
Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for similar materials or product components.

ADDITIONAL TOXICOLOGY INFORMATION:
This product contains diethylene glycol (DEG). The estimated oral lethal dose is about 50 cc (1.6 oz) for an adult human. DEG has caused the following effects in laboratory animals: liver abnormalities, kidney damage and blood abnormalities. It has been suggested as a cause of the following effects in humans: liver abnormalities, kidney damage, lung damage and central nervous system damage.

This product contains ethylene glycol (EG). The toxicity of EG via inhalation or skin contact is expected to be slight at room temperature. The estimated oral lethal dose is about 100 cc (3.3 oz.) for an adult human. Ethylene glycol is oxidized to oxalic acid which results in the deposition of calcium oxalate crystals mainly in the brain and kidneys. Early signs and symptoms of EG poisoning may resemble those of alcohol intoxication. Later, the victim may experience nausea, vomiting, weakness, abdominal and muscle pain, difficulty in breathing and decreased urine output. When EG was heated above the boiling point of water, vapors formed which reportedly caused unconsciousness, increased lymphocyte count,

and a rapid, jerky movement of the eyes in persons chronically exposed. When EG was administered orally to pregnant rats and mice, there was an increase in fetal deaths and birth defects. Some of these effects occurred at doses that had no toxic effects on the mothers. We are not aware of any reports that EG causes reproductive toxicity in human beings.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
The toxicity of this material to aquatic organisms has not been evaluated. Consequently, this material should be kept out of sewage and drainage systems and all bodies of water.

ENVIRONMENTAL FATE
This material is expected to be readily biodegradable.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: Anti-freeze Preparations, Proprietary
Additional Information: Bulk shipments with a reportable quantity (5000 pounds) of ethylene glycol are a hazardous material. The Proper Shipping Name is: Environmentally Hazardous Substance, Liquid, N.O.S. (ethylene glycol), 9, UN3082, III, RQ (ethylene glycol).

IMO/IMDG Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORTATION UNDER THE IMDG CODE

ICAO/IATA Shipping Description: Anti-freeze Preparations, Proprietary; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:

1.	Immediate (Acute) Health Effects:	YES
2.	Delayed (Chronic) Health Effects:	YES
3.	Fire Hazard:	NO
4.	Sudden Release of Pressure Hazard:	NO
5.	Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65

01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

The following components of this material are found on the regulatory lists indicated.

Diethylene glycol	07
Ethylene Glycol	03, 05, 06, 07

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), ENCS (Japan), IECSC (China), PICCS (Philippines), TSCA (United States).

One or more components does not comply with the following chemical inventory requirements: KECI (Korea).

NEW JERSEY RTK CLASSIFICATION:
Refer to components listed in Section 2.

WHMIS CLASSIFICATION:
Class D, Division 1, Subdivision B: Toxic Material - Acute Lethality
Class D, Division 2, Subdivision A: Very Toxic Material - Teratogenicity and Embryotoxicity

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 2 Flammability: 0 Reactivity: 0

HMIS RATINGS: Health: 2* Flammability: 0 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

LABEL RECOMMENDATION:
Label Category : ANTIFREEZE/COOLANT 1 - AFC1

REVISION STATEMENT: This revision updates the following sections of this Material Safety Data Sheet: 1
Revision Date: July 25, 2006

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Government Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	MSDS - Material Safety Data Sheet

CVX - Chevron	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by the Chevron Energy Technology Company, 100 Chevron Way, Richmond, California 94802.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Attachment I

Attachment I

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]
118-CT-01	118-CT-01	Compressor Turbine (Taurus 70-10802S)	2016	93 MMBtu/hr	New	N/A
118-WH-02	118-WH-02	Hydronic Heater	2016	4.6 MMBtu/hr	New	N/A
118-EG-03	118-EG-03	Emergency Generator (G3512B LE)	2016	8.4 MMBtu/hr	New	N/A
118-PF-04	118-PF-04	Pipeline Liquids Storage Tank	2016	3,760 gallons	New	N/A
118-LR-05	118-LR-05	Pipeline Liquids Truck Loading	2016	NA	New	N/A

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

Attachment J

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 1: Emissions Data

Emission Point ID No. *(Must match Emission Units Table & Plot Plan)*	Emission Point Type[1]	Emission Unit Vented Through This Point *(Must match Emission Units Table & Plot Plan)*		Air Pollution Control Device *(Must match Emission Units Table & Plot Plan)*		Vent Time for Emission Unit *(chemical processes only)*		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]	Emission Concentration[7] (mg/m^3)
		ID No.	Source	ID No.	Device Type	Short Term[2]	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
118-EG-03	**Upward Vertical Stack**	**118-EG-03**	**Emergency Generator**	**NA**	**NA**	**NA**	**NA**	**CO** **NO_x** **Total VOCs** **PM** **$PM_{2.5}$** **PM_{10}** **SO_2** **Total HAPs** **CO_2e**	**9.13** **4.56** **2.28** **0.08** **0.08** **0.08** **<0.01** **0.59** **1,207**	**2.28** **1.14** **0.57** **0.02** **0.02** **0.02** **<0.01** **0.15** **302**	**9.13** **4.56** **2.28** **0.08** **0.08** **0.08** **<0.01** **0.59** **1,207**	**2.28** **1.14** **0.57** **0.02** **0.02** **0.02** **<0.01** **0.15** **302**	**Gas**	**AP-42, 40 CFR 98, Vendor Data**	**NA**
118-CT-01	**Upward Vertical Stack**	**118-CT-01**	**Turbine**	**NA**	**NA**	**NA**	**NA**	**CO** **NO_x** **Total VOCs** **PM** **$PM_{2.5}$** **PM_{10}** **SO_2** **Total HAPs** **CO_2e**	**5.16** **8.48** **0.59** **0.61** **0.61** **0.61** **0.31** **0.09** **10,796**	**34.5** **35.1** **2.59** **2.49** **2.49** **2.49** **1.28** **0.41** **44,437**	**5.16** **8.48** **0.59** **0.61** **0.61** **0.61** **0.31** **0.09** **10,796**	**34.5** **35.1** **2.59** **2.49** **2.49** **2.49** **1.28** **0.41** **44,437**	**Gas**	**AP-42, 40 CFR 98, Vendor Guarantees**	**NA**
118-WH-02	**Upward Vertical Stack**	**118-WH-03**	**Hydronic Heater**	**NA**	**NA**	**NA**	**NA**	**CO** **NO_x** **Total VOCs** **PM** **$PM_{2.5}$** **PM_{10}** **SO_2** **Total HAPs** **CO_2e**	**0.25** **0.11** **0.03** **0.05** **0.05** **0.05** **<0.01** **<0.01** **541**	**1.11** **0.48** **0.12** **0.20** **0.20** **0.20** **0.01** **0.04** **2,371**	**0.25** **0.11** **0.03** **0.05** **0.05** **0.05** **<0.01** **<0.01** **541**	**1.11** **0.48** **0.12** **0.20** **0.20** **0.20** **0.01** **0.04** **2,371**	**Gas**	**AP-42, 40 CFR 98, Vendor Data**	**NA**
118-PF-04	**Vent**	**118-PF-04**	**Pipeline Liquids Storage Tank**	**NA**	**NA**	**NA**	**NA**	**Total VOC** **Total HAPs**	**0.05** **<0.01**	**0.2** **0.01**	**0.05** **<0.01**	**0.2** **0.01**	**Gas**	**E&P Software**	**NA**

The EMISSION POINTS DATA 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 EMISSION POINTS DATA 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] Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

[3] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. **LIST** Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. **DO NOT LIST** H_2, H_2O, N_2, O_2, and Noble Gases.

[4] 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).

[5] 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).

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

[7] Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m^3) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO_2, use units of ppmv (See 45CSR10).

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 2: Release Parameter Data								
Emission Point ID No. *(Must match Emission Units Table)*	Inner Diameter (ft.)	Exit Gas			Emission Point Elevation (ft)		UTM Coordinates (km)	
		Temp. (^{o}F)	Volumetric Flow [1] (acfm) *at operating conditions*	Velocity (fps)	Ground Level *(Height above mean sea level)*	Stack Height [2] *(Release height of emissions above ground level)*	Northing	Easting
118-EG-03	**1**	**979**	**6,425**	**107.08**	**852**	**20**	**4,252.59**	**438.28**
118-CT-01	**4.33**	**932**	**130,270**	**147.22**	**852**	**72.5**	**4,252.59**	**438.24**
118-WH-02	**1.83**	**450**	**4,894**	**24.36**	**852**	**20**	**4,252.59**	**438.28**
118-PF-04	**NA**	**Ambient**	**NA**	**NA**	**852**	**15**	**4,252.59**	**438.28**

Attachment K

Attachment K

FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA 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).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS
1.) Will there be haul road activities? ☐ Yes ☒ No ☐ If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.) Will there be Storage Piles? ☐ Yes ☒ No ☐ If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.) Will there be Liquid Loading/Unloading Operations? ☒ Yes ☐ No ☒ If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? ☒ Yes ☐ No ☒ If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.) Will there be General Clean-up VOC Operations? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.) Will there be any other activities that generate fugitive emissions? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants - Chemical Name/CAS [1]	Maximum Potential Uncontrolled Emissions [2]		Maximum Potential Controlled Emissions [3]		Est. Method Used [4]
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads	N/A	N/A	N/A	N/A	N/A	N/A
Unpaved Haul Roads	N/A	N/A	N/A	N/A	N/A	N/.A
Storage Pile Emissions	N/A	N/A	N/A	N/A	N/A	N/A
Loading/Unloading Operations	VOC HAP	21.23 0.84	0.01 <0.01	21.23 0.84	0.01 <0.01	AP-42
Wastewater Treatment Evaporation & Operations	N/A	N/A	N/A	N/A	N/A	N/A
Equipment Leaks	VOCs HAP CO_2e	0.6 0.1 277	2.4 0.4 1,214	0.6 0.1 277	2.4 0.4 1,214	EPA-453
General Clean-up VOC Emissions	N/A	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A	N/A

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. DO NOT LIST H_2, H_2O, N_2, O_2, and Noble Gases.

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

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

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

Attachment L

Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): **118-CT-01**

1. Name or type and model of proposed affected source:

   Solar Turbines,
   Taurus 70-10802S
   11,523 hp
   92.9 MMBtu/hr

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

   NA

4. Name(s) and maximum amount of proposed material(s) produced per hour:

   NA

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

   NA

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):

(a) Type and amount in appropriate units of fuel(s) to be burned:

Natural Gas Fuel – As Required

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

NA

(c) Theoretical combustion air requirement (ACF/unit of fuel):

NA @ **NA** °F and **NA** psia.

(d) Percent excess air: **NA**

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

NA

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

NA

(g) Proposed maximum design heat input: **NA** $\times 10^6$ BTU/hr.

7. Projected operating schedule:

Hours/Day	**24**	Days/Week	**7**	Weeks/Year	**52**

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@ **NA** °F and **Ambient** psia

a.	NO_X	**8.48**	lb/hr	**NA**	grains/ACF
b.	SO_2	**0.31**	lb/hr	**NA**	grains/ACF
c.	CO	**5.16**	lb/hr	**NA**	grains/ACF
d.	$PM/PM_{10}/PM_{2.5}$	**0.61**	lb/hr	**NA**	grains/ACF
e.	Hydrocarbons	**NA**	lb/hr	**NA**	grains/ACF
f.	VOCs	**0.59**	lb/hr	**NA**	grains/ACF
g.	Pb	**NA**	lb/hr	**NA**	grains/ACF
h.	Specify other(s)				
	CO_{2e}	**10,796**	lb/hr	**NA**	grains/ACF
	Total HAPs	**0.09**	lb/hr	**NA**	grains/ACF
			lb/hr	**NA**	grains/ACF
			lb/hr	**NA**	grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. 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	RECORDKEEPING
See Attachment O	**See Attachment O**
REPORTING	TESTING
See Attachment O	**See Attachment O**

MONITORING. 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.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

NA

STATION 118 EMISSION AND PERFORMANCE DATE ESTIMATES

SOLAR TURBINES INCORPORATED DATE RUN: 11-Aug-14
ENGINE PERFORMANCE CODE REV. 4.13.1.15.9 RUN BY: Kanat Ilter
CUSTOMER: Kinder Morgan Inc
JOB ID: 3U461

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 1

HP=11523, %Full Load=100.0, Elev= 800ft, %RH= 60.0, Temperature=-10.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: CHOICE GAS

29.08	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0004	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 942.3 SG = 0.5808 W.I. @60F (Btu/Scf) = 1236.3
Gas Fuel Suitability (GFS)# 28021

Methane (CH4)	= 94.7142
Ethane (C2H6)	= 4.7045
Propane (C3H8)	= 0.1616
I-Butane (C4H10)	= 0.0106
N-Butane (C4H10)	= 0.0139
I-Pentane (C5H12)	= 0.0028
N-Pentane (C5H12)	= 0.0013
Hexane (C6H14)	= 0.0019
Heptane (C7H16)	= 0.0014
Octane (C8H18)	= 0.0007
Carbon Dioxide (CO2)	= 0.0876
Nitrogen (N2)	= 0.2994
Sulfur Dioxide (SO2)	= 0.0001

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

4039.	lbm/hr	FUEL FLOW
1518.51	Scfm	FUEL FLOW
21254.	Btu/lbm	LOWER HEATING VALUE
942.	Btu/Scf	LOWER HEATING VALUE
51759.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
137785.	Acfm	ACTUAL EXHAUST FLOW CFm
233850.	lbm/hr	EXHAUST GAS FLOW
4604.7	deg R	ADIA STOICH FLAME TEMP, CHOICE GAS
4601.5	deg R	ADIA STOICH FLAME TEMP, SDNG
28.58	---	MOLECULAR WEIGHT OF EXHAUST GAS
57.07	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.91	3.10	6.03	75.71	14.26	VOLUME PERCENT WET
0.96	3.30	0.00	80.57	15.17	VOLUME PERCENT DRY

```
  2960.     11150.      8893.    173519.     37323.  lbm/hr
   0.73       2.76       2.20      42.96       9.24  g/(g FUEL)
```

100% load								
Ambient Temp, F	NOx (ppm)	NOx (lb/hr)	CO (ppm)	CO (lb/hr)	UHC (ppm)	UHC (lb/hr)	Exhaust Temp (F)	Exhaust Flow (lb/hr)
-10	42	14.4	100	20.8	50	5.9	884	233,850

```
SOLAR TURBINES INCORPORATED                          DATE RUN: 11-Aug-14
ENGINE PERFORMANCE CODE  REV. 4.13.1.15.9            RUN BY: Kanat Ilter
CUSTOMER: Kinder Morgan Inc
JOB ID: 3U461

          --- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
                      POINT NUMBER 2

HP=11499,  %Full Load=100.0,  Elev=  800ft,  %RH= 60.0,  Temperature=
0.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL:  CHOICE GAS
             29.08  in Hg       AMBIENT PRESSURE
              60.0  percent     RELATIVE HUMIDITY
            0.0006  ---         SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) =   942.3   SG = 0.5808   W.I. @60F (Btu/Scf) = 1236.3
Gas Fuel Suitability (GFS)#  28021

 Methane (CH4)               = 94.7142
 Ethane (C2H6)               =  4.7045
 Propane (C3H8)              =  0.1616
 I-Butane (C4H10)            =  0.0106
 N-Butane (C4H10)            =  0.0139
 I-Pentane (C5H12)           =  0.0028
 N-Pentane (C5H12)           =  0.0013
 Hexane (C6H14)              =  0.0019
 Heptane (C7H16)             =  0.0014
 Octane (C8H18)              =  0.0007
 Carbon Dioxide (CO2)        =  0.0876
 Nitrogen (N2)               =  0.2994
 Sulfur Dioxide (SO2)        =  0.0001

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F   Pressure:
29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES:   Temperature: 32 deg F   Pressure:
29.92 in Hg

Solar's turbines are capable of operating over a wide range of fuel
blends, however Engineering review is required when methane drops below
80% or other constituents exceed standard boundaries. Performance as
modeled here should be accurate, but note that alterations to the
combustion and package systems may be necessary.


GENERAL OUTPUT DATA

            3987.  lbm/hr       FUEL FLOW
         1498.98  Scfm          FUEL FLOW
           21254.  Btu/lbm      LOWER HEATING VALUE
```

942.	Btu/Scf	LOWER HEATING VALUE
51048.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
136320.	Acfm	ACTUAL EXHAUST FLOW CFm
230605.	lbm/hr	EXHAUST GAS FLOW
4616.4	deg R	ADIA STOICH FLAME TEMP, CHOICE GAS
4613.2	deg R	ADIA STOICH FLAME TEMP, SDNG
28.58	---	MOLECULAR WEIGHT OF EXHAUST GAS
57.01	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.91	3.10	6.07	75.68	14.24	VOLUME PERCENT WET
0.96	3.30	0.00	80.57	15.16	VOLUME PERCENT DRY
2918.	11004.	8827.	171071.	36780.	lbm/hr
0.73	2.76	2.21	42.91	9.22	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 23-Dec-14
ENGINE PERFORMANCE CODE REV. 4.15.1.17.10 RUN BY: David Shekhtman
JOB ID:

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 1

HP=11499, %Full Load=100.0, Elev= 800ft, %RH= 60.0, Temperature= 0.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: CHOICE GAS

29.08	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0006	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 942.3 SG = 0.5808 W.I. @60F (Btu/Scf) = 1236.3

Methane (CH4)	= 94.7142
Ethane (C2H6)	= 4.7045
Propane (C3H8)	= 0.1616
I-Butane (C4H10)	= 0.0106
N-Butane (C4H10)	= 0.0139
I-Pentane (C5H12)	= 0.0028
N-Pentane (C5H12)	= 0.0013
Hexane (C6H14)	= 0.0019
Heptane (C7H16)	= 0.0014
Octane (C8H18)	= 0.0007
Carbon Dioxide (CO2)	= 0.0876
Nitrogen (N2)	= 0.2994
Sulfur Dioxide (SO2)	= 0.0001

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

!!! PLEASE, SUBMIT INQUIRY ON GAS FUEL SUITABILITY TO SAN DIEGO !!!

GENERAL OUTPUT DATA

3987.	lbm/hr	FUEL FLOW
1498.97	Scfm	FUEL FLOW
21254.	Btu/lbm	LOWER HEATING VALUE
942.	Btu/Scf	LOWER HEATING VALUE
51048.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
136320.	Acfm	ACTUAL EXHAUST FLOW CFm
230605.	lbm/hr	EXHAUST GAS FLOW
4616.4	deg R	ADIA STOICH FLAME TEMP, CHOICE GAS
4613.2	deg R	ADIA STOICH FLAME TEMP, SDNG
28.58	---	MOLECULAR WEIGHT OF EXHAUST GAS
57.01	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.91	3.10	6.07	75.68	14.24	VOLUME PERCENT WET
0.96	3.30	0.00	80.57	15.16	VOLUME PERCENT DRY
2918.	10004.	8827.	171071.	36780.	lbm/hr
0.73	2.76	2.21	42.91	9.22	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 23-Dec-14
ENGINE PERFORMANCE CODE REV. 4.15.1.17.10 RUN BY: David Shekhtman
JOB ID:

NEW EQUIPMENT PREDICTED EMISSION PERFORMANCE
DATA FOR POINT NUMBER 1

Fuel: CHOICE GAS Customer:
Water Injection: NO Inquiry Number:
Model: TAURUS 70-10802S CS/MD STANDARD GAS
Emissions Data: REV. 0.1

The following predicted emissions performance is based on the following specific single point:

HP=11499, %Full Load=100.0, Elev= 800ft, %RH= 60.0, Temperature= 0.0F

NOX	CO	UHC	
25.00	25.00	25.00	PPMvd at 15% O2
37.12	22.60	12.94	ton/yr
0.100	0.061	0.035	lbm/MMBtu (Fuel LHV)
0.99	0.60	0.34	lbm/(MW-hr) (gas turbine shaft pwr)
8.48	5.16	2.96	lbm/hr

NOTES:

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load or gas, fuel, and between 65% and 100% load for liquid fuel except for the Centaur 40). An emission warranty for non-SoLoN x equipment is available for greater than 0 deg F or -20 deg C an
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

SOLAR TURBINES INCORPORATED DATE RUN: 23-Dec-14
ENGINE PERFORMANCE CODE REV. 4.15.1.17.10 RUN BY: David Shekhtman
JOB ID:

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 2

HP=10966, %Full Load=100.0, Elev= 800ft, %RH= 60.0, Temperature= 50.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: CHOICE GAS

29.08	in Hg	AMBIENT PRESSURE
60.0	percent	RELATIVE HUMIDITY
0.0047	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 942.3 SG = 0.5808 W.I. @60F (Btu/Scf) = 1236.3

Methane (CH4)	= 94.7142
Ethane (C2H6)	= 4.7045
Propane (C3H8)	= 0.1616
I-Butane (C4H10)	= 0.0106
N-Butane (C4H10)	= 0.0139
I-Pentane (C5H12)	= 0.0028
N-Pentane (C5H12)	= 0.0013
Hexane (C6H14)	= 0.0019
Heptane (C7H16)	= 0.0014
Octane (C8H18)	= 0.0007
Carbon Dioxide (CO2)	= 0.0876
Nitrogen (N2)	= 0.2994
Sulfur Dioxide (SO2)	= 0.0001

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

!!! PLEASE, SUBMIT INQUIRY ON GAS FUEL SUITABILITY TO SAN DIEGO !!!

GENERAL OUTPUT DATA

3735.	lbm/hr	FUEL FLOW
1404.19	Scfm	FUEL FLOW
21254.	Btu/lbm	LOWER HEATING VALUE
942.	Btu/Scf	LOWER HEATING VALUE
47244.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
130270.	Acfm	ACTUAL EXHAUST FLOW CFm
212873.	lbm/hr	EXHAUST GAS FLOW
4668.6	deg R	ADIA STOICH FLAME TEMP, CHOICE GAS
4665.3	deg R	ADIA STOICH FLAME TEMP, SDNG
28.50	---	MOLECULAR WEIGHT OF EXHAUST GAS
56.16	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	3.12	6.76	75.16	14.06	VOLUME PERCENT WET
0.96	3.35	0.00	80.61	15.07	VOLUME PERCENT DRY
2682.	10265.	9100.	157234.	33588.	lbm/hr
0.72	2.75	2.44	42.10	8.99	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 23-Dec-14
ENGINE PERFORMANCE CODE REV. 4.15.1.17.10 RUN BY: David Shekhtman
JOB ID:

NEW EQUIPMENT PREDICTED EMISSION PERFORMANCE
DATA FOR POINT NUMBER 2

Fuel: CHOICE GAS Customer:
Water Injection: NO Inquiry Number:
Model: TAURUS 70-10802S CS/MD STANDARD GAS
Emissions Data: REV. 0.1

The following predicted emissions performance is based on the following specific single point:

HP=10966, %Full Load=100.0, Elev= 800ft, %RH= 60.0, Temperature= 50.0F

NOX	CO	UHC	
25.00	25.00	25.00	PPMvd at 15% O2
34.64	21.09	12.08	ton/yr
0.100	0.061	0.035	lbm/MMBtu (Fuel LHV)
0.97	0.59	0.34	lbm/(MW-hr) (gas turbine shaft pwr)
7.91	4.81	2.76	lbm/hr

NOTES:

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load or gas, fuel, and between 65% and 100% load for liquid fuel except for the Centaur 40). An emission warranty for non-SoLoN x equipment is available for greater than 0 deg F or -20 deg C an
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

SOLAR TURBINES INCORPORATED
ENGINE PERFORMANCE CODE REV. 4.15.1.17.10
JOB ID:

DATE RUN: 23-Dec-14
RUN BY: David Shekhtman

TAURUS 70-10802S
CS/MD
STANDARD
GAS
TBC-2 REV. 2.0
ES-ES2235
ES-ES2235

DATA FOR NOMINAL PERFORMANCE

*** GAS GENERATOR SPEED REFLECTS ELEVATED SPEED CONTROL METHODOLOGY.
ALL OTHER PERFORMANCE PARAMETERS IDENTICAL TO NON ELEVATED SPEED CONTROL T70 MODELS. ***

Fuel Type		CHOICE GAS		
Elevation	feet	800		
Inlet Loss	in H2O	4.0		
Exhaust Loss	in H2O	6.0		
Accessory on GP Shaft	HP	23.8		
Engine Inlet Temp.	deg F	0	50.0	
Relative Humidity	%	60.0	60.0	
Elevation Loss	HP	335	320	
Inlet Loss	HP	182	177	
Exhaust Loss	HP	102	102	
Driven Equipment Speed	RPM	11925	11652	
Optimum Equipment Speed	RPM	11925	11652	
Gas Generator Speed	RPM	15200	15200	
Specified Load	HP	FULL	FULL	
Net Output Power	HP	11499	10966	
Fuel Flow	mmBtu/hr	84.74	79.39	
Heat Rate	Btu/HP-hr	7370	7239	
Therm Eff	%	34.526	35.148	
Inlet Air Flow	lbm/hr	227299	209768	
Engine Exhaust Flow	lbm/hr	230605	212873	
PCD	psiG	244.9	235.6	
Compensated PTIT	deg F	1372	1400	
PT Exit Temperature	deg F	894	932	
Exhaust Temperature	deg F	889	932	

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 942.3 SG = 0.5808 W.I. @60F (Btu/Scf) = 1236.3

Methane (CH4)	= 94.7142
Ethane (C2H6)	= 4.7045
Propane (C3H8)	= 0.1616
I-Butane (C4H10)	= 0.0106
N-Butane (C4H10)	= 0.0139
I-Pentane (C5H12)	= 0.0028
N-Pentane (C5H12)	= 0.0013
Hexane (C6H14)	= 0.0019

Heptane (C7H16)	=	0.0014
Octane (C8H18)	=	0.0007
Carbon Dioxide (CO2)	=	0.0876
Nitrogen (N2)	=	0.2994
Sulfur Dioxide (SO2)	=	0.0001

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

!!! PLEASE, SUBMIT INQUIRY ON GAS FUEL SUITABILITY TO SAN DIEGO !!!

This performance was calculated with a basic inlet and exhaust system.
Special equipment such as low noise silencers, special filters, heat
recovery systems or cooling devices will affect engine performance.
Performance shown is "Expected" performance at the pressure drops
stated, not guaranteed.

Solar® Turbines
A Caterpillar Company

PIL 167
Product Information Letter

SoLoNOx Products: Emissions in Non-SoLoNOx Modes

Leslie Witherspoon
Solar Turbines Incorporated

PURPOSE

Solar's gas turbine dry low NOx emissions combustion systems, known as *SoLoNOx*™, have been developed to provide the lowest emissions possible during normal operating conditions. In order to optimize the performance of the turbine, the combustion and fuel systems are designed to reduce NOx, CO and unburned hydrocarbons (UHC) without penalizing stability or transient capabilities. At very low load and cold temperature extremes, the *SoLoNOx* system must be controlled differently in order to assure stable operation. The required adjustments to the turbine controls at these conditions cause emissions to increase.

The purpose of this Product Information Letter is to provide emissions estimates, and in some cases warrantable emissions for NOx, CO and UHC, at off-design conditions.

Historically, regulatory agencies have not required a specific emissions level to be met at low load or cold ambient operating conditions, but have asked what emissions levels are expected. The expected values are necessary to appropriately estimate emissions for annual emissions inventory purposes and for New Source Review applicability determinations and permitting.

COLD AMBIENT EMISSIONS ESTIMATES

Solar's standard temperature range warranty for gas turbines with *SoLoNOx* combustion is ≥ 0°F (–20°C). The *Titan*™ 250 is an exception, with a lower standard warranty at ≥ –20°F (–29°C). At ambient temperatures below 0°F, many of Solar's turbine engine models are controlled to increase pilot fuel to improve flame stability and emissions are higher. Without the increase in pilot fuel at temperatures below 0°F the engines may exhibit combustor rumble, as operation may be near the lean stability limit.

If a cold ambient emissions warranty is requested, a new production turbine configured with the latest combustion hardware is required. For most models this refers to the inclusion of Cold Ambient Fuel Control Logic.

Emissions warranties are not offered for ambient temperatures below –20°F (–29°C). In addition, cold ambient emissions warranties cannot be offered for the *Centaur*® 40 turbine.

Table 1 provides expected and warrantable (upon Solar's documented approval) emissions levels for Solar's *SoLoNOx* combustion turbines. All emissions levels are in ppm at 15% O_2. Refer to Product Information Letter 205 for *Mercury*™ 50 turbine emissions estimates.

For information on the availability and approvals for cold ambient temperature emissions warranties, please contact Solar's sales representatives.

Table 2 summarizes "expected" emissions levels for ambient temperatures below 0°F (–20°C) for Solar's *SoLoNOx* turbines that do not have current production hardware or for new production hardware that is not equipped with the cold ambient fuel control logic. The emissions levels are extrapolated from San Diego factory tests and may vary at extreme temperatures and as a result of variations in other parameters, such as fuel composition, fuel quality, etc.

For more conservative NOx emissions estimate for new equipment, customers can refer to the New Source Performance Standard (NSPS) 40CFR60, subpart KKKK, where the allowable NOx emissions level for ambient temperatures < 0°F (–20°F) is 150 ppm NOx at 15% O_2. For pre-February 18, 2005, *SoLoNOx* combustion turbines subject to 40CFR60 subpart GG, a conservative estimate is the appropriate subpart GG emissions level. Subpart GG levels range from 150 to 214 ppm NOx at 15% O_2 depending on the turbine model.

Table 3 summarizes emissions levels for ambient temperatures below –20°F (–29°C) for the *Titan* 250.

Table 1. Warrantable Emissions Between 0°F and –20°F (–20° to –29°C) for New Production

Turbine Model	Fuel System	Fuel	Applicable Load	NOx, ppm	CO, ppm	UHC, ppm
Centaur 50	Gas Only	Gas	50 to 100% load	42	100	50
	Dual Fuel	Gas	50 to 100% load	72	100	50
Taurus™ 60	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Taurus 65	Gas Only	Gas	50 to 100% load	42	100	50
Taurus 70	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Mars® 90	Gas Only	Gas	50 to 100% load	42	100	50
Mars 100	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Titan 130	Gas Only or Dual Fuel	Gas	50 to 100% load	42	100	50
Titan 250	Gas Only	Gas	40 to 100% load	25	50	25
	Gas Only	Gas	40 to 100% load	15	25	25
Centaur 50	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 60	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 70	Dual Fuel	Liquid	65 to 100% load	120	150	75
Mars 100	Dual Fuel	Liquid	65 to 100% load	120	150	75
Titan 130	Dual Fuel	Liquid	65 to 100% load	120	150	75

Table 2. Expected Emissions below 0°F (–20°C) for SoLoNOx Combustion Turbines

Turbine Model	Fuel System	Fuel	Applicable Load	NOx, ppm	CO, ppm	UHC, ppm
Centaur 40	Gas Only or Dual Fuel	Gas	80 to 100% load	120	150	50
Centaur 50	Gas Only	Gas	50 to 100% load	120	150	50
	Dual Fuel	Gas	50 to 100% load	120	150	50
Taurus 60	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Taurus 65	Gas Only	Gas	50 to 100% load	120	150	50
Taurus 70	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Mars 90	Gas Only	Gas	80 to 100% load	120	150	50
Mars 100	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Titan 130	Gas Only or Dual Fuel	Gas	50 to 100% load	120	150	50
Centaur 40	Dual Fuel	Liquid	80 to 100% load	120	150	75
Centaur 50	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 60	Dual Fuel	Liquid	65 to 100% load	120	150	75
Taurus 70	Dual Fuel	Liquid	65 to 100% load	120	150	75
Mars 100	Dual Fuel	Liquid	65 to 100% load	120	150	75
Titan 130	Dual Fuel	Liquid	65 to 100% load	120	150	75

Table 3. Expected Emissions below –20°F (–29°C) for the Titan 250 SoLoNOx Combustion Turbine

Turbine Model	Fuel System	Fuel	Applicable Load	NOx, ppm	CO, ppm	UHC, ppm
Titan 250	Gas Only	Gas	40 to 100% load	70	150	50

COLD AMBIENT PERMITTING STRATEGY

There are several permitting options to consider when permitting in cold ambient climates. Customers can use a tiered permitting approach or choose to permit a single emission rate over all temperatures. Historically, most construction and operating permits were silent on the ambient temperature boundaries for *SoLoNOx* operation.

Some customers have used a tiered permitting strategy. For purposes of compliance and annual emissions inventories, a digital thermometer is installed to record ambient temperature. The amount of time is recorded that the ambient temperature falls below 0°F. The amount of time below 0°F is then used with the emissions estimates shown in Tables 1 and 2 to estimate "actual" emissions during sub-zero operation.

A conservative alternative to using the NOx values in Tables 1, 2 and 3 is to reference 40CFR60 subpart KKKK, which allows 150 ppm NOx at 15% O_2 for sub-zero operation.

For customers who wish to permit at a single emission rate over all ambient temperatures, inlet air heating can be used to raise the engine inlet air temperature (T_1) above 0°F. With inlet air heating to keep T_1 above 0°F, standard emission warranty levels may be offered.

Inlet air heating technology options include an electric resistance heater, an inlet air to exhaust heat exchanger and a glycol heat exchanger.

If an emissions warranty is desired and ambient temperatures are commonly below –20°F (–29°C), inlet air heating can be used to raise the turbine inlet temperature (T_1) to at least –20°F. In such cases, the values shown in Table 1 can be warranted for new production.

EMISSIONS ESTIMATES IN NON-SOLONOX MODE (LOW LOAD)

At operating loads < 50% (<40% load for the *Titan* 250) on natural gas fuel and < 65% (< 80% load for *Centaur* 40) on liquid fuels, *SoLoNOx* engines are controlled to increase stability and transient response capability. The control steps that are required affect emissions in two ways: 1) pilot fuel flow is increased, increasing NOx emissions, and 2) airflow through the combustor is increased, increasing CO emissions. Note that the load levels are approximate. Engine controls are triggered either by power output for single-shaft engines or gas producer speed for two-shaft engines.

A conservative method for estimating emissions of NOx at low loads is to use the applicable NSPS: 40CFR60 subpart GG or KKKK. For projects that commence construction after February 18, 2005, subpart KKKK is the applicable NSPS and contains a NOx level of 150 ppm @ 15% O_2 for operating loads less than 75%.

Table 4 provides estimates of NOx, CO, and UHC emissions when operating in non-SoLoNOx mode for natural gas or liquid fuel. The estimated emissions can be assumed to vary linearly as load is decreased from just below 50% load for natural gas (or 65% load for liquid fuel) to idle.

The estimates in Table 4 apply for any product for gas only or dual fuel systems using pipeline quality natural gas. Refer to Product Information Letter 205 for *Mercury* 50 emissions estimates.

Table 4. Estimated Emissions in non-SoLoNOx Mode

Ambient	Fuel System	Engine Load	NOx, ppm	CO, ppm	UHC, ppm
***Centaur* 40/50, *Taurus* 60/65/70, *Mars* 90/100, *Titan* 130**					
≥ –20°F (–29°C)	Natural Gas	Less than 50%	70	8,000	800
		Idle	50	10,000	1,000
< –20°F (–29°C)	Natural Gas	Less than 50%	120	8,000	800
		Idle	120	10,000	1,000
***Titan* 250**					
≥ –20°F (–29°C)	Natural Gas	Less than 40%	50	25	20
		Idle	50	2,000	200
< –20°F (–29°C)	Natural Gas	Less than 40%	70	150	50
		Idle	70	2,000	200
***Centaur* 50, *Taurus* 60/70, *Mars* 100, *Titan* 130**					
≥ –20°F (–29°C)	Liquid	Less than 65%	120	1,000	100
		Idle	120	10,000	3,000
< –20°F (–29°C)	Liquid	Less than 65%	120	1,000	150
		Idle	120	10,000	3,000
***Centaur* 40**					
≥ –20°F (–29°C)	Liquid	Less than 80%	120	1,000	100
		Idle	120	10,000	3,000
< –20°F (–29°C)	Liquid	Less than 80%	120	1,000	150
		Idle	120	10,000	3,000

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Emission Estimates at Start-up, Shutdown, and Commissioning for SoLoNOx Combustion Products

Leslie Witherspoon
Solar Turbines Incorporated

PURPOSE

The purpose of this Product Information Letter (PIL) is to provide emission estimates for start-up and shutdown events for *Solar*® gas turbines with *SoLoNOx*™ dry low emissions combustion systems. The commissioning process is also discussed.

INTRODUCTION

The information presented in this document is representative for both generator set (GS) and compressor set/mechanical drive (CS/MD) combustion turbine applications. Operation of duct burners and/or any add-on control equipment is not accounted for in the emissions estimates. Emissions related to the start-up, shutdown, and commissioning of combustion turbines will not be guaranteed or warranted.

Combustion turbine start-up occurs in one of three modes: cold, warm, or hot. On large, utility size, combustion turbines, the start-up time varies by the "mode". The start-up duration for a hot, warm, or cold *Solar* turbine is less than 10 minutes in simple-cycle and most combined heat and power applications.

Heat recovery steam generator (HRSG) steam pressure is usually 250 psig or less. At 250 psig or less, thermal stress within the HRSG is minimized and, therefore, firing ramp-up is not limited. However, some combined heat and power plant applications will desire or dictate longer start-up times, therefore emissions assuming a 60-minute start are also estimated.

A typical shutdown for a *Solar* turbine is <10 minutes. Emissions estimates for an elongated shutdown, 30-minutes, are also included.

Start-up and shutdown emissions estimates for the *Mercury*™ 50 engine are found in PIL 205.

For start-up and shutdown emissions estimates for conventional combustion turbines, landfill gas, digester gas, or other alternative fuel applications, contact Solar's Environmental Programs Department.

START-UP SEQUENCE

The start-up sequence, or getting to *SoLoNOx* combustion mode, takes three steps:

1. Purge-crank
2. Ignition and acceleration to idle
3. Loading / thermal stabilization

During the "purge-crank" step, rotation of the turbine shaft is accomplished with a starter motor to remove any residual fuel gas in the engine flow path and exhaust. During "igni-

tion and acceleration to idle," fuel is introduced into the combustor and ignited in a diffusion flame mode and the engine rotor is accelerated to idle speed.

The third step consists of applying up to 50% load[1] while allowing the combustion flame to transition and stabilize. Once 50% load is achieved, the turbine transitions to *SoLoNOx* combustion mode and the engine control system begins to hold the combustion primary zone temperature and limit pilot fuel to achieve the targeted nitrogen oxides (NOx), carbon monoxide (CO), and unburned hydrocarbons (UHC) emission levels.

Steps 2 and 3 are short-term transient conditions making up less than 10 minutes.

SHUTDOWN PROCESS

Normal, planned cool down/shutdown duration varies by engine model. The *Centaur*® 40, *Centaur* 50, *Taurus*™ 60, and *Taurus* 65 engines take about 5 minutes. The *Taurus* 70, *Mars*® 90 and 100, *Titan*™ 130 and *Titan* 250 engines take about 10 minutes. Typically, once the shutdown process starts, the emissions will remain in *SoLoNOx* mode for approximately 90 seconds and move into a transitional mode for the balance of the estimated shutdown time (assuming the unit was operating at full-load).

START-UP AND SHUTDOWN EMISSIONS ESTIMATES

Tables 1 through 5 summarize the estimated pounds of emissions per start-up and shutdown event for each product. Emissions estimates are presented for both GS and CS/MD applications on both natural gas and liquid fuel (diesel #2). The emissions estimates are calculated using empirical exhaust characteristics.

COMMISSIONING EMISSIONS

Commissioning generally takes place over a two-week period. Static testing, where no combustion occurs, usually requires one week and no emissions are expected. Dynamic testing, where combustion will occur, will see the engine start and shutdown a number of times and a variety of loads will be placed on the system. It is impossible to predict how long the turbine will run and in what combustion / emissions mode it will be running. The dynamic testing period is generally followed by one to two days of "tune-up" during which the turbine is running at various loads, most likely within low emissions mode (warranted emissions range).

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[1] 40% load for the *Titan* 250 engine on natural gas. 65% load for all engines on liquid fuel (except 80% load for the *Centaur* 40).

Table 1. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
10 Minute Start-up and 10 Minute Shutdown
Natural Gas Fuel

Data will NOT be warranted under any circumstances

	Centaur 40 4701S				Centaur 50 6201S				Taurus 60 7901S				Taurus 65 8401S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	0.6	58.1	3.3	359	0.8	75.0	4.3	454	0.8	78.5	4.5	482	0.9	85.8	4.9	523
Total Emissions per Shutdown (lbs)	0.3	25.5	1.5	160	0.4	31.1	1.8	194	0.4	34.7	2.0	217	0.4	38.2	2.2	237

	Taurus 70 10801S				Mars 90 13002S GSC				Mars 100 16002S GSC				Titan 130 20501S				Titan 250 30002S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	1.1	103.9	5.9	634	1.4	129.0	7.4	868	1.6	151.2	8.6	952	2.1	195.6	11.2	1,194	2.5	22.7	1.5	1,925
Total Emissions per Shutdown (lbs)	1.3	110.7	6.3	689	1.7	147.9	8.4	912	1.9	166.8	9.5	1,026	2.4	210.0	12.0	1,303	3.0	19.9	1.5	1,993

Assumes ISO conditions: 59F, 60% RH, sea level, no losses

Assumes unit is operating at full load prior to shutdown.

Assumes natural gas fuel; ES 9-98 compliant.

Table 2. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
60 Minute Start-up and 30 Minute Shutdown
Natural Gas Fuel

Data will NOT be warranted under any circumstances

	Centaur 40 4701S				Centaur 50 6201S				Taurus 60 7901S				Taurus 65 8401S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	4.1	219.4	13.0	3,420	5.0	272.4	16.1	4,219	5.7	299.8	17.8	4,780	6.1	326.5	19.3	5,074
Total Emissions per Shutdown (lbs)	1.8	121.1	7.1	1,442	2.3	163.3	9.5	1,834	2.5	163.5	9.6	1,994	2.6	177.2	10.4	2,119

	Taurus 70 10801S				Mars 90 13002S				Mars 100 16002S				Titan 130 20501S				Titan 250 30002S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	7.6	410.3	24.2	6,164	10.5	570.8	33.7	8,641	11.3	583.5	34.6	9,691	13.8	740.4	43.8	11,495	14.6	75.5	7.3	16,253
Total Emissions per Shutdown (lbs)	3.3	223.0	13.0	2,588	4.3	277.0	16.2	3,685	4.8	308.1	18.0	4,056	6.0	405.3	23.7	4,826	6.2	52.6	4.1	7,222

Assumes ISO conditions: 59F, 60% RH, sea level, no losses.

Assumes unit is operating at full load prior to shutdown.

Assumes natural gas fuel; ES 9-98 compliant.

Table 3. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications

10 Minute Start-up and 10 Minute Shutdown

Natural Gas Fuel

Data will NOT be warranted under any circumstances

	Centaur 40 4702S				Centaur 50 6102S				Taurus 60 7802S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	0.7	64.4	3.7	392	0.8	69.1	4.0	469	0.7	64.3	3.7	410
Total Emissions per Shutdown (lbs)	0.3	30.2	1.7	181	0.4	35.4	2.0	217	0.4	33.0	1.9	204

	Taurus 70 10302S				Mars 90 13002S CSMD				Mars 100 16002S CSMD				Titan 130 20502S				Titan 250 30002S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	0.8	73.1	4.2	519	1.2	109.3	6.2	805	1.4	123.5	7.1	829	1.9	176.9	10.1	1,161	2.6	26.2	1.7	1,794
Total Emissions per Shutdown (lbs)	1.1	93.4	5.3	575	1.5	132.6	7.6	817	1.7	149.2	8.5	920	2.4	207.6	11.9	1,272	2.9	19.1	1.4	1,918

Assumes ISO conditions: 59F, 60% RH, sea level, no losses.

Assumes unit is operating at full load prior to shutdown.

Assumes natural gas fuel; ES 9-98 compliant.

Table 4. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set
10 Minute Start-up and 10 Minute Shutdown
Liquid Fuel (Diesel #2)

Data will NOT be warranted under any circumstances

	Centaur 40 4701S				Centaur 50 6201S				Taurus 60 7901S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	1.3	44.5	7.4	473	1.7	59.0	9.8	601	1.7	59.8	9.9	636
Total Emissions per Shutdown (lbs)	0.6	17.3	2.8	211	0.7	21.2	3.4	256	0.8	23.5	3.8	286

	Taurus 70 10801S				Mars 100 16002S GSC				Titan 130 20501S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	2.3	78.5	13.0	823	3.4	114.1	18.8	1,239	4.3	147.5	24.4	1,547
Total Emissions per Shutdown (lbs)	2.5	73.6	12.0	889	3.8	111.4	18.1	1,331	4.7	139.1	22.6	1,677

Assumes ISO conditions: 59F, 60% RH, sea level, no losses.

Assumes unit is operating at full load prior to shutdown.

Assumes #2 Diesel fuel; ES 9-98 compliant.

Table 5. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set
60 Minute Start-up and 30 Minute Shutdown
Liquid Fuel (Diesel #2)

Data will NOT be warranted under any circumstances

	Centaur 40 4701S				Centaur 50 6201S				Taurus 60 7901S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	11.7	194.7	30.9	4,255	15.2	271.9	43.3	5,302	14.7	282.6	45.0	5,962
Total Emissions per Shutdown (lbs)	4.4	84.7	13.6	1,816	6.7	164.3	27.0	2,334	6.3	159.0	26.0	2,515

	Taurus 70 10801S				Mars 100 16002S				Titan 130 20501S			
	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)	NOx (lbs)	CO (lbs)	UHC (lbs)	CO2 (lbs)
Total Emissions per Start (lbs)	18.4	360.3	57.4	7,375	29.1	552.0	87.7	11,685	34.4	677.0	108.0	13,731
Total Emissions per Shutdown (lbs)	8.0	207.8	34.1	3,156	12.3	302.6	49.4	4,970	15.0	388.5	63.7	5,876

Assumes ISO conditions: 59F, 60% RH, sea level, no losses.

Assumes unit is operating at full load prior to shutdown.

Assumes #2 Diesel fuel; ES 9-98 compliant.

Attachment L

Affected Sources Data

NATURAL GAS COMPRESSOR/GENERATOR ENGINE DATA SHEET

Source Identification Number[1]		118-EG-01	
Engine Manufacturer and Model		CATERPILLAR G3512B LE	
Manufacturer's Rated bhp/rpm		1,035 BHP @1400 RPM	
Source Status[2]		New Source (NS)	
Date Installed/Modified/Removed[3]		2016	
Engine Manufactured/Reconstruction Date[4]		NA	
Is this a Certified Stationary Spark Ignition Engine according to 40CFR60 Subpart JJJJ? (Yes or No)[5]		TBD	
Engine, Fuel and Combustion Data	Engine Type[6]	LB4S	
	APCD Type[7]	NA	
	Fuel Type[8]	PG	
	H_2S (gr/100 scf)	0.25	
	Operating bhp/rpm	1,035 BHP @1400 RPM	
	BSFC (Btu/bhp-hr)	6,979 @ 100% load	
	Fuel throughput (ft^3/hr)	7,982	
	Fuel throughput ($MMft^3$/yr)	69.9	
	Operation (hrs/yr)	500	
Reference[9]	Potential Emissions[10]	lbs/hr	tons/yr
NSPS JJJJ	NO_X	4.56	1.14
NSPS JJJJ	CO	9.13	2.28
NSPS JJJJ	VOC	2.28	0.57
AP-42 Chapter 3.2	SO_2	<0.01	<0.01
AP-42 Chapter 3.2	PM_{10}	0.08	0.02
AP-42 Chapter 3.2	Formaldehyde	0.43	0.11

Attachment L

Affected Sources Data

1. Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion compressor/generator engine located at the compressor station. Multiple compressor engines should be designated CE-1, CE-2, CE-3 etc. Generator engines should be designated GE-1, GE-2, GE-3 etc. If more than three (3) engines exist, please use additional sheets.

2. Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Removal of Source

3. Enter the date (or anticipated date) of the engine's installation (construction of source), modification or removal.

4. Enter the date that the engine was manufactured, modified or reconstructed.

5. Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart JJJJ. If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance according to 40CFR§60.4243a(2)(i) through (iii), as appropriate.

   Provide a manufacturer's data sheet for all engines being registered.

6. Enter the Engine Type designation(s) using the following codes:

LB2S	Lean Burn Two Stroke	RB4S	Rich Burn Four Stroke
LB4S	Lean Burn Four Stroke		

7. Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

A/F	Air/Fuel Ratio	IR	Ignition Retard
HEIS	High Energy Ignition System	SIPC	Screw-in Precombustion Chambers
PSC	Prestratified Charge	LEC	Low Emission Combustion
NSCR	Rich Burn & Non-Selective Catalytic Reduction	SCR	Lean Burn & Selective Catalytic Reduction

8. Enter the Fuel Type using the following codes:

PQ	Pipeline Quality Natural Gas	RG	Raw Natural Gas

9. Enter the Potential Emissions Data Reference designation using the following codes. Attach all referenced data to this *Compressor/Generator Data Sheet(s)*.

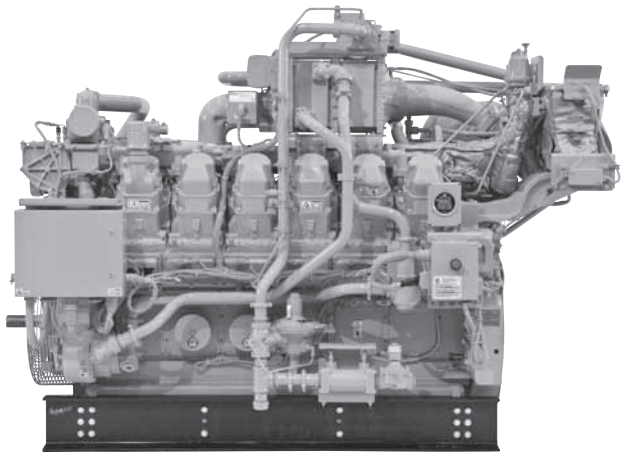
MD	Manufacturer's Data	AP	AP-42	
GR	GRI-HAPCalc™	OT	Other _____	(please list)

10. Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the *Emissions Summary Sheet*.

G3512B LE Gas Petroleum Engine

772 bkW (1035 bhp)
1400 rpm

0.5 g/bhp-hr NOx or 1.0 g/bhp-hr NOx (NTE)



CAT® ENGINE SPECIFICATIONS

V-12, 4-Stroke-Cycle

Bore	170 mm (6.7 in)
Stroke	190 mm (7.5 in)
Displacement	52 L (3173 in^3)
Aspiration	Turbocharged-2 Stage Aftercooled
Digital Engine Management Governor and Protection	Electronic (ADEM™ A3)
Combustion	Low Emissions (Lean Burn)
Engine Weight net dry (approx)	4950 kg (10,913 lb)
Power Density	6.4 kg/kW (10.5 lb/bhp)
Power per Displacement	19.9 bhp/L
Oil Change Interval	1000 hours
Rotation (from flywheel end)	Counterclockwise
Flywheel and Flywheel Housing	SAE No. 00
Flywheel Teeth	183

FEATURES

Engine Design
- Built on G3500 LE proven reliability and durability
- Ability to burn a wide spectrum of gaseous fuels
- Robust diesel strength design prolongs life and lowers owning and operating costs
- Broad operating speed range at lower site air densities (high altitude/hot ambient temperatures)
- Higher power density improves fleet management
- Quality engine diagnostics
- Detonation-sensitivetiming control for individual cylinders

Ultra Lean Burn Technology (ULB)

ULBtechnology uses an advanced control system, a better turbo match, improved air and fuel mixing, and a more sophisticated combustion recipe to provide:
- Lower environmental impact
- Higher return on investment
- Lower operating costs
- Higher work force efficiency

Emissions
- Capableof meeting U.S. EPA Spark Ignited Stationary NSPS emissions for 2010 and some non-attainment areas
- Leanair/fuel mixture provides best available emissions and fuel efficiency for engines of this bore size

Advanced Digital Engine Management

ADEM A3 engine management system integrates speed control, air/fuel ratio control, and ignition/detonation controls into a complete engine management system. ADEM A3 has improved: user interface, display system, shutdown controls, and system diagnostics.

Full Range of Attachments

Large variety of factory-installed engine attachments reduces packaging time.

Testing

Every engine is full-load tested to ensure proper engine performance.

Gas Engine Rating Pro

GERP is a PC-based program designed to provide site performance capabilities for Cat® natural gas engines for the gas compression industry. GERP provides engine data for your site's altitude, ambient temperature, fuel, engine coolant heat rejection, performance data, installation drawings, spec sheets, and pump curves.

Product Support Offered Through Global Cat Dealer Network

More than 2,200 dealer outlets

Cat factory-trained dealer technicians service every aspect of your petroleum engine

Cat parts and labor warranty

Preventive maintenance agreements available for repair-before-failure options

S•O•S℠ program matches your oil and coolant samples against Caterpillar set standards to determine:
- Internal engine component condition
- Presence of unwanted fluids
- Presence of combustion by-products
- Site-specific oil change interval

Over 80 Years of Engine Manufacturing Experience

Over 60 years of natural gas engine production

Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable products
- Castengine blocks, heads, cylinder liners, and flywheel housings
- Machine critical components
- Assemble complete engine

Web Site

For all your petroleum power requirements, visit www.catoilandgas.cat.com.

STANDARD EQUIPMENT

Air Inlet System
Axial flow air cleaner
Cleanable
Single element canister type with service indicator

Control System
ADEM A3 with integrated electronic throttle control
CSA certified

Cooling System
Two-stage charge air cooling
DM8828 and DM8829
First stage — JW + OC + 1AC
Second stage — 2AC
DM9331 and DM9332
First stage — JW + 1AC
Second stage — OC + 2AC
Thermostats and housing
Gear-driven jacket and aftercooler water pump
Stainless steel aftercooler cores

Exhaust System
Dry exhaust manifolds
Exhaust outlet: 200 mm I.D.

Flywheels and Flywheel Housings
SAE No. 00 flywheel
SAE No. 00 flywheel housing
SAE standard rotation

Fuel System
7-50 psi gas supply
Electronic fuel metering valve
Gas pressure regulator, pivot valve operated

Ignition System
ADEM A3
Outdoor CSA certified

Lubrication System
Crankcase breather — top mounted
Oil cooler
Oil filter — RH
Oil pan
Oil sampling valve
Turbo oil accumulator

Power Take-Offs
Front housing — two-sided
Front lower — LH accessory drive

Torsional Vibration Analysis
Provided through Caterpillar

General
Paint — Cat yellow
Crankshaft vibration damper and guard

OPTIONAL EQUIPMENT

Air Inlet System
Round air inlet adaptors

Charging System
Battery chargers
CSA certified version available with
Charging system
CSA alternator (24V, 65A)

Cooling System
Mechanical joint assembly connections

Exhaust System
Flexible fittings
Elbows
Flanges

Fuel System
Gas filter

Instrumentation
Advisor display panel
Communications module

Lubrication System
Lubricating oil
Oil bypass filter
Air prelube pump

Power Take-Offs
Front stub shaft
Pulleys

General
Special paint

EU Certification
EEC DOI certification

Support
Factory commissioning

TECHNICAL DATA

G3512B Gas Petroleum Engine — 1400 rpm

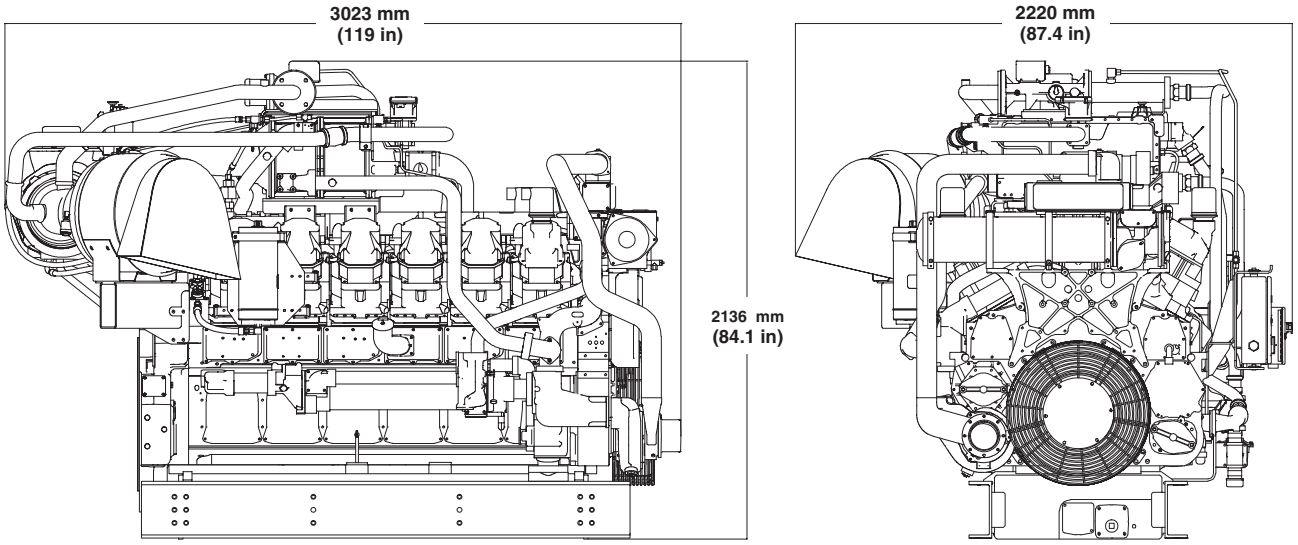
Fuel System	**DM9332-00**	**1.0 g NOx NTE Rating 0.5 g NOx NTE Rating DM8829-01 DM8828-01 DM9331-00**	
Engine Power @ 100% Load bkW	(bhp) 772	(1035) 772	(1035)
Engine Speed rpm		**1400 1400**	
Max Altitude @ Rated Torque and 100°F (38°C) m	(ft) 2133.6	(7000) 1828.8	(6000)
Speed Turndown @ Max Altitude, Rated Torque, and 100°F (38°C) %	31	34	
Aftercooler Temperature			
JW Temp °C	(°F) 95	(203) 95	(203)
SCAC Temp °C	(°F) 54.44	(130) 54.44	(130)
Compression Ratio	8.0:1	8.0:1	
Emissions (NTE)*			
NOx g/bkW-hr	(g/bhp-hr) 1.34	(1) 0.67	(0.5)
CO g/bkW-hr	(g/bhp-hr) 3.49	(2.6) 3.00	(2.24)
CO_2 g/bkW-hr	(g/bhp-hr) 600.78	(448) 611.51	(456)
VOC** g/bkW-hr	(g/bhp-hr) 0.58	(0.43) 0.66	(0.49)
Fuel Consumption***			
@ 100% Load MJ/bkW-hr	(Btu/bhp-hr) 9.87	(6979) 10.24	(7237)
@ 75% Load MJ/bkW-hr	(Btu/bhp-hr) 10.38	(7337) 10.73	(7586)
Cooling Configuration			
DM8829	JW	+ OC + 1AC, 2AC	
DM9332	JW	+ 1AC, OC + 2AC	
DM8828		JW	+ OC + 1AC, 2AC
DM9331			JW + 1AC, OC + 2AC
Heat Balance			
Heat Rejection to Jacket Water			
JW bkW	(Btu/min) 286.7	(16,304) 306.35	(17,422)
OC bkW	(Btu/min) 69.23	(3937) 69.23	(3937)
Heat Rejection to Aftercooler			
1st Stage bkW	(Btu/min) 97.07	(5520) 112.54	(6400)
2nd Stage bkW	(Btu/min) 69.88	(3974) 74.68	(4247)
Heat Rejection to Exhaust @ 100% Load bkW	(Btu/min) 766.85	(43,610) 806.47	(45,863)
Heat Rejection to Atmosphere @ 100% Load bkW	(Btu/min) 82.01	(4664) 82.01	(4664)
Exhaust System			
Exhaust Gas Flow Rate m	^{3}/min (cfm) 181.94	(6425) 190.77	(6737)
Exhaust Stack Temperature @ 100% Load °C	(°F) 526.11	(979) 523.89	(975)
Intake System			
Air Inlet Flow Rate @ 100% Load m	^{3}/min (scfm) 62.89	(2221) 66.18	(2337)
Gas Pressure kPag	(psig) 48-345	(7-50) 48-345	(7-50)

*at 100% load and speed, all values are listed as not to exceed

**Volatile organic compounds as defined in U.S. EPA 40 CFR 60, subpart JJJJ

***ISO 3046/1

G3512B DIMENSIONS



DIMENSIONS		
Length mm	(in) 3023	(119)
Width mm	(in) 2220	(87.4)
Height mm	(in) 2136	(84.1)
Shipping Weight kg	(lb) 4950	(10,913)

Note: General configuration not to be used for installation. See general dimension drawing number 358-6642.

RATING DEFINITIONS AND CONDITIONS

Engine performance is obtained in accordance with SAE J1995, ISO3046/1, BS5514/1, and DIN6271/1 standards.

Transient response data is acquired from an engine/generator combination at normal operating temperature and in accordance with ISO3046/1 standard ambient conditions. Also in accordance with SAE J1995, BS5514/1, and DIN6271/1 standard reference conditions.

Conditions: Power for gas engines is based on fuel having an LHV of 33.74 kJ/L (905 Btu/cu ft) at 101 kPa (29.91 in Hg) and 15°C (59°F). Fuel rate is based on a cubic meter at 100 kPa (29.61 in Hg) and 15.6°C (60.1°F). Air flow is based on a cubic foot at 100 kPa (29.61 in Hg) and 25°C (77°F). Exhaust flow is based on a cubic foot at 100 kPa (29.61 in Hg) and stack temperature.

Performance Numbers: DM8828-01, DM8829-01, DM9331-00, DM9332-00
LEHW0095-01 (9-11)

Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.

Identification Number (as assigned on *Equipment List Form*): **118-WH-02**

1. Name or type and model of proposed affected source:

   Hydronic Heater
   4.60 MMBtu/hr

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

   NA

4. Name(s) and maximum amount of proposed material(s) produced per hour:

   NA

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

   NA

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):

(a) Type and amount in appropriate units of fuel(s) to be burned:

Natural Gas Fuel – As Required

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

NA

(c) Theoretical combustion air requirement (ACF/unit of fuel):

NA @ **NA** °F and **NA** psia.

(d) Percent excess air: **NA**

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

NA

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

NA

(g) Proposed maximum design heat input: **NA** $\times 10^6$ BTU/hr.

7. Projected operating schedule:

Hours/Day	**24**	Days/Week	**7**	Weeks/Year	**52**

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@ **NA** °F and **Ambient** psia

a.	NO_X	**0.11**	lb/hr	**NA**	grains/ACF
b.	SO_2	**<0.01**	lb/hr	**NA**	grains/ACF
c.	CO	**0.25**	lb/hr	**NA**	grains/ACF
d.	$PM/PM_{10}/PM_{2.5}$	**0.05**	lb/hr	**NA**	grains/ACF
e.	Hydrocarbons	**NA**	lb/hr	**NA**	grains/ACF
f.	VOCs	**0.03**	lb/hr	**NA**	grains/ACF
g.	Pb	**NA**	lb/hr	**NA**	grains/ACF
h.	Specify other(s)				
	CO_{2e}	**541**	lb/hr	**NA**	grains/ACF
	Total HAPs	**<0.01**	lb/hr	**NA**	grains/ACF
			lb/hr	**NA**	grains/ACF
			lb/hr	**NA**	grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.

(2) Complete the Emission Points Data Sheet.

9. 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	RECORDKEEPING
See Attachment O	**See Attachment O**
REPORTING	TESTING
See Attachment O	**See Attachment O**

MONITORING. 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.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

NA

PO# 6501955-0-STAT
REFERENCE: AFE 62018 -TGP STATION 315 - ROSE LAKE
ACTIVITY: 620183680999999

ONE (1) PARKER BOILER T4600LR,
DIRECT FIRED HOT WATER GLYCOL BOILER SKID MOUNTED

BOILER MANUFACTURER

PARKER BOILER
5930 BANDINI BLVD
LOS ANGELES, CA 90040
TEL: 323-727-9800
FAX: 323-722-2848
www.parkerboiler.com

KINDER MORGAN, INC
1001 LOUISIANA ST, STE 1000
HOUSTON, TX 77002
TEL: 713-420-6105
CONTACT: BILL THOMAS
bill_a_thomas@kindermorgan.com

PARKER BOILER CO.

MANUFACTURER OF QUALITY INDUSTRIAL BOILERS
WEB SITE: www.parkerboiler.com • E-MAIL: sales@parkerboiler.com

5930 Bandini Blvd
Los Angeles, CA 90040
Ph. (323) 727-9800
Fax. (323) 722-2848

EMISSION DATA FOR METAL FIBER PREMIX NATURAL GAS FIRED BURNER SYSTEMS ON PARKER BOILERS

The following is our approximation of the Emission Levels from our boilers. Emissions may vary, based on Boiler and Field Conditions.

		PPM @ 3%O_2	
1.	HC (Hydrocarbons)	60	= .031 Lbs./ 1.0 Million BTU/HR
2.	CO (Carbon Monoxide)	60	= .0552 Lbs./ 1.0 Million BTU/HR
3.	SO_2 (Sulfur Dioxide)	NIL	= NIL
4.	NOx (Nitrous Oxides)	20	= .024 Lbs./ 1.0 Million BTU/HR
5.	PM-15 (Particulate Matter)		< .01 Lbs./ 1.0 Million BTU/HR

By multiplying these levels by the BTU input in millions, you can calculate the Lbs./Hr. Emissions based on full firing of the subject boiler.

Contact Parker Boiler should you have any questions.

GED/srl
GREG/FORM/EMISSION.doc

Attachment L
EMISSIONS UNIT DATA SHEET
STORAGE TANKS

Provide the following information for each new or modified bulk liquid storage tank as shown on the *Equipment List Form* and other parts of this application. A tank is considered modified if the material to be stored in the tank is different from the existing stored liquid.

IF USING US EPA'S TANKS EMISSION ESTIMATION PROGRAM (AVAILABLE AT **www.epa.gov/tnn/tanks.html**), APPLICANT MAY ATTACH THE SUMMARY SHEETS IN LIEU OF COMPLETING SECTIONS III, IV, & V OF THIS FORM. HOWEVER, SECTIONS I, II, AND VI OF THIS FORM MUST BE COMPLETED. US EPA'S AP-42, SECTION 7.1, "ORGANIC LIQUID STORAGE TANKS," MAY ALSO BE USED TO ESTIMATE VOC AND HAP EMISSIONS (**http://www.epa.gov/tnn/chief/**).

I. GENERAL INFORMATION (required)

1. Bulk Storage Area Name Storage Tank Area	2. Tank Name Pipeline Liquids Storage Tank
3. Tank Equipment Identification No. (as assigned on *Equipment List Form*) 118-PF-04	4. Emission Point Identification No. (as assigned on *Equipment List Form*) 118-PF-04
5. Date of Commencement of Construction (for existing tanks) NA	
6. Type of change ☒ New Construction ☐ New Stored Material ☐ Other Tank Modification	
7. Description of Tank Modification (if applicable) NA	
7A. Does the tank have more than one mode of operation? (e.g. Is there more than one product stored in the tank?) ☐ Yes ☒ No	
7B. If YES, explain and identify which mode is covered by this application (Note: A separate form must be completed for each mode).	
7C. Provide any limitations on source operation affecting emissions, any work practice standards (e.g. production variation, etc.): NA	

II. TANK INFORMATION (required)

8. Design Capacity (specify barrels or gallons). Use the internal cross-sectional area multiplied by internal height. 3,760 gallons	
9A. Tank Internal Diameter (ft) 8	9B. Tank Internal Height (or Length) (ft) 10
10A. Maximum Liquid Height (ft) 10	10B. Average Liquid Height (ft) 8
11A. Maximum Vapor Space Height (ft) 8	11B. Average Vapor Space Height (ft) 6
12. Nominal Capacity (specify barrels or gallons). This is also known as "working volume" and considers design liquid levels and overflow valve heights. 3,760 gallons	

13A. Maximum annual throughput (gal/yr)	13B. Maximum daily throughput (gal/day)
7,520	10

14. Number of Turnovers per year (annual net throughput/maximum tank liquid volume): 2

15. Maximum tank fill rate (gal/min): 90 (assumed)

16. Tank fill method: ☐ Submerged ☐ Splash ☒ Bottom Loading

17. Complete 17A and 17B for Variable Vapor Space Tank Systems ☒ Does Not Apply

17A. Volume Expansion Capacity of System (gal)	17B. Number of transfers into system per year

18. Type of tank (check all that apply):
- ☒ Fixed Roof X vertical ___ horizontal ___ flat roof X cone roof ___ dome roof ___ other (describe)
- ☐ External Floating Roof ___ pontoon roof ___ double deck roof
- ☐ Domed External (or Covered) Floating Roof
- ☐ Internal Floating Roof ___ vertical column support ___ self-supporting
- ☐ Variable Vapor Space ___ lifter roof ___ diaphragm
- ☐ Pressurized ___ spherical ___ cylindrical
- ☐ Underground
- ☐ Other (describe)

III. TANK CONSTRUCTION & OPERATION INFORMATION (optional if providing TANKS Summary Sheets)

19. Tank Shell Construction:
☐ Riveted ☐ Gunite lined ☐ Epoxy-coated rivets ☒ Other (describe) TBD

20A. Shell Color grey/light	20B. Roof Color grey/light	20C. Year Last Painted NA

21. Shell Condition (if metal and unlined):
☒ No Rust ☐ Light Rust ☐ Dense Rust ☐ Not applicable

22A. Is the tank heated? ☐ YES ☒ NO

22B. If YES, provide the operating temperature (°F)

22C. If YES, please describe how heat is provided to tank.

23. Operating Pressure Range (psig): Atmospheric to

24. Complete the following section for **Vertical Fixed Roof Tanks** ☐ Does Not Apply

24A. For dome roof, provide roof radius (ft)

24B. For cone roof, provide slope (ft/ft) 0.0625

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

25A. Year Internal Floaters Installed:

25B. Primary Seal Type: (check one) ☐ Metallic (Mechanical) Shoe Seal ☐ Liquid Mounted Resilient Seal ☐ Vapor Mounted Resilient Seal ☐ Other (describe):

25C. Is the Floating Roof equipped with a Secondary Seal? ☐ YES ☐ NO

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

25E. Is the Floating Roof equipped with a weather shield? ☐ YES ☐ NO

25F. Describe deck fittings; indicate the number of each type of fitting:

ACCESS HATCH		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:

AUTOMATIC GAUGE FLOAT WELL		
BOLT COVER, GASKETED:	UNBOLTED COVER, GASKETED:	UNBOLTED COVER, UNGASKETED:

COLUMN WELL		
BUILT-UP COLUMN – SLIDING COVER, GASKETED:	BUILT-UP COLUMN – SLIDING COVER, UNGASKETED:	PIPE COLUMN – FLEXIBLE FABRIC SLEEVE SEAL:

LADDER WELL	
PIP COLUMN – SLIDING COVER, GASKETED:	PIPE COLUMN – SLIDING COVER, UNGASKETED:

GAUGE-HATCH/SAMPLE PORT	
SLIDING COVER, GASKETED:	SLIDING COVER, UNGASKETED:

ROOF LEG OR HANGER WELL		
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:	SAMPLE WELL-SLIT FABRIC SEAL (10% OPEN AREA)

VACUUM BREAKER	
WEIGHTED MECHANICAL ACTUATION, GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:

RIM VENT	
WEIGHTED MECHANICAL ACTUATION GASKETED:	WEIGHTED MECHANICAL ACTUATION, UNGASKETED:

DECK DRAIN (3-INCH DIAMETER)	
OPEN:	90% CLOSED:

STUB DRAIN
1-INCH DIAMETER:

OTHER (DESCRIBE, ATTACH ADDITIONAL PAGES IF NECESSARY)

26. Complete the following section for Internal Floating Roof Tanks ☒ Does Not Apply		
26A. Deck Type: ☐ Bolted ☐ Welded		
26B. For Bolted decks, provide deck construction:		
26C. Deck seam: ☐ Continuous sheet construction 5 feet wide ☐ Continuous sheet construction 6 feet wide ☐ Continuous sheet construction 7 feet wide ☐ Continuous sheet construction 5 × 7.5 feet wide ☐ Continuous sheet construction 5 × 12 feet wide ☐ Other (describe)		
26D. Deck seam length (ft)	26E. Area of deck (ft^2)	
For column supported tanks: 26F. Number of columns:	26G. Diameter of each column:	

IV. SITE INFORMANTION (optional if providing TANKS Summary Sheets)

27. Provide the city and state on which the data in this section are based. See attached summary sheets
28. Daily Average Ambient Temperature (°F)
29. Annual Average Maximum Temperature (°F)
30. Annual Average Minimum Temperature (°F)
31. Average Wind Speed (miles/hr)
32. Annual Average Solar Insulation Factor (BTU/(ft^2·day))
33. Atmospheric Pressure (psia)

V. LIQUID INFORMATION (optional if providing TANKS Summary Sheets)

34. Average daily temperature range of bulk liquid: See attached summary sheets			
34A. Minimum (°F)		34B. Maximum (°F)	
35. Average operating pressure range of tank:			
35A. Minimum (psig)		35B. Maximum (psig)	
36A. Minimum Liquid Surface Temperature (°F)		36B. Corresponding Vapor Pressure (psia)	
37A. Average Liquid Surface Temperature (°F)		37B. Corresponding Vapor Pressure (psia)	
38A. Maximum Liquid Surface Temperature (°F)		38B. Corresponding Vapor Pressure (psia)	
39. Provide the following for <u>each</u> liquid or gas to be stored in tank. Add additional pages if necessary.			
39A. Material Name or Composition	Pipeline Liquids		
39B. CAS Number			
39C. Liquid Density (lb/gal)			
39D. Liquid Molecular Weight (lb/lb-mole)			
39E. Vapor Molecular Weight (lb/lb-mole)			

Maximum Vapor Pressure 39F. True (psia) 39G. Reid (psia)			
Months Storage per Year 39H. From 39I. To			

VI. EMISSIONS AND CONTROL DEVICE DATA (required)

40. Emission Control Devices (check as many as apply): ☒ Does Not Apply

- ☐ Carbon Adsorption[1]
- ☐ Condenser[1]
- ☐ Conservation Vent (psig)
  - Vacuum Setting Pressure Setting
- ☐ Emergency Relief Valve (psig)
- ☐ Inert Gas Blanket of
- ☐ Insulation of Tank with
- ☐ Liquid Absorption (scrubber)[1]
- ☐ Refrigeration of Tank
- ☐ Rupture Disc (psig)
- ☐ Vent to Incinerator[1]
- ☐ Other[1] (describe):

[1] Complete appropriate Air Pollution Control Device Sheet.

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

Material Name & CAS No.	Breathing Loss (lb/hr)	Working Loss Amount	Working Loss Units	Annual Loss (lb/yr)	Estimation Method[1]
Pipeline Liquids	See attached summary sheets				

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

☒ Remember to attach emissions calculations, including TANKS Summary Sheets if applicable.

Attachment L
EMISSIONS UNIT DATA SHEET
BULK LIQUID TRANSFER OPERATIONS

Furnish the following information for each new or modified bulk liquid transfer area or loading rack, as shown on the *Equipment List Form* and other parts of this application. This form is to be used for bulk liquid transfer operations such as to and from drums, marine vessels, rail tank cars, and tank trucks.

Identification Number (as assigned on *Equipment List Form*): **118-LR-05**

1. Loading Area Name: **Tank Truck Loading Area**

2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply):
☐ Drums ☐ Marine Vessels ☐ Rail Tank Car ☒ Tank Trucks

3. Loading Rack or Transfer Point Data:

Number of pumps	**1**
Number of liquids loaded	**1**
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	**1**

4. Does ballasting of marine vessels occur at this loading area?
☐ Yes ☐ No ☒ Does not apply

5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point:
NA

6. Are cargo vessels pressure tested for leaks at this or any other location?
☐ Yes ☒ No
If YES, describe:

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

Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day	**As Needed**			
days/week	**As Needed**			
weeks/quarter	**As Needed**			

8. Bulk Liquid Data *(add pages as necessary):*		
Pump ID No.		**NA**
Liquid Name		**Wastewater**
Max. daily throughput (1000 gal/day)		**7.52**
Max. annual throughput (1000 gal/yr)		**7.52**
Loading Method [1]		**SUB**
Max. Fill Rate (gal/min)		**90**
Average Fill Time (min/loading)		**60**
Max. Bulk Liquid Temperature (^{o}F)		**60 ^{o}F**
True Vapor Pressure [2]		**7.70**
Cargo Vessel Condition [3]		**U**
Control Equipment or Method [4]		**NA**
Minimum control efficiency (%)		**NA**
Maximum Emission Rate	Loading (lb/hr)	**VOC – 21.23** **Total HAP – 0.84**
	Annual (lb/yr)	**VOC – 29.57** **Total HAP – 1.17**
Estimation Method [5]		**EPA AP-42**

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

[2] At maximum bulk liquid temperature

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

[4] List as many as apply (complete and submit appropriate *Air Pollution Control Device Sheets*):
CA = Carbon Adsorption LOA = Lean Oil Adsorption CO = Condensation
SC = Scrubber (Absorption) CRA = Compressor-Refrigeration-Absorption
TO = Thermal Oxidation or Incineration CRC = Compression-Refrigeration-Condensation
VB = Dedicated Vapor Balance (closed system) O = other (descibe)

[5] EPA = EPA Emission Factor as stated in AP-42
MB = Material Balance
TM = Test Measurement based upon test data submittal
O = other (describe)

9. **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	RECORDKEEPING
TGP will comply with all monitoring requirements set forth in the permit that is issued.	**TGP will comply with all recordkeeping requirements set forth in the permit that is issued.**
REPORTING	TESTING
TGP will comply with all reporting requirements set forth in the permit that is issued.	**TGP will comply with all testing requirements set forth in the permit that is issued.**

MONITORING. 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.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

NA

Attachment M

Attachment M
Air Pollution Control Devices

There are no proposed air pollution control devices at Station 118A. The combustion turbine will utilize Solar Turbines' *SoLoNO$_X$* technology, as described in the emissions calculation methodology included in this application, as well as in the Solar Turbines manufacturer data included in Attachment L. This technology is part of the unit design.

Attachment N

Table N-1 Equipment List

Emission Point ID	Source	Manufacturer	Model/Type	Rated Capacity [1]	Heat Input (MMBTU/Hr)
118-CT-01	Compressor Turbine	Solar Turbines	Taurus 70-10802S	11,523 hp	92.9
118-EG-03	Emergency Generator	Caterpillar	G 3512B LE	1,035 hp	8.14
118-WH-02	Hydronic Heater	Parker Boiler	T-4600LR	-	4.60
FUG	Fugitive Emissions	-	-	-	-
V/BD	Venting/Blowdown Emissions	-	-	-	-
118-PF-04	Pipeline Liquids Storage Tank	-	-	3,760 gal	-
118-LR-05	Pipeline Liquids Truck Loading	-	-	-	-

1. The rated hp capacity for the compressor turbine is based on 100% load operation at -10°F.

Table N-2 Summary of Potential Emissions

Emission Point ID	Source Description	CO		NO_X		PM		$PM_{2.5}$		PM_{10}		SO_2		VOC		Total HAP		CO_2e	
		lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
118-CT-01	Compressor Turbine	5.16	34.4	8.48	35.1	0.61	2.49	0.61	2.49	0.61	2.49	0.31	1.28	0.59	2.59	0.09	0.41	10,796	44,437
118-EG-03	Emergency Generator	9.13	2.28	4.56	1.14	0.08	0.02	0.08	0.02	0.08	0.02	<0.01	<0.01	2.28	0.57	0.59	0.15	1,207	302
118-WH-02	Hydronic Heater	0.25	1.11	0.11	0.48	0.05	0.20	0.05	0.20	0.05	0.20	<0.01	0.01	0.03	0.12	<0.01	0.04	541	2,371
FUG	Fugitive Emissions	-	-	-	-	-	-	-	-	-	-	-	-	0.55	2.41	0.09	0.41	277	1,214
V/BD	Venting/Blowdown Emissions	-	-	-	-	-	-	-	-	-	-	-	-	0.03	0.13	<0.01	<0.01	361	1,580
118-PF-04	Pipeline Liquids Storage Tank	-	-	-	-	-	-	-	-	-	-	-	-	0.05	0.20	<0.01	0.01	Neg.	Neg.
118-LR-05	Pipeline Liquids Truck Loading	-	-	-	-	-	-	-	-	-	-	-	-	21.2	0.01	0.84	<0.01	Neg.	Neg.
Facility-Wide:		**14.5**	**37.7**	**13.2**	**36.7**	**0.7**	**2.7**	**0.7**	**2.7**	**0.7**	**2.7**	**0.3**	**1.3**	**24.8**	**6.0**	**1.6**	**1.0**	**13,183**	**49,903**

Solar Turbines Taurus 70-10802S Compressor Turbine (118-CT-01)
Potential to Emit Calculations

Source Designation:	118-CT-01
Manufacturer:	Solar Turbines
Model:	Taurus 70-10802S
Fuel Used:	Natural Gas
Control Device:	N/A
Emission Point Name:	118-CT-01

	Ambient Temperature (^{o}F): -10	Ambient Temperature (^{o}F): 0	Ambient Temperature (^{o}F): 50
Power (hp):	11,523	11,499	10,966
Lower Heating Value (LHV) (Btu/scf):	942	942	942
Lower Heating Value (LHV) (Btu/lbm):	21,254	21,254	21,254
Maximum Higher Heating Value (HHV) (Btu/scf):	1,020	1,020	1,020
Fuel Flow (lbm/hr):	4,039	3,987	3,735
Fuel Flow (scfm):	1,519	1,499	1,404
Fuel Flow (scf/hr):	91,111	89,938	84,251
Heat Input (LHV) (MMBtu/hr):	85.8	84.7	79.4
Heat Input (HHV) (MMBtu/hr):	92.9	91.7	85.9

Performance data for -10°F, 0 °F, and 50 °F based on Solar Turbines Emission and Performance Data Estimates for Titan 130-20502S (6 Jan 2015).

Operational Parameters:

Total Annual Hours of Operation (hr/yr):	8,760
Annual Hours of Operation at 50 ^{o}F (hr/yr):	8,660
Annual Hours of Operation at -10 ^{o}F (hr/yr):	100
Ratio HHV:LHV	1.08
Number of Identical Units:	1

Start-up and Shutdown Emissions:

Annual Number of Start-ups:	150
Annual Number of Shutdowns:	150

Pollutant	Start-up Emissions			Shutdown Emissions			
	lb/event	lb/hr	tpy	lb/event	lb/hr	tpy	Reference
CO	73.10	1.25	5.48	93.40	1.60	7.01	1
NO_x	0.80	0.01	0.06	1.10	0.02	0.08	1
VOC	0.84	0.01	0.06	1.06	0.02	0.08	1, 2
CO_2	519.00	8.89	38.93	575.00	9.85	43.13	1
CH_4	3.36	0.06	0.25	4.24	0.07	0.32	1, 2
Total GHG		8.94	39.18		9.92	43.44	1
Total CO_2e		10.33	45.23		11.66	51.08	1

1. Start-up and Shutdown Emissions based on Solar Turbines Incorporated Product Information Letter 170: Emission Estimates at Start-up, Shutdown, and Commissioning for SoLoNO$_x$ Combustion Products (13 June 2012). Emission estimates provided do not include SO_2, PM, N_2O, or any HAPs.
2. VOCs assumed to be 20% of UHC and CH_4 assumed to be 80% of UHC.

Solar Turbines Taurus 70-10802S Compressor Turbine (118-CT-01) (Continued)

Criteria Pollutant & Greenhouse Gas Emission Factors During Operation at Subzero and Normal Operating Temperatures:

Pollutant	Emission Factors at Various Ambient Temperatures					
	Value, -10°F	Value, 0°F	Value, 50°F	Units	LHV/HHV	Reference
CO	20.80	5.16	4.81	lb/hr	NA	1
NO_X	14.40	8.48	7.91	lb/hr	NA	1
SO_2	3.40E-03	3.40E-03	3.40E-03	lb/MMBtu	HHV	2
VOC	1.18	0.59	0.55	lb/hr	NA	1
PM (Filterable + Condensable)	6.60E-03	6.60E-03	6.60E-03	lb/MMBtu	HHV	2
PM_{10} (Filterable + Condensable)	6.60E-03	6.60E-03	6.60E-03	lb/MMBtu	HHV	2
$PM_{2.5}$ (Filterable + Condensable)	6.60E-03	6.60E-03	6.60E-03	lb/MMBtu	HHV	2
CO_2	53.06	53.06	53.06	kg/MMBtu	HHV	3
CH_4	4.72	2.37	2.21	lb/hr	NA	1
N_2O	1.00E-04	1.00E-04	1.00E-04	kg/MMBtu	HHV	4

References

1. Emission factors taken from Solar Turbines performance data for the Titan 130-20502S at ambient temperatures of -10°F, 0°F, and 50°F (6 Jan 2015). VOCs assumed to be 20% of UHC and CH_4 assumed to be 80% of UHC.
2. AP-42, 5th ed., Section 3.1: Stationary Gas Turbines, Table 3.1-2a: Emission Factors for Criteria Pollutants and Greenhouse Gases from Stationary Gas Turbines (April 2000). Conservatively assumes PM (Filterable + Condensable) = PM10 = PM2.5
3. 40 CFR Part 98 Subpart C, Table C-1: Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel, for natural gas.
4. 40 CFR Part 98 Subpart C, Table C-2: Default CH_4 and N_2O Emission Factors and High Heat Values for Various Types of Fuel, for natural gas.

Normal Operation Criteria Pollutant & Greenhouse Gas Potential Emissions Calculations:

Pollutant	Potential Emissions - Normal Operation (Excluding SU/SD)				
	lb/hr, 0°F	lb/hr, 50°F	Reference	tpy	Reference
CO	5.16	4.81	1	20.83	6
NO_X	8.48	7.91	1	34.25	6
SO_2	0.31	0.29	2	1.27	6
VOC	0.59	0.55	1	2.39	6
PM (Filterable + Condensable)	0.61	0.57	2	2.46	6
PM_{10} (Filterable + Condensable)	0.61	0.57	2	2.46	6
$PM_{2.5}$ (Filterable + Condensable)	0.61	0.57	2	2.46	6
Total CO_2e	10,796	10,113	3	43,791	6
Total GHG	10,734	10,055	4	43,538	6
CO_2	10,731	10,053	5	43,528	6
CH_4	2.37	2.21	1	9.56	6
N_2O	0.02	0.02	5	0.08	6

References/Sample Calculations:

1. See emission factor table above.
2. Potential Emissions (lb/hr) Excluding SU/SD at Each Ambient Temperature (°F) = Emission $Factor_{HHV}$ (lb/MMBtu) at (°F) * Heat $Input_{HHV}$ (MMBtu/hr) at (°F). *Sample calculation:*
   *0.31 (lb SO2/hr) = 3.4E-03 (lb SO2/MMBtu) * 91.7 (MMBtu/hr)*
3. Total CO_2e (lb/hr) Excluding SU/SD at Each Ambient Temperature (°F) = CO_2 Emissions (lb/hr) at (°F) + [CH_4 Emissions (lb/hr) at (°F) * Global Warming Potential] + [N_2O Emissions (lb/hr) at (°F) * Global Warming Potential]. *Sample calculation*:
   *10,796 (lb CO2e/hr) = 10,731 (lb CO2/hr) + [2.37 (lb CH4/hr) * 25] + [0.02 (lb N2O/hr) * 298]*
4. Total GHG (lb/hr) Excluding SU/SD at Each Ambient Temperature (°F) = CO_2 Emissions (lb/hr) at (°F) + CH_4 Emissions (lb/hr) at (°F) + N_2O Emissions (lb/hr) at (°F). *Sample calculation*:
   10,734 (lb GHG/hr) = 10,731 (lb CO2/hr) + 2.37 (lb CH4/hr) + 0.02 (lb N2O/hr)
5. Potential Emissions (lb/hr) Excluding SU/SD at Each Ambient Temperature (°F) = Emission $Factor_{HHV}$ (kg/MMBtu) at (°F) * 2.204628 (lb/kg) * Heat $Input_{HHV}$ (MMBtu/hr) at (°F). *Sample calculation:*
   *0.02 (lb N2O/hr) = 1.E-04 (kg N2O/MMBtu) * 2.204628 (lb/kg) * 91.7 (MMBtu/hr)*
6. Annual (tpy) emissions during normal operation of each pollutant, excluding SU/SD emissions, are based on 8,660 hours per year of operation at 50°F ambient temperature. The average annual ambient temperature of the compressor station location is between 50°F and 59°F, and as emissions are expected to decrease as ambient temperature increases, potential annual emissions for the majority of each operating year (8,660 hours) were based a conservative ambient operating temperature of 50°F. Potential Emissions (tpy) at Normal Operation Excluding SU/SD at Each Ambient Temperature (°F) = Potential Emissions (lb/hr) at (50°F) * Operating Hours Assumed Per Year at 50°F / 2,000 (lb/ton). *Sample calculation:*

   *20.83 (tons CO/yr) = 4.81 (lb CO/hr) * 8,660 (hr/yr) / 2,000 (lb/ton)*

Solar Turbines Taurus 70-10802S Compressor Turbine (118-CT-01) (Continued)

Sub-Zero Operation Criteria Pollutant & Greenhouse Gas Potential Emissions Calculations:

Pollutant	Potential Emissions - Subzero Operation (Excluding SU/SD)			
	lb/hr (-10°F)	Reference	tpy (-10°F)	Reference
CO	20.80	1	1.04	6
NO_X	14.40	1	0.72	6
SO_2	0.32	2	0.02	6
VOC	1.18	1	0.06	6
PM (Filterable + Condensable)	0.61	2	0.03	6
PM_{10} (Filterable + Condensable)	0.61	2	0.03	6
$PM_{2.5}$ (Filterable + Condensable)	0.61	2	0.03	6
Total CO_2e	10,995	3	549.8	6
Total GHG	10,876	4	543.8	6
CO_2	10871	5	543.6	6
CH_4	4.72	1	0.24	6
N_2O	0.02	5	0.00	6

References/Sample Calculations:

1. See emission factor table above.
2. Potential Emissions (lb/hr) Excluding SU/SD at -10°F = Emission $Factor_{HHV}$ (lb/MMBtu) at (-10°F) * Heat $Input_{HHV}$ (MMBtu/hr) at (-10°F). *Sample calculation:*
   *0.32 (lb SO2/hr) = 3.4E-03 (lb SO2/MMBtu) * 92.9 (MMBtu/hr)*
3. Total CO_2e (lb/hr) Excluding SU/SD at -10°F = CO_2 Emissions (lb/hr) at (-10°F) + [CH_4 Emissions (lb/hr) at (-10°F) * Global Warming Potential] + [N_2O Emissions (lb/hr) at (-10°F) * Global Warming Potential]. *Sample calculation*:
   *10,995 (lb CO2e/hr) = 10,871 (lb CO2/hr) + [4.72 (lb CH4/hr) * 25] + [0.02 (lb N2O/hr) * 298]*
4. Total GHG (lb/hr) Excluding SU/SD at -10°F = CO_2 Emissions (lb/hr) at (-10°F) + CH_4 Emissions (lb/hr) at (-10°F) + N_2O Emissions (lb/hr) at (-10°F). *Sample calculation*:
   10,876 (lb GHG/hr) = 10,871 (lb CO2/hr) + 4.72 (lb CH4/hr) + 0.02 (lb N2O/hr)
5. Potential Emissions (lb/hr) Excluding SU/SD at -10°F = Emission $Factor_{HHV}$ (kg/MMBtu) at (-10°F) * 2.204628 (lb/kg) * Heat $Input_{HHV}$ (MMBtu/hr) at (-10°F). *Sample calculation:*
   *0.02 (lb N2O/hr) = 2.02E-02 (kg N2O/MMBtu) * 2.204628 (lb/kg) * 92.9 (MMBtu/hr)*
6. Annual (tpy) emissions at sub-zero operation of each pollutant, excluding SU/SD emissions, assume 100 hours per year of operation at -10°F ambient temperature.
   Potential Emissions (tpy) at Sub-Zero Operation Excluding SU/SD at (-10°F) = Potential Emissions (lb/hr) at (-10°F) * Operating Hours Assumed Per Year at -10°F / 2,000 (lb/ton). *Sample calculation:*

   *1.04 (tons CO/yr) = 20.8 (lb CO/hr) * 100 (hr/yr) / 2,000 (lb/ton)*

Solar Turbines Taurus 70-10802S Compressor Turbine (118-CT-01) (Continued)

Potential Criteria Pollutant & Greenhouse Gas Potential Emissions Including Normal and Sub-Zero Operation:

Pollutant	Potential Emissions (Excluding SU/SD)		Potential Emissions (Including SU/SD)	
	tpy	Reference	tpy	Reference
CO	21.87	1	34.35	2
NO_X	34.97	1	35.11	2
SO_2	1.28	1	1.28	2
VOC	2.45	1	2.59	2
PM (Filterable + Condensable)	2.49	1	2.49	2
PM10 (Filterable + Condensable)	2.49	1	2.49	2
PM2.5 (Filterable + Condensable)	2.49	1	2.49	2
Total CO_2e	44,341	1	44,437	2
Total GHG	44,081	1	44,170	2
CO_2	44,071	1	44,154	2
CH_4	9.80	1	10.37	2
N_2O	0.08	1	0.08	2

References/Sample Calculations:

1. Total Potential Emissions (tpy), excluding SU/SD, of each pollutant assume 100 hours per year of operation at -10°F and 8,660 hours of operation at 50°F.
   Total Potential Emissions (tpy), excluding SU/SD = Potential Emissions (tpy) (-10°F) + Potential Emissions (tpy) (50°F). *Sample calculation:*
   21.87 (tons CO/yr Total) = 1.04 (tons CO/yr @ -10F) + 20.83 (tons CO/yr @ 50F)
2. Total Potential Emissions (tpy), including SU/SD, of each pollutant assume 100 hours per year of operation at -10°F and 8,660 hours of operation at 50.0°F.
   Total Potential Emissions (tpy), including SU/SD = Potential Emissions (tpy) (-10°F) + Potential Emissions (tpy) (50°F) + Start-up Emissions + Shutdown Emissions. *Sample calculation:*
   34.35 (tons CO/yr Total) = 1.04 (tons CO/yr @ -10F) + 20.83 (tons CO/yr @ 50F) + 5.48 (tons CO/yr for Start-Ups) + 7.01 (tons CO/yr for Shutdowns)

Normal Operation Hazardous Air Pollutant Emission Factors and Potential Emission Calculations:

HAP	Emission Factor (HHV)			Potential Emissions		
	Value	Units	Reference	lb/hr	tpy	Reference
1,3-Butadiene	4.30E-07	lb/MMBtu	1	3.94E-05	1.73E-04	2, 3
Acetaldehyde	4.00E-05	lb/MMBtu	1	3.67E-03	1.61E-02	2, 3
Acrolein	6.40E-06	lb/MMBtu	1	5.87E-04	2.57E-03	2, 3
Benzene	1.20E-05	lb/MMBtu	1	1.10E-03	4.82E-03	2, 3
Ethylbenzene	3.20E-05	lb/MMBtu	1	2.94E-03	1.29E-02	2, 3
Formaldehyde	7.10E-04	lb/MMBtu	1	6.51E-02	2.85E-01	2, 3
Naphthalene	1.30E-06	lb/MMBtu	1	1.19E-04	5.22E-04	2, 3
PAH	2.20E-06	lb/MMBtu	1	2.02E-04	8.84E-04	2, 3
Propylene Oxide	2.90E-05	lb/MMBtu	1	2.66E-03	1.17E-02	2, 3
Toluene	1.30E-04	lb/MMBtu	1	1.19E-02	5.22E-02	2, 3
Xylene	6.40E-05	lb/MMBtu	1	5.87E-03	2.57E-02	2, 3
			Total HAP	**0.09**	**0.41**	

References/Sample Calculations:

1. AP-42, 5th ed., Section 3.1: Stationary Gas Turbines, Table 3.1-3: Emission Factors for Hazardous Air Pollutants from Natural Gas-Fired Stationary Gas Turbines (April 2000).
2. Potential Emissions (lb/hr) = Emission Factor (lb/MMBtu) * Heat $Input_{HHV}$ at 0°F (MMBtu/hr). *Sample calculation:*
   *5.87E-04 (lb Acrolein/hr) = 6.4E-06 (lb Acrolein/MMBtu) * 91.7 (MMBtu/hr)*
3. Potential Emissions (tons/yr) = $(lb/hr)_{Potential}$ × (Annual Hours of Operation) × (1 ton/2,000 lb). *Sample calculation:*
   *2.57E-03 (tons Acrolein/yr) = 5.87E-04 (lb Acrolein/hr) * 8,760 (hr/yr) * 1 ton/2,000 lb*

Caterpillar G 3512B LE Emergency Generator (118-EG-03)
Potential to Emit Calculations

Source Designation:	118-EG-03
Manufacturer:	Caterpillar
Model:	G 3512B LE
Stroke Cycle:	4
Type of Burn:	Lean
Fuel Used:	Natural Gas
Lower Heating Value (LHV) (Btu/scf):	905
Higher Heating Value (HHV) (Btu/scf):	1,020
Ratio HHV:LHV	1.13
Engine Rating (bhp):	1,035
Fuel Flow (scfm):	133
Heat Input at 100% Load (MMBtu/hr) (LHV):	7.22
Heat Input at 100% Load (MMBtu/hr) (HHV):	8.14
Fuel Consumption (Btu/bhp-hr) (100% Load)	6,979
Control Device:	N/A

Operational Parameters:

Annual Hours of Operation (hr/yr):	500
Number of Identical Units	1

Emission Factors:

Pollutant	Emission Factor Basis			
	Value	Units	LHV/HHV	Reference
CO	4.00	g/bhp-hr	HHV (Assumed)	1
NO_x	2.00	g/bhp-hr	HHV (Assumed)	1
SO_2	5.88E-04	lb/MMBtu	HHV	2
VOC	1.00	g/bhp-hr	HHV (Assumed)	1
PM (Filterable + Condensable)	9.98E-03	lb/MMBtu	HHV	2, 3
PM_{10} (Filterable + Condensable)	9.98E-03	lb/MMBtu	HHV	2, 3
$PM_{2.5}$ (Filterable + Condensable)	9.98E-03	lb/MMBtu	HHV	2, 3
CO_2	53.1	kg/MMBtu	HHV	4
CH_4	1.25	lb/MMBtu	HHV	2
N_2O	1.00E-04	kg/MMBtu	HHV (Assumed)	5

References

1. NOx, CO, and VOC emissions are based on 40 CFR 60 Subpart JJJJ emission limits, Table 1.
2. AP-42, 5th ed., Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2: Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines (July 2000).
3. Conservatively assumes PM (Filterable + Condensable) = PM10 = PM2.5
4. 40 CFR Part 98 Subpart C, Table C-1: Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel, for natural gas.
5. 40 CFR Part 98 Subpart C, Table C-2: Default CH_4 and N_2O Emission Factors and High Heat Values for Various Types of Fuel, for natural gas.

Criteria Pollutant & Greenhouse Gas Emissions Calculations:

Pollutant	Emission Factor (HHV)		Potential Emissions	
	lb/MMBtu	Reference	lb/hr	tpy
CO	1.12	1	9.13	2.28
NO_x	0.56	1	4.56	1.14
SO_2	5.88E-04	-	4.79E-03	1.20E-03
VOC	0.28	1	2.28	0.57
PM (Filterable + Condensable)	9.98E-03	-	0.08	0.02
PM_{10} (Filterable + Condensable)	9.98E-03	-	0.08	0.02
$PM_{2.5}$ (Filterable + Condensable)	9.98E-03	-	0.08	0.02
Total CO_2e			1,207	302
Total GHG			963	241
CO_2	117	2	952	238
CH_4	1.25	-	10.2	2.54
N_2O	2.20E-04	2	1.79E-03	4.49E-04

Caterpillar G 3512B LE Emergency Generator (118-EG-03) (Continued)

References:

1. Converted emission factors from g/bhp-hr to lb/MMBtu to calculate all emissions on a consistent basis.
   EF (lb/MMBtu) = EF (g/bhp-hr) * (1 lb/453.592g) * Engine Rating (hp) / Heat Input (MMBtu/hr)
   *1.12 (lb CO/MMBtu) = 4 (g CO/bhp-hr) / 453.592 (g/lb) * 1,035 (bhp) / 8.14 (MMBtu/hr)*
2. Converted emission factors from kg/MMBtu to lb/MMBtu to calculate all emissions on a consistent basis.
   EF (lb/MMBtu) = EF (kg/MMBtu) * (2.20462 lb/kg)
   *2.2E-04 (lb N2O/MMBtu) = 1.E-04 (kg N2O/MMBtu) * 2.20462 (lb/kg)*

Sample Calculations:

Potential Emissions (lb/hr) = Emission Factor (lb/MMBtu) * Heat $Input_{HHV}$ (MMBtu/hr)
*0.08 (lb PM/hr) = 9.98E-03 (lb PM/MMBtu) * 8.14 (MMBtu/hr)*

Potential Emissions (tons/yr) = $(lb/hr)_{Potential}$ × (Annual hours of operation) × (1 ton/2,000 lb)
*0.02 (tons PM/yr) = 0.08 (lb PM/hr) * 500 hr/yr * 1 ton/2,000 lb*

Hazardous Air Pollutant Emissions Calculations:

HAP	Emission Factor (HHV)		Potential Emissions	
	lb/MMBtu	Reference	lb/hr	tpy
1,1,2,2-Tetrachloroethane	4.00E-05	1	3.26E-04	8.14E-05
1,1,2-Trichloroethane	3.18E-05	1	2.59E-04	6.47E-05
1,3-Butadiene	2.67E-04	1	2.17E-03	5.43E-04
1,3-Dichloropropene	2.64E-05	1	2.15E-04	5.37E-05
2-Methylnaphthalene	3.32E-05	1	2.70E-04	6.76E-05
2,2,4-Trimethylpentane	2.50E-04	1	2.04E-03	5.09E-04
Acenaphthene	1.25E-06	1	1.02E-05	2.54E-06
Acenaphthylene	5.53E-06	1	4.50E-05	1.13E-05
Acetaldehyde	8.36E-03	1	6.81E-02	1.70E-02
Acrolein	5.14E-03	1	4.18E-02	1.05E-02
Benzene	4.40E-04	1	3.58E-03	8.96E-04
Benzo(b)fluoranthene	1.66E-07	1	1.35E-06	3.38E-07
Benzo(e)pyrene	4.15E-07	1	3.38E-06	8.45E-07
Benzo(g,h,i)perylene	4.14E-07	1	3.37E-06	8.43E-07
Biphenyl	2.12E-04	1	1.73E-03	4.31E-04
Carbon Tetrachloride	3.67E-05	1	2.99E-04	7.47E-05
Chlorobenzene	3.04E-05	1	2.47E-04	6.19E-05
Chloroform	2.85E-05	1	2.32E-04	5.80E-05
Chrysene	6.93E-07	1	5.64E-06	1.41E-06
Ethylbenzene	3.97E-05	1	3.23E-04	8.08E-05
Ethylene Dibromide	4.43E-05	1	3.61E-04	9.02E-05
Flouranthene	1.11E-06	1	9.04E-06	2.26E-06
Flourene	5.67E-06	1	4.62E-05	1.15E-05
Formaldehyde	5.28E-02	1	4.30E-01	1.07E-01
Methanol	2.50E-03	1	2.04E-02	5.09E-03
Methylene Chloride	2.00E-05	1	1.63E-04	4.07E-05
n-Hexane	1.11E-03	1	9.04E-03	2.26E-03
Naphthalene	7.44E-05	1	6.06E-04	1.51E-04
PAH	2.69E-05	1	2.19E-04	5.47E-05
Phenanthrene	1.04E-05	1	8.47E-05	2.12E-05
Phenol	2.40E-05	1	1.95E-04	4.88E-05
Pyrene	1.36E-06	1	1.11E-05	2.77E-06
Styrene	2.36E-05	1	1.92E-04	4.80E-05
Tetrachloroethane	2.48E-06	1	2.02E-05	5.05E-06
Toluene	4.08E-04	1	3.32E-03	8.30E-04
Vinyl Chloride	1.49E-05	1	1.21E-04	3.03E-05
Xylene	1.84E-04	1	1.50E-03	3.74E-04
		Total HAP	**0.59**	**0.15**

References:

1. AP-42, 5th ed., Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2: Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines (July 2000).

Sample Calculations:

Potential Emissions (lb/hr) = Emission Factor (lb/MMBtu) * Fuel $Consumption_{HHV}$ (MMBtu/hr)
*4.18E-02 (lb Acrolein/hr) = 5.14E-03 (lb Acrolein/MMBtu) * 8.14 (MMBtu/hr)*

Potential Emissions (tons/yr) = $(lb/hr)_{Potential}$ × (Annual hours of operation) × (1 ton/2,000 lb).
*1.05E-02 (tons Acrolein/yr) = 4.18E-02 (lb Acrolein/hr) * 500 (hr/yr) * 1 ton/2,000 lb*

Parker Boiler T-4600LR Hydronic Heater (118-WH-02)
Potential to Emit Calculations

Source Designation:	118-WH-02
Manufacturer:	Parker Boiler
Model:	T-4600LR
Fuel Used:	Natural Gas
Lower Heating Value (LHV) (Btu/scf):	942
Higher Heating Value (HHV) (Btu/scf):	1,020
Heat Input (MMBtu/hr) (LHV):	4.25
Heat Input (MMBtu/hr) (HHV):	4.60
Hourly Fuel Consumption (scf/hr):	4,510
Fuel Flow (scfm):	75.2
Control Device:	N/A

Operational Parameters:

Annual Hours of Operation (hr/yr):	8,760
Annual Fuel Consumption (MMscf/yr):	39.5
Number of Identical Units:	1

Emission Factors:

Pollutant	Emission Factor Basis			
	Value	Units	LHV/HHV	Reference
CO	0.06	lb/MMBtu	HHV (Assumed)	1
NO_x	0.02	lb/MMBtu	HHV (Assumed)	1
SO_2	0.60	lb/MMscf	HHV	2
VOC	6.20E-03	lb/MMBtu	HHV (Assumed)	1
PM (Filterable + Condensable)	0.01	lb/MMBtu	HHV	1, 3
PM_{10} (Filterable + Condensable)	0.01	lb/MMBtu	HHV	1, 3
$PM_{2.5}$ (Filterable + Condensable)	0.01	lb/MMBtu	HHV	1, 3
Non-Biogenic CO_2	53.1	kg/MMBtu	HHV	4
CH_4	0.02	lb/MMBtu	HHV	1
N_2O	1.00E-04	kg/MMBtu	HHV (Assumed)	5

References

1. Parker Industrial Boiler, Emission Data for Metal Fiber Premix Natural Gas Fired Burner Systems on Parker Boilers (September 27, 2013). VOCs assumed to be 20% of UHC and CH4 assumed to be 80% of UHC.
2. AP-42, 5th ed., Section 1.4: Natural Gas Combustion, Table 1.4-2: Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion.
3. Conservatively assumed PM = PM10 = PM2.5
4. 40 CFR Part 98 Subpart C, Table C-1: Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel, for natural gas.
5. 40 CFR Part 98 Subpart C, Table C-2: Default CH_4 and N_2O Emission Factors and High Heat Values for Various Types of Fuel, for natural gas.

Parker Boiler T-4600LR Hydronic Heater (118-WH-02)(Continued)

Criteria Pollutant & Greenhouse Gas Emissions Calculations:

Pollutant	Emission Factor (HHV)		Potential Emissions	
	lb/MMBtu	Reference	lb/hr	tpy
CO	0.06	-	0.25	1.11
NO_x	0.02	-	0.11	0.48
SO_2	5.88E-04	1	2.71E-03	0.01
VOC	6.20E-03	-	0.03	0.12
PM (Filterable + Condensable)	0.01	-	0.05	0.20
PM_{10} (Filterable + Condensable)	0.01	-	0.05	0.20
$PM_{2.5}$ (Filterable + Condensable)	0.01	-	0.05	0.20
Total CO_2e			541	2,371
Total GHG			538	2,357
Non-Biogenic CO_2	117	2	538	2,357
CH_4	0.02	-	0.11	0.50
N_2O	2.20E-04	2	1.01E-03	4.44E-03

References:

1. Converted emission factors from lb/MMscf to lb/MMBtu to calculate all emissions on a consistent basis.

   EF (lb/MMBtu) = EF (lb/MMscf) * HHV (MMscf/MMBtu)

   5.88E-04 (lb SO2/MMscf) = 0.6 (lb SO2 / MMscf) / 1020 (Btu/scf)

2. Converted emission factors from kg/MMBtu to lb/MMBtu to calculate all emissions on a consistent basis.

   EF (lb/MMBtu) = EF (kg/MMBtu) * (2.20462 lb/kg)

   *2.2E-04 (lb N2O/MMBtu) = 1.E-04 (kg N2O/MMBtu) * 2.20462 (lb/kg)*

Sample Calculations:

Potential Emissions (lb/hr) = Emission Factor (lb/MMBtu) / Heating $Value_{HHV}$ (Btu/scf)

*0.05 (lb PM/hr) = 0.01 (lb PM/MMBtu) * 4.6 (MMBtu/hr)*

Potential Emissions (tons/yr) = $(lb/hr)_{Potential}$ × (Annual hours of operation) × (1 ton/2,000 lb)

*0.2 (tons PM/yr) = 0.05 (lb PM/hr) * 8760 (hr/yr) * 1 ton/2,000 lb*

Parker Boiler T-4600LR Hydronic Heater (118-WH-02)(Continued)

Hazardous Air Pollutant Emissions Calculations:

HAP	Emission Factor (HHV)		Potential Emissions	
	lb/MMBtu	Reference	lb/hr	tons/yr
2-Methylnaphthalene	2.35E-08	1	1.08E-07	4.74E-07
3-Methylchloranthrene	1.76E-09	1	8.12E-09	3.56E-08
7,12-Dimethylbenz(a)anthracene	1.57E-08	1	7.22E-08	3.16E-07
Acenaphthene	1.76E-09	1	8.12E-09	3.56E-08
Acenaphthylene	1.76E-09	1	8.12E-09	3.56E-08
Anthracene	2.35E-09	1	1.08E-08	4.74E-08
Arsenic	1.96E-07	2	9.02E-07	3.95E-06
Benz(a)anthracene	1.76E-09	1	8.12E-09	3.56E-08
Benzene	2.06E-06	1	9.47E-06	4.15E-05
Benzo(a)pyrene	1.18E-09	1	5.41E-09	2.37E-08
Benzo(b)fluoranthene	1.76E-09	1	8.12E-09	3.56E-08
Benzo(g,h,i)perylene	1.18E-09	1	5.41E-09	2.37E-08
Benzo(k)fluoranthene	1.76E-09	1	8.12E-09	3.56E-08
Beryllium	1.18E-08	2	5.41E-08	2.37E-07
Cadmium	1.08E-06	2	4.96E-06	2.17E-05
Chromium	1.37E-06	2	6.31E-06	2.77E-05
Chrysene	1.76E-09	1	8.12E-09	3.56E-08
Cobalt	8.24E-08	2	3.79E-07	1.66E-06
Dibenzo(a,h)anthracene	1.18E-09	1	5.41E-09	2.37E-08
Dichlorobenzene	1.18E-06	1	5.41E-06	2.37E-05
Fluoranthene	2.94E-09	1	1.35E-08	5.93E-08
Fluorene	2.75E-09	1	1.26E-08	5.53E-08
Formaldehyde	7.35E-05	1	3.38E-04	1.48E-03
n-Hexane	1.76E-03	1	8.12E-03	0.04
Indeno(1,2,3-cd)pyrene	1.76E-09	1	8.12E-09	3.56E-08
Manganese	3.73E-07	2	1.71E-06	7.51E-06
Mercury	2.55E-07	2	1.17E-06	5.14E-06
Napthalene	5.98E-07	1	2.75E-06	1.20E-05
Nickel	2.06E-06	2	9.47E-06	4.15E-05
Phenanthrene	1.67E-08	1	7.67E-08	3.36E-07
Pyrene	4.90E-09	1	2.25E-08	9.88E-08
Selenium	2.35E-08	2	1.08E-07	4.74E-07
Toluene	3.33E-06	1	1.53E-05	6.72E-05
Total HAP			**8.51E-03**	**0.04**

References

1. AP-42, 5th ed., Section 1.4: Natural Gas Combustion, Table 1.4-3: Emission Factors for Speciated Organic Compounds from Natural Gas Combustion.
2. AP-42, 5th ed., Section 1.4: Natural Gas Combustion, Table 1.4-4: Emission Factors for Metals from Natural Gas Combustion.

Sample Calculations:

Potential Emissions (lb/hr) = Emission Factor (lb/MMBtu) * Fuel Consumption$_{HHV}$ (MMBtu/hr)

*9.47E-06 (lb Benzene/hr) = 2.06E-06 (lb Benzene/MMBtu) * 4.6 (MMBtu/hr)*

Potential Emissions (tons/yr) = (lb/hr)$_{Potential}$ × (Annual hours of operation) × (1 ton/2,000 lb).

*4.15E-05 (tons Benzene/yr) = 9.47E-06 (lb Benzene/hr) * 8760 (hr/yr) * 1 ton/2,000 lb*

Fugitive Emissions (FUG)
Potential to Emit Calculations

Source Designation:	FUG

Operational Parameters:

Annual Hours of Operation (hr/yr):	8,760

Fugitive Natural Gas Emissions:

Equipment	Service	Emission Factor		Source Count[2]	Total HC Potential Emissions		VOC Weight Fraction	VOC Emissions	CH_4 Weight Fraction	CH_4 Emissions	HAP Weight Fraction	HAP Emissions
		lb/hr/source	Reference		lb/hr	tpy		tpy		tpy		tpy
Connectors	Gas	4.41E-04	1	3,309	1.46	6.4	0.0020	0.01	0.95	6.05	0.00002	0.00012
Flanges	Gas	8.60E-04	1	622	0.53	2.3	0.0020	0.00	0.95	2.22	0.00002	0.00004
Others	Gas	1.94E-02	1	95.6	1.85	8.1	0.0020	0.02	0.95	7.69	0.00002	0.00015
Valves	Gas	9.92E-03	1	743	7.4	32.3	0.0020	0.06	0.95	30.56	0.00002	0.00061
Open Ended Lines	Gas	4.41E-03	1	26	0.11	0.49	0.0020	0.00	0.95	0.47	0.00002	0.00001
Connectors	Light Oil	4.63E-04	1	336	0.16	0.68	0.56	0.38	0.38	0.26	0.10	0.06813
Flanges	Light Oil	2.43E-04	1	90	0.02	0.10	0.56	0.05	0.38	0.04	0.10	0.00956
Others	Light Oil	1.65E-02	1	14	0.23	1.01	0.56	0.57	0.38	0.38	0.10	0.10139
Valves	Light Oil	5.51E-03	1	97	0.53	2.34	0.56	1.31	0.38	0.88	0.10	0.23416
				Total	12.3	53.8	-	2.4	-	48.5	-	0.4142

1. EPA Protocol for Equipment Leaks Emissions Estimate (EPA-453/R-95-017) Table 2-4: Oil and Gas Production Operations Average Emission Factor.
2. Component counts for flanges and valves in gas service are estimated based on design data. Counts for other components in gas service are each assumed to be equal to 20% of Station 106's existing gas service component counts. Component counts for equipment in light oil service are each assumed to be equal to the same Station 106 component counts.

Sample Calculations:

Potential Emissions (lb/hr) = Emission Factor (lb/hr/source) * Source Count

*1.46 (lb HC from connectors in gas service/hr) = 4.41E-04 (lb/hr/source) * 3309 (source count)*

Potential Emissions (tons/yr) = $(lb/hr)_{Potential}$ × Hours of Operation (hr/yr) × (1 ton/2,000 lb).

*6.39 (tons HC from connectors in gas service/yr) = 1.46 (lb HC /hr) * 8760 (hr/yr) * / 2000 lb/ton*

Gas Speciated Fugitive Natural Gas Emissions:

Pollutant	Wt. Fraction[1] %
Non-VOC	
Methane	94.66%
Ethane	4.75%
VOC	
Propane	0.16%
i-Butane	0.01%
n-Butane	0.01%
i-Pentane	0.00%
n-Pentane	0.00%
C6 Plus	0.00%
Total VOC	0.20%
HAP	
n-Hexane	0.002%

Gas speciation based on a natural gas average hydrocarbon composition for a similar site.

Condensate Speciated Fugitive Natural Gas Emissions:

Pollutant	Wt. Fraction %
Non-VOC	
Methane	37.6%
Ethane	6.4%
VOC	
Propane	10.1%
i-Butane	0.4%
n-Butane	7.4%
Pentane	5.6%
C6 Plus	32.5%
Total VOC	56.0%
HAP	
n-Hexane	9.9%
Benzene	0.1%
Total HAP	10.0%

Condensate speciation based on November 2009 KY application submittal for Station 114.

Gas Venting/Blowdown Emissions (V/BD)
Potential to Emit Calculations

Source Designation:	V/BD

Operational Parameters:

Annual Volume of Natural Gas Release (MMscf/yr)[1]:	3
Density Air, 60 ^{o}F, 1 atm (lb/ft^{3}):	0.077
Specific Gravity Natural Gas:	0.582
Density Natural Gas, 60 ^{o}F, 1 atm (lb/ft^{3}):	0.045
Annual Mass of Natural Gas Release (lb/yr):	133,500
Annual Mass of Natural Gas Release (tpy):	67

Gas Venting/Blowdown Emissions:

Pollutant	Weight Fraction (%)	Emissions	
		(lb/hr)	(tpy)
Non-VOC			
Methane	94.66%	14.4	63.2
Ethane	4.75%	0.72	3.17
VOC			
Propane	0.16%	0.02	0.11
i-Butane	0.01%	0.00	0.01
n-Butane	0.01%	0.00	0.01
i-Pentane	0.003%	0.00	0.00
n-Pentane	0.001%	0.00	0.00
C6 Plus	0.004%	0.00	0.00
Total VOC	0.20%	0.03	0.13
HAP			
n-Hexane	0.002%	0.0003	0.0013

1. Annual Volume of Natural Gas Release based on estimated volume of natural gas released.
2. Weight fractions of natural gas based on 90 day average from Station 110 completed over April, May, and June of 2014.

Storage Tanks (118-PF-04)
Potential to Emit Calculations

Source Designation:	118-PF-04

Tank Parameters

Source	Type of Tank	Contents	Capacity	Throughput	Tank Diam.	Tank Length	Paint Color	Paint Condition
			(gal)	gal/yr	ft	ft		
118-PF-04	Vertical, fixed	Pipeline Liquids	3,760	7,520	8	10	Light Grey	Good

Potential Emissions [1]

Source	Contents	Total VOC Emissions		HAP Emissions	
		lb/hr	tpy	lb/hr	tpy
118-PF-04	Pipeline Liquids	0.05	0.20	0.002	0.01

1. Emissions were calculated using E&P Software. See attached E&P output.

```
*****************************************************************************************
*     Project Setup Information                                                         *
*****************************************************************************************
Project File              : Z:\Eastern Pipelines\AIR\NEW\TGP\Broad Run & UMTP\Broad Run Expansion\Tanks Run_WV.e
Flowsheet Selection       : Oil Tank with Separator
Calculation Method        : AP42
Control Efficiency        : 100.0%
Known Separator Stream    : Low Pressure Gas
Entering Air Composition  : No

Filed Name                : Tennessee Gas Pipeline, Broad Run Expansion Project, WV
Date                      : 2015.01.16


*****************************************************************************************
*     Data Input                                                                        *
*****************************************************************************************

Separator Pressure        : 552.00[psig]
Separator Temperature     : 77.00[F]
Molar GOR                 : 0.0500
Ambient Pressure          : 14.70[psia]
Ambient Temperature       : 60.00[F]
C10+ SG                   : 0.8990
C10+ MW                   : 166.00

-- Low Pressure Gas ---------------------------------------------------------------------
   No.    Component            mol %
   1      H2S                   0.0000
   2      O2                    0.0000
   3      CO2                   0.0000
   4      N2                    0.0000
   5      C1                   69.4535
   6      C2                    6.3060
   7      C3                    6.7857
   8      i-C4                  0.2039
   9      n-C4                  3.7724
   10     i-C5                  2.2997
   11     n-C5                  0.0000
   12     C6                    7.7373
   13     C7+                   0.0000
   14     Benzene               0.0379
   15     Toluene               0.0000
   16     E-Benzene             0.0000
   17     Xylenes               0.0000
   18     n-C6                  3.4036
   19     224Trimethylp         0.0000

   C7+ Molar Ratio: C7  :     C8  :     C9  :     C10+
                    1.0000    1.0000    1.0000    1.0000

-- Sales Oil ----------------------------------------------------------------------------
Production Rate           : 0.5[bbl/day]
Days of Annual Operation  : 365 [days/year]
API Gravity               : 46.0
Reid Vapor Pressure       : 7.70[psia]
Bulk Temperature          : 80.00[F]

-- Tank and Shell Data ------------------------------------------------------------------
Diameter                  : 8.00[ft]
Shell Height              : 10.00[ft]
Cone Roof Slope           : 0.06
Average Liquid Height     : 8.00[ft]
Vent Pressure Range       : 0.06[psi]
Solar Absorbance          : 0.54
```

-- Meteorological Data ----------

City : Charleston, WV
Ambient Pressure : 14.70[psia]
Ambient Temperature : 60.00[F]
Min Ambient Temperature : 44.00[F]
Max Ambient Temperature : 65.50[F]
Total Solar Insolation : 1123.00[Btu/ft^2*day]

****

* Calculation Results *

****

-- Emission Summary ----------

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
Total HAPs	0.010	0.002
Total HC	0.243	0.055
VOCs, C2+	0.218	0.050
VOCs, C3+	0.201	0.046

Uncontrolled Recovery Info.

Vapor	11.8100 x1E-3	[MSCFD]
HC Vapor	11.1300 x1E-3	[MSCFD]
GOR	23.62	[SCF/bbl]

-- Emission Composition ----------

No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
1	H2S	0.001	0.000
2	O2	0.000	0.000
3	CO2	0.012	0.003
4	N2	0.001	0.000
5	C1	0.025	0.006
6	C2	0.017	0.004
7	C3	0.034	0.008
8	i-C4	0.018	0.004
9	n-C4	0.059	0.013
10	i-C5	0.026	0.006
11	n-C5	0.032	0.007
12	C6	0.010	0.002
13	C7	0.010	0.002
14	C8	0.004	0.001
15	C9	0.001	0.000
16	C10+	0.000	0.000
17	Benzene	0.001	0.000
18	Toluene	0.000	0.000
19	E-Benzene	0.000	0.000
20	Xylenes	0.000	0.000
21	n-C6	0.007	0.002
22	224Trimethylp	0.000	0.000
	Total	0.258	0.059

-- 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	0.0508	0.0377	0.0000	0.6656	0.0000	0.4837
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.2437	0.1047	0.0000	6.7852	0.0001	4.9302
4	N2	28.01	0.0102	0.0005	0.0000	0.4655	0.0001	0.3383
5	C1	16.04	0.9543	0.1738	0.0000	37.6955	0.0001	27.3898
6	C2	30.07	0.6701	0.3944	0.0000	13.6469	0.0001	9.9159
7	C3	44.10	2.1827	1.8560	0.0514	17.5629	2.2197	13.3682
8	i-C4	58.12	1.1269	1.0684	0.4674	3.8807	9.1341	5.3170
9	n-C4	58.12	4.6091	4.4760	2.6691	10.8742	36.6013	17.9078
10	i-C5	72.15	3.1066	3.1125	2.7362	2.8280	15.2156	6.2147
11	n-C5	72.15	5.0558	5.0931	4.7863	3.2984	19.5128	7.7313
12	C6	86.16	4.1726	4.2443	4.5165	0.7994	5.6808	2.1340

13	C7	100.20	10.3655	10.5720	11.6638	0.6458	5.0621	1.8532
14	C8	114.23	10.8426	11.0685	12.3681	0.2088	1.7645	0.6341
15	C9	128.28	5.5127	5.6291	6.3152	0.0358	0.3223	0.1141
16	C10+	166.00	45.9695	46.9460	52.7836	0.0064	0.0663	0.0228
17	Benzene	78.11	0.5685	0.5793	0.6312	0.0611	0.4498	0.1674
18	Toluene	92.13	0.2132	0.2176	0.2425	0.0062	0.0497	0.0181
19	E-Benzene	106.17	0.0711	0.0726	0.0814	0.0007	0.0056	0.0020
20	Xylenes	106.17	0.6802	0.6945	0.7789	0.0055	0.0473	0.0169
21	n-C6	86.18	3.5939	3.6591	3.9413	0.5272	3.8676	1.4404
22	224Trimethylp	114.24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	MW		123.89	125.75	130.75	36.33	68.55	45.14
	Stream Mole Ratio		1.0000	0.9792	0.9714	0.0208	0.0078	0.0286
	Heating Value	[BTU/SCF]				1909.45	3799.14	2426.08
	Gas Gravity	[Gas/Air]				1.25	2.37	1.56
	Bubble Pt. @ 100F	[psia]	56.28	21.39	4.72			
	RVP @ 100F	[psia]	126.75	82.72	30.54			
	Spec. Gravity @ 100F		0.800	0.803	0.812			

Pipeline Liquids Truck Loading (118-LR-05)
Potential to Emit Calculations

Source Designation:	118-LR-05

Chemical Parameters

Chemical	Vapor Mol. Weight [1] (lb/lb-mol)	Avg. Vapor Pressure [1] (psia)	Avg. Temperature [2] (deg. R)	Saturation Factor [3]	Throughput [4] Mgal/yr
Pipeline Liquids	45.14	7.70	520	0.6	7.52

References:
1. Vapor molecular weight and vapor pressure based on E&P output for Pipeline Liquids Storage Tank 118-PF-04.
2. Based on average abient temperature data for the area.
3. Saturation Factor based on "Submerged loading: dedicated normal service" in Table 5.2-1 of AP-42, Ch. 5.2.
4. Assumed that two turnovers of the pipeline liquids tank could be loaded out via truck per year.

Total Potential Emissions

Source	Total Loading Losses[1]		Pump Capacity [2]	Max Hourly Losses
	Average	Annual		
	(lbs/Mgal)	(tpy)	(gal/min)	lb/hr
Pipeline Liquids Truck Loading	5.00	0.02	90	27.0

References:
1. AP-42, Ch. 5.2, Equation 1 (Loading Loss = 12.46 x (Saturation Factor x TVP x Molecular Weight) / Temp.)
2. Assumed pump rate.

Speciated Potential Emissions

Source	Contents	VOC Weight Fraction[1] (%)	HAP Weight Fraction[1] (%)	Total VOC Emissions		Total HAP Emissions	
				lb/hr	tpy	lb/hr	tpy
Pipeline Liquids Truck Loading	Pipeline Liquids	79%	3%	21.23	0.01	0.84	0.001

References:
1. VOC and HAP weight fractions are based on 118-PF-04 tank emissions speciation.

Attachment O

Attachment O
Monitoring, Recordkeeping, Reporting, Testing

TGP will comply with all of the monitoring, recordkeeping, reporting, and testing requirements set forth in the issued permit for Station 118A.

Attachment P

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that Kinder Morgan Energy Partners' Tennessee Gas Pipeline, L.L.C. has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a General Permit for a compressor station operation located in Charleston, Kanawha County, West Virginia. The latitude and longitude coordinates are: 38.41825 and -81.70873.

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

Particulate Matter (PM) = 2.7 tpy
Sulfur Dioxide (SO_2) = 1.3 tpy
Volatile Organic Compounds (VOC) = 6.0 tpy
Carbon Monoxide (CO) = 37.7 tpy
Nitrogen Oxides (NO_x) = 36.7 tpy
Hazardous Air Pollutants (HAPs) = 1.0 tpy
Carbon Dioxide Equivalents (CO_2e) = 49,903 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 30th day of January, 2015.

By: Tennessee Gas Pipeline Company, LLC.
Shrishti Chhabra
Environmental Engineer III
1001 Louisiana St.
Houston, TX 77002

Attachment Q

Attachment Q
Business Confidential Claims

There is no confidential information associated with this permit application.

Attachment R

Attachment R
Authority Forms

Since this application is signed by the "Responsible Official," this section is not applicable.

Attachment S

Attachment S
Title V Permit Revision Information

Attachment S is not being provided with this permit application since the site does not currently possess a Title V Permit.