VIA ELECTRONIC SUBMITTAL

February 5, 2016

Texas Commission on Environmental Quality (TCEQ), MC-161
Air Permits Initial Review Team (APIRT)
12100 Park 35 Circle, Building C, Third Floor
Austin, TX 78753

Re: LINN Operating, Inc.
Permit By Rule Application
Customer No.: CN603395690
Regulated Entity No.: RN105009245

To Whom It May Concern:

TRICORD Consulting, LLC (TRICORD), on behalf of LINN Operating, Inc. (LINN), hereby submits the enclosed permit by rule application for the FR Hill Compressor station located near Fairfield, Texas. FR Hill is currently authorized under SP No. 87128. LINN requests that the existing standard permit be voided upon approval of the new PBR.

In addition to replacing the standard permit authorization with a PBR, LINN also requests to revise and update site-wide representations and emission sources to reflect current and planned operations since the recent transfer of ownership. The significant changes being made to this standard permit include the following:

1. Replacement of one Caterpillar G3601 engine (EPN ENG-06) with a 1,380 hp Caterpillar G3516B engine (ENG-07). There will be a total of two engines on site.
2. Update fugitive component counts to reflect that the site does not produce or process any liquids that would meet the definition of light or heavy liquids for the purpose of calculating fugitive emissions.
3. Update fugitive, tank, loading, and dehydrator emissions based on new sample data. Gas speciation is based on site-specific samples. Because no oil is available to sample at the FR Hill Compressor station, the RVP from a nearby facility, Dew Compressor Station, is used to estimate emissions from produced water tanks and water loading activities.

If you have questions, please contact Mr. Paul Nowak of LINN at (713) 904-6579 or by email at PNowak@linnenergy.com. Thank you for your time and consideration regarding this matter.

Sincerely,

Shane T. Dillard
TRICORD Consulting, LLC
402A West Palm Valley Blvd., PMB348
Round Rock, TX 78664
Office and Fax: (888) 900-0746, ext. 703

Attachments

cc: Mr. Paul Nowak, LINN Operating, Inc.
Mr. Jason Neumann, Air Section Manager, TCEQ Region 9, Waco

Permit by Rule Registration for F.R. Hill Compressor Station

30 TAC § 106.352(l)

February 2016

LINN Operating, Inc.

F.R. Hill Compressor Station

LINN Operating, Inc.
JP Morgan Chase Tower
600 Travis St, Suite 5100
Houston, TX 77002

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1 INTRODUCTION

LINN Operating, Inc. (LINN) currently owns and operates a natural gas compressor station located in Freestone County near Fairfield, Texas, herein referred to as FR Hill. This site was purchased by LINN and a transfer of ownership was submitted to TCEQ in February 2015. The site is authorized under existing registration number 87128.

1.1 Purpose and Applicability

FR Hill is currently authorized under 30 TAC §116.602 for Oil and Gas Production Facility Standard Permit Registration Number 87128. The purpose of this revision is to update site-wide representations and emission sources to reflect current and planned operations since the transfer of ownership, including voiding Standard Permit registration number 87128 and reauthorizing the facility under Permit by Rules 30 TAC §§106.352(l) and 106.512, as follows:

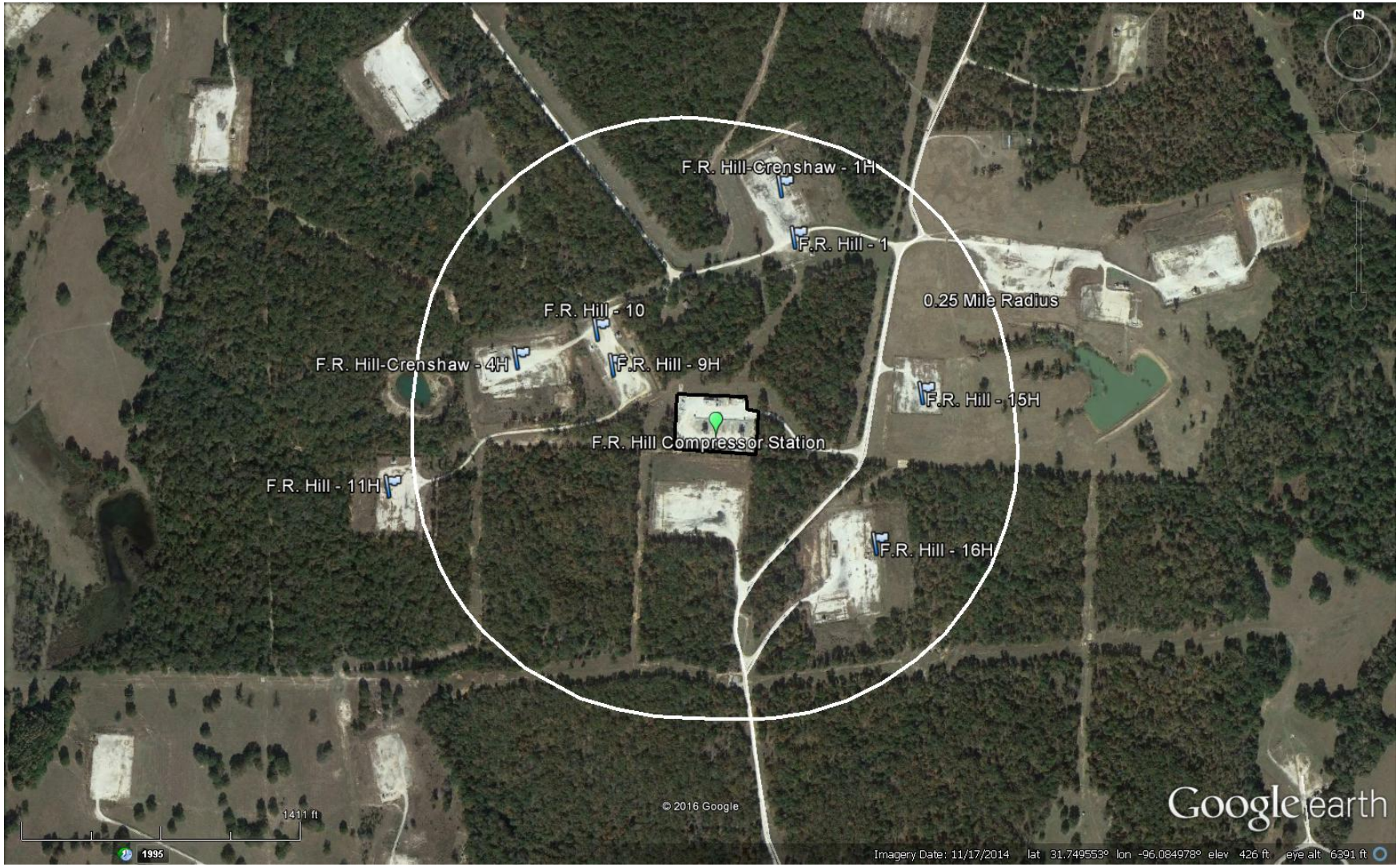
1. Replacement of one Caterpillar G3601 engine (EPN ENG-06) with a 1,380 hp Caterpillar G3516B engine (ENG-07). There will be a total of two engines on site.
2. Update fugitive component counts to reflect that the site does not produce or process any liquids that would meet the definition of light or heavy liquids for the purpose of calculating fugitive emissions.
3. Update fugitive, tank, loading, and dehydrator emissions based on new sample data. Gas speciation is based on site-specific samples. Because no oil is available to sample at the FR Hill Compressor station, the RVP from a nearby facility, Dew Compressor Station, is used to estimate emissions from produced water tanks and water loading activities.
4. The natural gas-fired compressor engines will be authorized under the PBR for "Stationary Engines and Turbines" as specified in Title 30 of the Texas Administrative Code, Chapter 106, Section 512 (30 TAC §106.512).
5. All other operations and associated emission sources are authorized under the PBR for "Oil and Gas Handling and Production Facilities" as specified in 30 TAC §106.352(l).

1.2 PBR Registration Contents

This document contains the materials necessary for demonstrating compliance with TCEQ PBRs §§106.352(l) and 106.512. All applicable TCEQ checklists are included in Appendix A. Appendix B contains detailed emission calculations. Appendix C contains technical data, including lab analyses and compressor specification sheets. Appendix D contains a copy of the current PBR rule text. Appendix E contains Air Quality Analysis discussion and results.

Figure 1-1

Area Map of Facility



2 PROCESS DESCRIPTION

LINN owns and operates an oil and gas site, FR Hill, located in Freestone County. The site produces 217.87 barrels of water per day (BWPD) and 11,268 thousand cubic feet per day (MSCFD) of field gas.

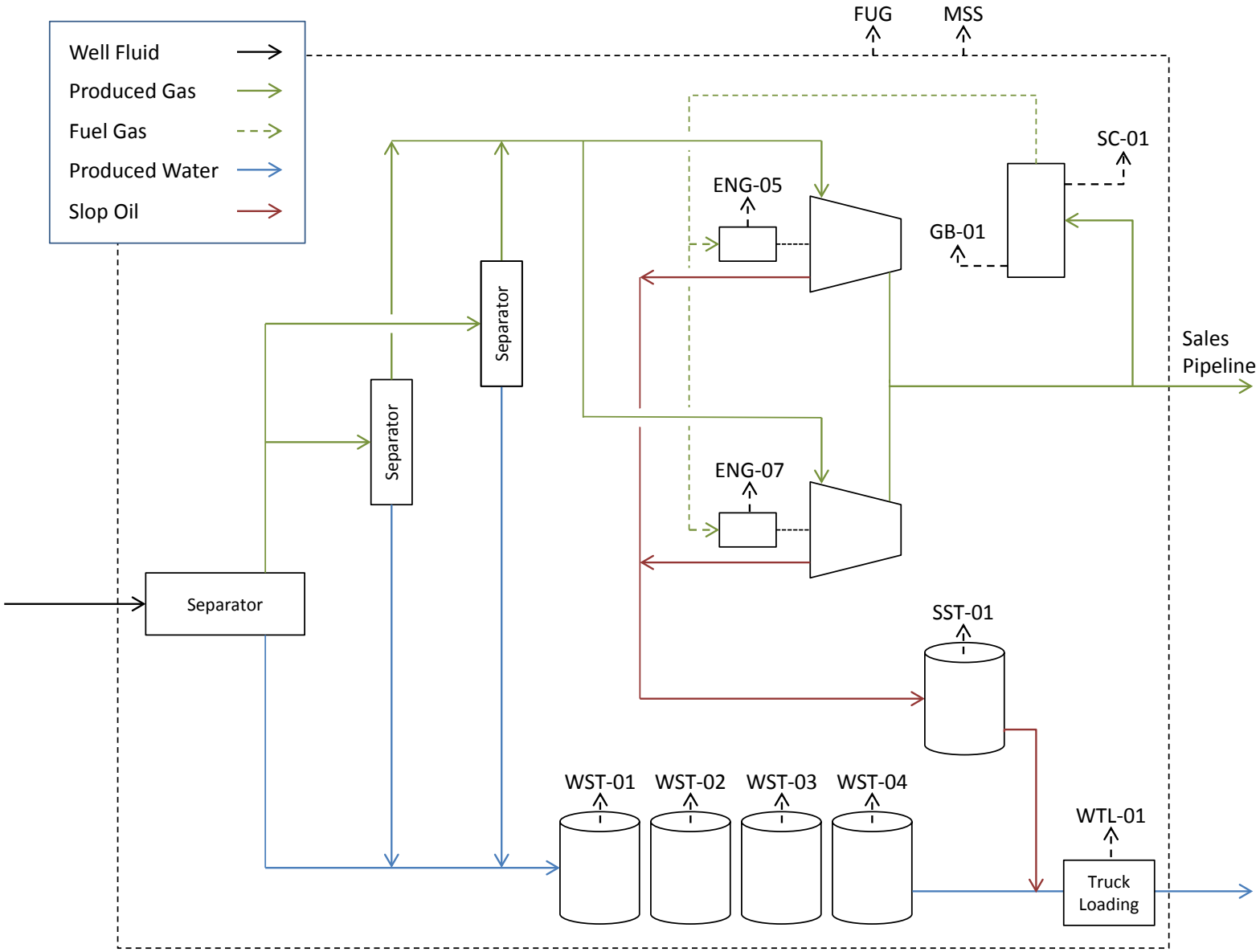
The site currently consists of three separators, four 210 BBL water tanks (EPNs: WST-01, 02, 03 and 04), one slop oil tank (EPN: SST-01), one glycol unit (EPN: SC-01) and associated reboiler (EPN: GB-01), and two compressors driven by a field-gas-fired internal combustion engine (EPNs: ENG-05 and 07).

Produced liquids and gases from the wells pass through separators where entrained water is knocked out prior to being routed to two compressors where the gas is compressed en route to the sales pipeline. Water is routed to the water tanks where it is stored until it can be loaded into trucks for disposal (EPN: WTL-01). Fugitive emissions from valves, flanges, etc. are represented by EPN: FUG. Rainwater, engine oil, and other heavy equipment oil is routed to the slop tank and then trucked off for disposal.

Planned maintenance, startup, and shutdown (MSS) activities at the site may include tank maintenance, painting and blasting operations, compressor blowdowns, and other insignificant activities such as pipe clearing and use of aerosols. The planned MSS activities and the associated emissions are represented by the EPN: MSS.

Figure 2-1 is a process flow diagram of the equipment currently in operation at FR Hill.

Figure 2-1
Process Flow Diagram



3 EMISSION CALCULATION METHODOLOGY

This section includes descriptions of the methods used to calculate emission rates. Detailed potential emission rate calculations are provided in Appendix B. Emissions were calculated using TCEQ's Oil & Gas Emission Estimation spreadsheet, updated in October 2014.

3.1 Piping Component Fugitive Emissions

Fugitive emission rates of volatile organic compounds (VOC) and hydrogen sulfide (H_2S) from the piping components and ancillary equipment were estimated using the emission factors from US EPAs "Protocol for Equipment Leak Emission Estimates" November 1995, EPA 4531, R-95-017, Table 2-4, where available. Emission factors not available in the US EPAs protocol are based on TCEQ's Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives, October 2000.

Fugitive component counts were based on Table W-1B from Title 40 of the Code of Federal Regulations (40 CFR) Part 98, Subpart W. The site does not have a Leak Detection and Repair (LDAR) program so no control efficiencies are claimed.

3.2 Storage Tank Emissions

There are produced water and slop oil storage tanks at the site.

Produced Water Storage Tanks

The produced water tanks were modeled as a crude oil in the TANKS 4.0.9d program. Emissions from the produced water tanks were estimated to be 1% of the emissions from crude oil, consistent with TCEQ guidance. Hourly emissions were calculated using Equation V-1 from TCEQ's "Technical Guidance Package for Chemical Sources - Storage Tanks".

Flash emissions were calculated using the Gas-to-Water Ratio (GWR). The GWR was determined from lab samples taken at the separator.

Slop Oil Storage Tank

The slop oil tank manages mostly rainwater with some heavy oils from the engine casing. The slop tank is assumed to contain 98% water and 2% oil. Emissions were modeled in TANKS 4.0.9d program using distillate fuel oil no. 2 and taking a 98% reduction, similar to produced water.

The analytical data is provided in Appendix C of this document.

3.3 Truck Loading Emissions

Produced water emissions from truck loading were calculated using Equation 1 from US EPA's AP-42 Chapter 5.2. Annual emissions were calculated assuming 100% of the oil and produced water production are sent off-site via tank truck. Hourly emissions were calculated assuming an entire tank truck may be filled in one hour.

3.4 Compressor Engines

There are two engines in service at FR Hill. Engine ENG-05 is a 1,085-hp Caterpillar G3516 TALE engine. The NO_X and CO emission factors are based on the manufacturer specification sheet. All other emission factors are based on AP-42 Table 3.2-2, "Uncontrolled Emission Factors for 4-Stroke Lean-Burn Engines," dated August 2008. Engine ENG-07 is a 1,380-hp caterpillar G3516B engine. The NO_X, CO, VOC, and formaldehyde emission factors are based on the manufacturer specification sheet. The SO_2 and PM emission factor are from AP-42, Table 3.2-2..

3.5 Glycol Dehydration Emissions

There is one glycol dehydration unit at the site with a maximum total throughput of 11.3 MMscf/day. This unit is used to dehydrate gas before it enters the fuel system. Glycol vent emissions are calculated using the GRI GLYCalc program. The still vent emissions are routed to a BTEX condenser at 98% control. Flash gas emissions are routed to the reboiler at 50% control.

3.6 Glycol Reboiler Emissions

The emissions factors are based on AP-42, Chapter 1, Tables 1.4-1 and 1.4-2, assuming a heating value of 1,020 Btu/scf as per AP-42 Chapter 1.4 (July 1998).

3.7 Planned Maintenance, Startup, and Shutdown Emissions

Planned MSS emissions were calculated consistent with TCEQ's Oil and Gas Emission Estimation spreadsheet (October 2014 version). Tank MSS emissions were calculated assuming non-forced ventilation and assuming one MSS event per year per tank.

Emissions from MSS blowdowns were calculated conservatively assuming 730 blowdowns a year per engine onsite and the entire event occurring in one hour.

Emissions from insignificant activities and from painting and blasting were calculated using default assumptions from the TCEQ Oil and Gas Emission Estimation spreadsheet.

4 REGULATORY APPLICABILITY

4.1 State Regulatory Applicability

Please refer to the TCEQ Regulatory Applicability Checklists for PBR §§106.4, 106.352(l), and 106.512 provided in Appendix A for a demonstration of compliance with the PBR requirements.

4.2 Federal Regulatory Applicability

The site will comply with all applicable provisions of the Federal Clean Air Act. An evaluation of potentially applicable federal regulations is provided in Tables 4-1 and 4-2 on the following two pages.

Table 4-1
Potentially Applicable Federal Regulations – Part 60

Regulation	Description	Applicability Comments
NSPS A	General Provisions	The site will comply with all requiremens of NSPS A.
NSPS K	Standards of Performance for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After June 11, 1973, and Prior to May 19, 1978	The tanks at the site are all upstream of the custody transfer, and are therefore not subject to the requirements of NSPS K.
NSPS Ka	Standards of Performance for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978 and Prior to July 23, 1984	The tanks at the site are all upstream of the custody transfer and less than 420,000 gallons, and are therefore not subject to the requirements of NSPS Ka.
NSPS Kb	Standards of Performance for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984	The tanks at the site are all upstream of the custody transfer and less than 420,000 gallons, and are therefore not subject to the requirements of NSPS Kb.
NSPS GG	Standards of Performance for Stationary Gas Turbines	This site does not have stationary combustion turbines, and is therefore not subject to the requirements of NSPS GG.
NSPS KKK	Standards of Performance for Equipment Leaks of VOC From Onshore Natural Gas Processing Plants	The site is not an onshore natural gas processing plant, and is therefore not subject to the requirements of NSPS KKK.
NSPS LLL	Standards of Performance for Onshore Natural Gas Processing: SO2 Emission	This site does not have amine units, and is therefore not subject to the requirements of NSPS LLL.
NSPS IIII	Standards of Performance for Stationary Compression Ignition Internal Combustion Engines	This site does not have compression ignition engines, and is therefore not subject to the requirements of NSPS IIII.
NSPS JJJJ	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines	The spark ignition engines at the site will meet all requirements of NSPS JJJJ.
NSPS KKKK	Standards of Performance for Stationary Combustion Turbines	This site does not have stationary combustion turbines, and is therefore not subject to the requirements of NSPS KKKK.
NSPS OOOO	Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution	The storage vessels at the site all have annual uncontrolled emission rates less than 6 tpy, and are therefore not subject to the requirements of NSPS OOOO.

Table 4-2
Potentially Applicable Federal Regulations – Part 61 and Part 63

Regulation	Description	Applicability Comments
NESHAP A	National Emission Standards for Hazardous Air Pollutants (NESHAP) General Provisions	The site is not subject to any regulations under NESHAP, and is therefore not subject to the requiremens of NESHAP A.
NESHAP V	National Emission Standards for Equipment Leaks (Fugitive Emission Sources)	The fugitive components at this site are all less than 10 wt% VHAP, and are therefore not subject to the requirements of NESHAP V.
MACT A	National Emission Standards for Hazardous Air Pollutants (MACT) General Provisions.	This site contains a facility/facilities subject to MACT A and will comply with all requirements of the rule.
MACT HH	National Emission Standards for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities	This site is not a major source of HAP and has benzene emissions less than 1.0 tpy. The site will compile annual throughput demonstrations per the requirements of MACT HH.
MACT HHH	National Emission Standards for Hazardous Air Pollutants From Natural Gas Transmission and Storage Facilities	The site is not involved in the transmission of natural gas, and is therefore not subject to the requirements of MACT HHH.
MACT YYYY	National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines	This site does not have stationary combustion turbines, and is therefore not subject to the requirements of MACT YYYY.
MACT ZZZZ	National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines	This site contains a facility/facilities subject to MACT ZZZZ and will comply with all requirements of the rule.

APPENDIX A TCEQ FORMS & CHECKLISTS

The following attachments are included in this appendix in the following order:

- Form PI-7CERT
- CORE Data Form;
- General Applicability §106.4 Checklist;
- PBR §106.352(l) Checklist;
- PBR §106.512 Checklists;
- Table 29s; and
- Fee Payment Voucher.

Texas Commission on Environmental Quality
Certification and Registration for Permits by Rule
Form PI-7-CERT
(Page 1)

I. Registrant Information		
A. Company or Other Legal Customer Name: **LINN Operating, INC.**		
B. Company Official Contact Information (☒ Mr. ☐ Mrs. ☐ Ms. ☐ Other _____)		
Name: **Mr. Jeremy Ensz**		
Title: **Asset Manager**		
Mailing Address: **14701 Hertz Quail Springs Parkway**		
City: **Oklahoma City**	State: **OK**	ZIP Code: **73134**
Phone: **(405)241-2339**	Fax: **n/a**	
E-mail Address: **jensz@LINNEnergy.com**		
All PBR registration responses will be sent via e-mail unless a hard copy is specifically requested. The company official must initial here if hard copy is requested. _____ *(please initial)*		
C. Technical Contact Information (☒ Mr. ☐ Mrs. ☐Ms. ☐ Other _____)		
Name: **Paul Nowak**		
Title: **EH&S Representative**		
Company Name: **LINN Operating, INC.**		
Mailing Address: **600 Travis, Suite 4900**		
City: **Houston**	State: **TX**	ZIP Code: **77002**
Phone: (**712)904-6579**	Fax: **n/a**	
E-mail: **pnowak@LINNEnergy.com**		
II. Facility and Site Information		
A. Name and Type of Facility		
Facility Name: **F.R. Hill Compressor Station**		
Type of Facility:	☒ Permanent	☐ Temporary
For portable units, please provide the serial number of the equipment being authorized below.		
Serial No:	Serial No:	
B. Facility Location Information		
Street Address: **n/a**		
If there is no street address, provide written driving directions to the site and provide the closest city or town, county, and ZIP code for the site (attach description if additional space is needed).		
From the intersection of Hwy 488 & Hwy 84 in Fairfield, travel north on HWY 488 1.84 mi, veer right onto RR 1124 (FM 2570), travel 1.24 mi, veer rigth on RR 3285, travel 3.1 mi, turn right onto unnamed road, travel 1.2 mi, facility is west of the road.		
City: **Fairfield**	County: **Freestone**	ZIP Code: **75840**

II. Facility and Site Information *(continued)*	
C. TCEQ Core Data Form	
Is the Core Data Form (TCEQ Form Number 10400) attached?	☒ YES ☐ NO
If "NO," provide customer reference number (CN) and regulated entity number (RN) below.	
Customer Reference Number (CN): **603395690**	
Regulated Entity Number (RN): **105009245**	
D. TCEQ Account Identification Number (if known):	
E. PBR number(s) claimed under 30 TAC Chapter 106	
(List all the individual rule number(s) that are being claimed.)	
106.**352(l)**	106.
106.**512**	106.
106.	106.
F. Historical Standard Exemption or PBR	
Are you claiming a historical standard exemption or PBR?	☐ YES ☒ NO
If "YES," enter rule number(s) and associated effective date in the spaces provided below.	
Rule Number(s)	Effective Date
G. Previous Standard Exemption or PBR Registration Number	
Is this authorization for a change to an existing facility previously authorized under a standard exemption or PBR?	☐ YES ☒ NO
If "YES," enter previous standard exemption number(s) and PBR registration number(s), and associated effective dates in the spaces provided below.	
Standard Exemption and PBR Registration Number(s)	Effective Date
H. Other Facilities at this Site Authorized by Standard Exemption, PBR, or Standard Permit	
Are there any other facilities at this site that are authorized by an Air Standard Exemption, PBR, or Standard Permit?	☒ YES ☐ NO
If "YES," enter standard exemption number(s), PBR registration number(s), and Standard Permit registration number(s), and associated effective date in the spaces provided below.	
Standard Exemption, PBR Registration, and Standard Permit Registration Number(s)	Effective Date
Standard Permit Registration No. 87128	**2/5/2009**

II. Facility and Site Information *(continued)*	
I. Other Air Preconstruction Permits	
Are there any other air preconstruction permits at this site?	☐ YES ☒ NO
If "YES," enter permit number(s) in the spaces provided below.	
J. Affected Air Preconstruction Permits	
Does the PBR being claimed directly affect any permitted facility?	☐ YES ☒ NO
If "YES," enter the permit number(s) in the spaces provided below.	
K. Federal Operating Permit (FOP) Requirements (30 TAC Chapter 122 Applicability)	
1. Is this facility located at a site that is required to obtain an FOP pursuant to 30 TAC Chapter 122?	☐ YES ☒ NO ☐ To Be Determined
If the site currently has an existing FOP, enter the permit number:	
Check the requirements of 30 TAC Chapter 122 that will be triggered if this certification is accepted. *(check all that apply)* ☐ Initial Application for an FOP ☐ Significant Revision for an SOP ☐ Minor Revision for an SOP ☐ Operational Flexibility/Off Permit Notification for an SOP ☐ Revision for a GOP ☐ To be Determined ☐ None	
2. Identify the type(s) of FOP issued and/or FOP application(s) submitted/pending for the site. *(check all that apply)* ☐ SOP ☐ GOP ☐ GOP application/revision (submitted or under APD review) ☐ N/A ☐ SOP application/revision (submitted or under APD review)	
III. Fee Information (*See Section VII. for address to send fee or go to www.tceq.texas.gov/epay to pay online.)*	
A. Fee Requirements	
Is a fee required per Title 30 TAC § 106.50?	☒ YES ☐ NO
If "NO," specify the exception (*check all that apply*)	
1. Registration is solely to establish a federally enforceable emission limit.	☐ YES ☒ NO
2. Registration is within six months of an initial PBR review, and it is addressing deficiencies, administrative changes, or other allowed changes.	☐ YES ☒ NO
3. Registration is for a remediation project (30 TAC § 106.533).	☐ YES ☒ NO

III. Fee Information (*See Section VII. for address to send fee or go to www.tceq.texas.gov/epay to pay online.) (continued)*	
B. Fee Amount	
1. A $100 fee is required if *any* of the answers in III.B.1 are "YES."	
This business has less than 100 employees.	☐ YES ☒ NO
This business has less than 6 million dollars in annual gross receipts.	☐ YES ☒ NO
This registration is submitted by a governmental entity with a population of less than 10,000.	☐ YES ☒ NO
This registration is submitted by a non-profit organization.	☐ YES ☒ NO
2. A $450 fee is required for all other registrations.	
C. Payment Information	
Check/money order/transaction or voucher number:	
Individual or company name on check:	
Fee Amount: $	
Was fee paid online?	☐ YES ☐ NO
IV. Technical Information Including State And Federal Regulatory Requirements **Place a check next to the appropriate box to indicate what is included in your submittal.** **NOTE:** *Any technical or essential information needed to confirm that facilities are meeting the requirements of the PBR must be provided. Not providing key information could result in an automatic deficiency and voiding of the project.*	
A. PBR requirements (Checklists are optional; however, your review will go faster if you provide applicable checklists.)	
Did you demonstrate that the general requirements in 30 TAC § 106.4 are met?	☒ YES ☐ NO
Did you demonstrate that the individual requirements of the specific PBR are met?	☒ YES ☐ NO
B. Confidential Information (All pages properly marked "CONFIDENTIAL")	☐ YES ☒ NO
C. Process Flow Diagram	☒ YES ☐ NO
D. Process Description	☒ YES ☐ NO
E. Maximum Emissions Data and Calculations	☒ YES ☐ NO
Note: *If the facilities listed in this registration are subject to the Mass Emissions Cap & Trade program under* ***30 TAC Chapter 101, Subchapter H, Division 3,*** *the owner/operator of these facilities must possess NO_x allowances equivalent to the actual NO_x, emissions from these facilities.*	

IV. Technical Information Including State And Federal Regulatory Requirements *(continued)* **Place a check next to the appropriate box to indicate what is included in your submittal.** **Note:** Any technical or essential information needed to confirm that facilities are meeting the requirements of the PBR must be provided. Not providing key information could result in an automatic deficiency and voiding of the project.	
F. Is this certification being submitted to certify the emissions for the entire site?	☒ YES ☐ NO
If "NO," include a summary of the specific facilities and emissions being certified.	
G. Table 1(a) (Form 10153) Emission Point Summary	☒ YES ☐ NO
H. Distances from Property Line and Nearest Off-Property Structure	
Distance from this facility's emission release point to the nearest property line: **15 feet**	
Distance from this facility's emission release point to the nearest off-property structure: **>1,320 feet**	
I. Project Status	
Has the company implemented the project or waiting on a response from TCEQ? ☐Implemented ☒ Waiting	
J. Projected Start of Construction and Projected Start of Operation Dates	
Projected Start of Construction (provide date): **February 15, 2016**	
Projected Start of Operation (provide date): **January 2016**	
V. Delinquent Fees	
This form **will not be processed** until all delinquent fees and/or penalties owed to the TCEQ or the Office of the Attorney General on behalf of the TCEQ is paid in accordance with the Delinquent Fee and Penalty Protocol. For more information regarding Delinquent Fees and Penalties, go to the TCEQ Web site at: www.tceq.texas.gov/agency/delin/index.html.	
VI. Signature For Registration And Certification	
The signature below confirms that I have knowledge of the facts included in this application and that these facts are true and correct to the best of my knowledge and belief. I further state that to the best of my knowledge and belief, the project for which this application is made will not in any way violate any provision of the Texas Water Code (TWC), Chapter 7; the Texas Health and Safety Code, Chapter 382, the Texas Clean Air Act (TCAA); the air quality rules of the Texas Commission on Environmental Quality; or any local governmental ordinance or resolution enacted pursuant to the TCAA. I further state that I understand my signature indicates that this application meets all applicable nonattainment, prevention of significant deterioration, or major source of hazardous air pollutant permitting requirements. The signature further signifies awareness that intentionally or knowingly making or causing to be made false material statements or representations in the application is a criminal offense subject to criminal penalties.	
Name (printed):	
Signature (original signature required):	
Date:	

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission *(If other is checked please describe in space provided)*

☒ New Permit, Registration or Authorization *(Core Data Form should be submitted with the program application)*

☐ Renewal *(Core Data Form should be submitted with the renewal form)* ☐ Other

2. Attachments — Describe Any Attachments: *(ex. Title V Application, Waste Transporter Application, etc.)*

☒ Yes ☐ No — Permit 87128 Update

3. Customer Reference Number *(if issued)*	Follow this link to search for CN or RN numbers in Central Registry**	4. Regulated Entity Reference Number *(if issued)*
CN **603395690**		RN **105009245**

SECTION II: Customer Information

5. Effective Date for Customer Information Updates (mm/dd/yyyy)

6. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check only one of the following:*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other: _____

7. General Customer Information

☐ New Customer ☐ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State) ☒ No Change**

If "No Change" and Section I is complete, skip to Section III – Regulated Entity Information.

8. Type of Customer:	☐ Corporation	☐ Individual	☐ Sole Proprietorship- D.B.A
☐ City Government	☐ County Government	☐ Federal Government	☐ State Government
☐ Other Government	☐ General Partnership	☐ Limited Partnership	☐ Other:

9. Customer Legal Name *(If an individual, print last name first: ex: Doe, John)*	*If new Customer, enter previous Customer below*	*End Date:*

10. Mailing Address:							
	City		State		ZIP		ZIP + 4	

11. Country Mailing Information *(if outside USA)*	12. E-Mail Address *(if applicable)*

13. Telephone Number	14. Extension or Code	15. Fax Number *(if applicable)*
( ) -		( ) -

16. Federal Tax ID *(9 digits)*	17. TX State Franchise Tax ID *(11 digits)*	18. DUNS Number *(if applicable)*	19. TX SOS Filing Number *(if applicable)*

20. Number of Employees

☐ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

21. Independently Owned and Operated?

☐ Yes ☐ No

SECTION III: Regulated Entity Information

22. General Regulated Entity Information *(If 'New Regulated Entity" is selected below this form should be accompanied by a permit application)*

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information ☒ No Change** *(See below)*

**If "NO CHANGE" is checked and Section I is complete, skip to Section IV, Preparer Information.

23. Regulated Entity Name *(name of the site where the regulated action is taking place)*

24. Street Address of the Regulated Entity: *(No P.O. Boxes)*							
	City		State		ZIP		ZIP + 4	
25. Mailing Address:							
	City		State		ZIP		ZIP + 4	
26. E-Mail Address:							

27. Telephone Number	28. Extension or Code	29. Fax Number *(if applicable)*
( ) -		( ) -

30. Primary SIC Code (4 digits)	31. Secondary SIC Code (4 digits)	32. Primary NAICS Code (5 or 6 digits)	33. Secondary NAICS Code (5 or 6 digits)

34. What is the Primary Business of this entity? *(Please do not repeat the SIC or NAICS description.)*

Questions 34 – 37 address geographic location. Please refer to the instructions for applicability.

35. Description to Physical Location:	

36. Nearest City	County	State	Nearest ZIP Code

37. Latitude (N) In Decimal:			38. Longitude (W) In Decimal:		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form or the updates may not be made. If your Program is not listed, check other and write it in. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Industrial Hazardous Waste	☐ Municipal Solid Waste
☐ New Source Review – Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS	☐ Sludge
☐ Stormwater	☐ Title V – Air	☐ Tires	☐ Used Oil	☐ Utilities
☐ Voluntary Cleanup	☐ Waste Water	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:

SECTION IV: Preparer Information

40. Name:	Paul Nowak	41. Title:	EH&S Representative

42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(713) 904-6579		(832) 426-5963	pnowak@linnenergy.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 9 and/or as required for the updates to the ID numbers identified in field 39.

(See the Core Data Form instructions for more information on who should sign this form.)

Company:	Linn Operating, Inc.	Job Title:	EH&S Representative
Name *(In Print)* :	Paul Nowak	Phone:	(713) 904-6579
Signature:		Date:	

Texas Commission on Environmental Quality
Permit by Rule Applicability Checklist
Title 30 Texas Administrative Code § 106.4

The following checklist was developed by the Texas Commission on Environmental Quality (TCEQ), **Air Permits Division**, to assist applicants in determining whether or not a facility meets all of the applicable requirements. Before claiming a specific Permit by Rule (PBR), a facility must first meet all of the requirements of **Title 30 Texas Administrative Code § 106.4** (30 TAC § 106.4), "Requirements for Permitting by Rule." Only then can the applicant proceed with addressing requirements of the specific Permit by Rule being claimed.

The use of this checklist is not mandatory; however, it is the responsibility of each applicant to show how a facility being claimed under a PBR meets the general requirements of 30 TAC § 106.4 and also the specific requirements of the PBR being claimed. If all PBR requirements cannot be met, a facility will not be allowed to operate under the PBR and an application for a construction permit may be required under 30 TAC § 116.110(a).

Registration of a facility under a PBR can be performed by completing **Form PI-7** (Registration for Permits by Rule) or **Form PI-7-CERT** (Certification and Registration for Permits by Rule). The appropriate checklist should accompany the registration form. Check the most appropriate answer and include any additional information in the spaces provided. If additional space is needed, please include an extra page and reference the question number. The PBR forms, tables, checklists, and guidance documents are available from the TCEQ, Air Permits Division Web site at: www.tceq.texas.gov/permitting/air/nav/air_pbr.html.

1. 30 TAC § 106.4(a)(1) and (4): Emission limits	
List emissions in tpy for **each** facility (add additional pages or table if needed):	
• Are the SO_2, PM_{10}, VOC, or other air contaminant emissions claimed for **each** facility in this PBR submittal less than 25 tpy?	☒ YES ☐ NO
• Are the NO_x and CO emissions claimed for each facility in this PBR submittal less than 250 tpy?	☒ YES ☐ NO
*If the answer to both is "Yes," continue to the question below. If the answer to either question is "No," a **PBR cannot be claimed**.*	
Has any facility at the property had public notice and opportunity for comment under 30 TAC Section 116 for a regular permit or permit renewal? (This does not include public notice for voluntary emission reduction permits, grandfathered existing facility permits, or federal operating permits.)	☐ YES ☒ NO
If "Yes," skip to Section 2. If "No," continue to the questions below.	
If the site has had no public notice, please answer the following:	
• Are the SO_2, PM_{10}, VOC, or other emissions claimed for **all** facilities in this PBR submittal less than 25 tpy?	☒ YES ☐ NO
• Are the NO_x and CO emissions claimed for all facilities in this PBR submittal less than 250 tpy?	☒ YES ☐ NO
If the answer to both questions is "Yes," continue to Section 2.	
*If the answer to either question is "No," **a PBR cannot be claimed**. A permit will be required under Chapter 116.*	

2. 30 TAC § 106.4(a)(2): Nonattainment check	
• Are the facilities to be claimed under this PBR located in a designated ozone nonattainment county?	☐ YES ☒ NO
If "Yes," please indicate which county by checking the appropriate box to the right.	
(Marginal) - Hardin, Jefferson, and Orange counties:	☐ BPA
(Moderate) - Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties:	☐ HGA
(Moderate) - Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant counties	☐ DFW
If "Yes," to any of the above, continue to the next question. If "No," continue to Section 3.	
• Does this project trigger a nonattainment review?	☐ YES ☐ NO
Does this project trigger a nonattainment review?	
• Is the project's potential to emit (PTE) for emissions of VOC or NO_x increasing by 100 tpy or more? *PTE is the maximum capacity of a stationary source to emit any air pollutant under its worst-case physical and operational design unless limited by a permit, rules, or made federally enforceable by a certification.*	☐ YES ☐ NO
• Is the site an existing major nonattainment site and are the emissions of VOC or NO_x increasing by 40 tpy or more?	☐ YES ☐ NO
If needed, attach contemporaneous netting calculations per nonattainment guidance.	
Additional information can be found at: www.tceq.texas.gov/permitting/air/forms/newsourcereview/tables/nsr_table8.html and www.tceq.texas.gov/permitting/air/nav/air_docs_newsource.html	
*If "Yes," to any of the above, the project is a major source or a major modification and **a PBR may not be used**. A Nonattainment Permit review must be completed to authorize this project. If "No," continue to Section 3.*	
3. 30 TAC § 106.4(a)(3): Prevention of Significant Deterioration (PSD) check	
Does this project trigger a review under PSD rules?	
To determine the answer, review the information below:	
• Are emissions of any regulated criteria pollutant increasing by 100 tpy of any criteria pollutant at a named source?	☐ YES ☒ NO
• Are emissions of any criteria pollutant increasing by 250 tpy of any criteria pollutant at an unnamed source?	☐ YES ☒ NO
• Are emissions increasing above significance levels at an existing major site?	☐ YES ☒ NO
PSD information can be found at: www.tceq.texas.gov/assets/public/permitting/air/Forms/NewSourceReview/Tables/10173tbl.pdf and www.tceq.texas.gov/permitting/air/nav/air_docs_newsource.html *If "Yes," to any of the above, **a PBR may not be used**. A PSD Permit review must be completed to authorize the project. If "No," continue to Section 4.*	

Permit by Rule Applicability Checklist
Title 30 Texas Administrative Code § 106

4. 30 TAC § 106.4(a(6): Federal Requirements	
• Will all facilities under this PBR meet applicable requirements of Title 40 Code of Federal Regulations (40 CFR) Part 60, New Source Performance Standards (NSPS)?	☒ YES ☐ NO ☐ NA
If "Yes," which Subparts are applicable?	**NSPS JJJJ**
• Will all facilities under this PBR meet applicable requirements of 40 CFR Part 63, Hazardous Air Pollutants Maximum Achievable Control Technology (MACT) standards?	☒ YES ☐ NO ☐ NA
If "Yes," which Subparts are applicable?	**MACT HH, MACT ZZZZ**
• Will all facilities under this PBR meet applicable requirements of 40 CFR Part 61, National Emissions Standards for Hazardous Air Pollutants (NESHAPs)?	☐ YES ☐ NO ☒ NA
If "Yes," which Subparts are applicable?	
If "Yes" to any of the above, please attach a discussion of how the facilities will meet any applicable standards.	

5. 30 TAC § 106.4(a)(7): PBR prohibition check	
• Are there any air permits at the site containing conditions which prohibit or restrict the use of PBRs?	☐ YES ☒ NO
If "Yes," PBRs may not be used or their use must meet the restrictions of the permit. A new permit or permit amendment may be required.	
List permit number(s):	

6. 30 TAC § 106.4(a)(8): NO_x Cap and Trade	
• Is the facility located in Harris, Brazoria, Chambers, Fort Bend, Galveston, Liberty, Montgomery, or Waller County?	☐ YES ☒ NO
If "Yes," answer the question below. If "No," continue to Section 7.	
• Will the proposed facility or group of facilities obtain required allowances for NO_x if they are subject to 30 TAC Chapter 101, Subchapter H, Division 3 (relating to the Mass Emissions Cap and Trade Program)?	☐ YES ☐ NO

Permit by Rule Applicability Checklist
Title 30 Texas Administrative Code § 106

7. Highly Reactive Volatile Organic Compounds (HRVOC) check		
• Is the facility located in Harris County?		☐ YES ☒ NO
If "Yes," answer the next question. If "No," skip to the box below.		
• Will the project be constructed after June 1, 2006?		☐ YES ☐ NO
If "Yes," answer the next question. If "No," skip to the box below.		
• Will one or more of the following HRVOC be emitted as a part of this project?		☐ YES ☐ NO
If "Yes," complete the information below:		
	lb/hr	tpy
► 1,3-butadiene		
► all isomers of butene (e.g., isobutene [2-methylpropene or isobutylene])		
► alpha-butylene (ethylethylene)		
► beta-butylene (dimethylethylene, including both cis- and trans-isomers)		
► ethylene		
► propylene		
• Is the facility located in Brazoria, Chambers, Fort Bend, Galveston, Liberty, Montgomery, or Waller County?		☐ YES ☒ NO
If "Yes," answer the next question. If "No," the checklist is complete.		
• Will the project be constructed after June 1, 2006?		☐ YES ☐ NO
If "Yes," answer the next question. If "No," the checklist is complete.		
• Will one or more of the following HRVOC be emitted as a part of this project?		☐ YES ☐ NO
If "Yes," complete the information below:		
	lb//hr	tpy
► Ethylene		
► Propylene		

Oil and Gas Handling and Production Facilities
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.352(l)

Check the most appropriate answer and include any technical information in the spaces provided. If additional space is needed, please include an extra page that references this checklist. The forms, checklists, and guidance documents are available from the Texas Commission on Environmental Quality (TCEQ), Air Permits Division Web site at: www.tceq.texas.gov/permitting/air/permitbyrule/subchapter-o/oil_and_gas.html. If you have any questions, or need additional assistance, please contact the Air Permits Division at (512) 239-1250.

The facility can register by submitting this application and any supporting documentation. Below is a checklist to ensure you have provided all appropriate documentation. For sites that require registration or if the company chooses to register the site with the TCEQ, a Core Data Form is required with this checklist.

For additional assistance with your application, including resources to help calculate your emissions, please visit the Small Business and Local Government Assistance (SBLGA) webpage at the following link: www.TexasEnviroHelp.org

This checklist is for use by the operator to ensure a complete application.

Have you included each of the following items in the application?

- ☒ Process Description.
- ☒ Plot plan or area map.
- ☒ TCEQ Oil and Gas Emission Calculation Spreadsheet (or equivalent).
- ☒ Detailed summary of maximum emissions estimates with supporting documentation, such as result reports from any emission estimation computer program.
- ☒ Gas and Liquid analyses. If a site specific analysis is not submitted, please provide justification as to why a representative site was used.
- ☒ Technical documents (manufacturer's specification sheet, operational design sheets)
- ☒ State and Federal applicability.
- ☒ Core Data Form (for new sites that have never been registered with the TCEQ).

General Information and Questions/Descriptions

Is the project located in one of the Barnett Shale counties and did the start of construction or modification begin on or after April 1, 2011? ☐ Yes ☒ No

[**Note:** *Counties included in the Barnett Shale area: Cooke, , Dallas, Denton, , Ellis, Erath, Hill, Hood, Jack, Johnson, Montague, Palo Pinto, Parker, Somervell, Tarrant, and Wise counties.*]

For what is considered start of construction see: www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/factsheet-const.pdf

*If **"Yes,"** do not complete this checklist. The project is subject to the requirements of §106.352(a)-(k). Additional information for Barnett Shale area projects can be found at:* **www.tceq.texas.gov/permitting/air/permitbyrule/subchapter-o/oil_and_gas.html.**

Are the total site-wide emissions from all facilities claimed under 30 TAC §106.352(l) less than 25 tpy VOC, 250 tpy NOx, 250 tpy CO, and 25 tpy SO_2? ☒ Yes ☐ No

Oil and Gas Handling and Production Facilities
Title 30 Texas Administrative Code § 106.352(l)

General Information and Questions/Descriptions *(continued)*		
Does any facility at the site handle a stream with more than 24 ppm hydrogen sulfide (H_2S)?	☐ Yes	☒ No
*If **"Yes,"** answer the following questions.*		
Are there flares, engines, or turbines at the site?	☒ Yes	☐ No
*If **"Yes,"** attach supporting documentation to demonstrate compliance with the requirements.* ***Additional information and checklists can be found at:*** *§106.492 Flares:* www.tceq.texas.gov/permitting/air/permitbyrule/subchapter-v/flares.html *§106.512 Stationary Engines and turbines:* www.tceq.texas.gov/permitting/air/permitbyrule/subchapter-w/stationary_eng_turb.html		
Does any facility at the site handle a stream with more than 24 ppm hydrogen sulfide (H_2S)?	☐ Yes	☒ No
*If **"Yes,"** answer the following questions. Registration is required prior to the start of operation.* *If **"No,"** The questions below are not applicable.*		
Indicate the actual distance from the nearest emissions point to the nearest offsite receptor(ft.): >100 ft [**Note:** *An offsite receptor includes any recreational area, residence, or other structure not occupied or used solely by the owner or operator of the facility. A facility handling sour gas must be located at least 1/4 mile from the nearest offsite receptor.*]		
Indicate the total actual emission rate of sulfur compounds, excluding sulfur oxides, from all vents (lb/hr.): 0.0 lb/hr		
Does the height of all vents at the site emitting sulfur compounds meet the minimum required height based on the H_2S emission rate in 106.352(l)(4)? **NOT APPLICABLE** [**Note:** *Truck loading and fugitive sources are not considered vents.*]	☐ Yes	☐ No

Recordkeeping: To demonstrate compliance with the requirements of the PBR, sufficient records must be maintained at all times. The records must be made available immediately upon request to the commission or any air pollution control program having jurisdiction. If you have any questions about the recordkeeping requirements, contact the Air Permits Division or the Air Program in the TCEQ Regional Office for the region in which the site is located.

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response		
Will the engine or turbine be used as a replacement at an oil and gas site and does it meet all the requirements of the policy memo entitled, "Replacement of All Engine and Turbine Components for Oil and Gas Production?"		☐ YES ☒ NO
If "YES," registration is not required for like-kind replacements of engine or turbine components. *If "NO," please continue.*		
Rule	**Introduction**	
(1)	Is the engine or turbine rated less than 240 hp?	☐ YES ☒ NO
If "YES," then registration is not required, but the facility must comply with conditions (5) and (6) of this rule. *If "NO," then registration is required and the facility must be registered by submitting a completed Form PI-7 and Table 29 or Table 31, as applicable, within 10 days after construction begins.*		
Indicate the type of equipment (pick one): ☒ Engine ☐ Turbine		
If an engine, continue to the questions regarding "Engines." *If a turbine, skip to the questions regarding "Gas Turbines."*		
Rule	**Engines**	
(2)	Is the engine rated at 500 hp or greater?	☒ YES ☐ NO
If "NO," the engine is between 240 hp and 500 hp. The engine must be registered by submitting a completed Form PI-7 and a Table 29 within 10 days after construction begins and must comply with the conditions in §§ 106.512(5) and (6). Skip to the questions regarding § 106.512(4). *If "YES," in addition to registration, the engine must operate in compliance with the following nitrogen (NO_x) emission limit(s). Check the limit(s) applicable to this engine by answering the following:*		
(2)(A)(i)	The engine is a gas-fired, rich-burn engine and will not exceed 2.0 grams per horsepower hour (g/hp-hr) under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x:_____ (g/hp-hr)		
(2)(A)(ii)	The engine is a spark-ignited, gas-fired, lean-burn engine or any compression-ignited, dual fuel-fired engine manufactured new after June 18, 1992, and will not exceed 2.0 g/hp-hr NO_x at manufacturer's rated full load and speed at all times; except, the engine will not exceed 5.0 g/hp-hr NO_x under reduced speed and 80% and 100% of full torque conditions.	☒ YES ☐ NO
Indicate grams per horsepower hour NO_x: ENG-05: 2.0 g/hp-hr_____ (g/hp-hr)		

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response		
Rule	**Engines (*continued*)**	
(2)(A)(iii)	The engine is any spark-ignited, lean-burn two-cycle or four-cycle engine or any compression-ignited, dual fuel-fired engine rated 825 hp or greater and manufactured between September 23, 1982 and June 18, 1992, and will not exceed 5.0 g/hp-hr NO_x under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(A)(iv)	The engine is any spark-ignited, gas-fired, lean-burn, four-cycle engine or compression-ignited, dual-fuel-fired engine that was manufactured before June 18, 1992, and is rated less than 825 hp, or was manufactured before September 23, 1982, and will not exceed 5.0 g/hp-hr NO_x at manufacturer's rated full load and speed at all times; except, the engine will not exceed 8.0 g/hp-hr NO_x under reduced speed and 80% and 100% of full torque conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(A)(v)	The engine is any spark-ignited, gas-fired, two-cycle, lean-burn engine that was manufactured before June 18, 1992, and is rated less than 825 hp, or was manufactured before September 23, 1982, and will not exceed 8.0 g/hp-hr NO_x under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(A)(vi)	The engine is any compression-ignited, liquid-fired engine and will not exceed 11.0 g/hp-hr NO_x under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(B)	Does the engine require an automatic air-fuel ratio controller to meet the NO_x limit(s) above?	☒ YES ☐ NO
(2)(B)	For spark-ignited gas-fired or compression-ignited dual fuel-fired engines, is the engine required to have an automatic air-fuel ratio controller under condition (2)(B) of the PBR?	☒ YES ☐ NO
(2)(C)	Are you aware of and accept responsibility for the record and testing requirements as specified in (2)(C) of the PBR?	☒ YES ☐ NO

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response		
Rule	**Gas Turbines**	
(3)	Is the turbine rated 500 hp or more?	☐ YES ☐ NO
If "NO," the turbine is between 240 hp and 500 hp. The engine only needs to be registered by submitting a completed Form PI-7 and a Table 31 within 10 days after construction begins. *If "YES," in addition to registration, the turbine must operate in compliance with the following emission limit(s) and must comply with the conditions in §§ 106.512(5)(6). Skip to questions regarding "Additional Requirements."*		
(3)(A)	Will the emissions of NO_x exceed 3.0 g/hp-hr for gas firing?	☐ YES ☐ NO
(3)(B)	Will the turbine meet all applicable NO_x and sulfur dioxide (or fuel sulfur) emission limitations, monitoring requirements, and reporting requirements of 40 CFR Part 60, NSPS Subpart GG?	☐ YES ☐ NO
Rule	**Additional Requirements**	
(4)	Is the engine or turbine rated less than 500 hp or used for temporary replacement purposes?	☐ YES ☒ NO
If "NO," continue to next question. *If "YES," the equipment does not have to meet the emission limits of §§ 106.512(2) and (3). However, the temporary replacement equipment can only remain in service for a maximum of 90 days.*		
(5)	What type of fuel will be used and will the fuel meet the requirements of the PBR?	☒ YES ☐ NO
Indicate the fuel(s) used. ☐ Natural gas ☐ Liquid Petroleum gas ☒ Field gas ☐ Liquid fuel		
(6)	Does the installation comply with the National Ambient Air Quality Standards (NAAQS)?	☒ YES ☐ NO
Indicate which method is used and attach the modeling report and/or calculations and diagrams to support the selected method. ☒ Modeling ☐ Stack height ☐ Facility emissions and property line distance		
(6)	Have you included a modeling report and/or calculations and diagrams to support the selected NAAQS compliance determination method?	☒ YES ☐ NO
Rule	**Other Applicable Rules and Regulations**	
For the following four questions, please refer to the Electric Generators under Permit by Rule policy memo from October 2006.		
Is the engine or turbine used to generate electricity?		☐ YES ☒ NO
If "NO," the following do not apply.		

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response	
Rule	**Other Applicable Rules and Regulations (continued)**
Will the engine or turbine be used to generate electricity to operate facilities authorized by a New Source Review Permit? ☐ YES ☐ NO	
If "YES," the engine or turbine does not qualify for this PBR and authorization must be obtained through a permit amendment.	
If the engine or turbine is used to generate electricity, will it be exclusively for on-site use at locations which cannot be connected to an electric grid? ☐ YES ☐ NO	
If "YES," describe why access to the electric grid is not available. *If "NO," the engine or turbine does not qualify for this PBR.*	
Has an Electric Generating Unit Standard Permit been issued for one of the following activities for which the engine or turbine will only be used to generate electricity? ☐ YES ☐ NO	
☐ Engines or turbines used to provide power for the operation of facilities registered under the Air Quality Standard Permit for Concrete Batch Plants. ☐ Engines or turbines satisfying the conditions for facilities permitted by rule under 30 TAC Chapter 106, Subchapter E (relating to Aggregate and Pavement). ☐ Engines or turbines used exclusively to provide power to electric pumps used for irrigating crops	
If "NO," the engine or turbine does not qualify for this PBR.	
If the engine or turbine is located in the Houston/Galveston nonattainment area, is the site subject to the Mass Emission Cap and Trade Program? ☐ YES ☐ NO	
Why or Why Not:	
Is the facility subject to 30 TAC Chapter 115? ☐ YES ☒ NO	
Why or Why Not: **The facility is not located in one of the listed non-attainment areas.**	
Is the facility subject to 30 TAC Chapter 117? ☐ YES ☒ NO	
Why or Why Not: **The facility is not located in one of the listed non-attainment areas.**	

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
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Other Applicable Rules and Regulations (continued)	
Is the facility subject to 40 CFR Part 60, NSPS Subpart D?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart Da?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart Db?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart Dc?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart GG?	☐ YES ☒ NO
Why or Why Not: **The engine is not a stationary gas turbine.**	
Is the facility subject to 40 CFR Part 63, MACT Subpart YYYY?	☐ YES ☒ NO
Why or Why Not: **The engine is not a stationary gas turbine.**	
Is the facility subject to 40 CFR Part 63, MACT Subpart ZZZZ	☒ YES ☐ NO
Why or Why Not: **The engine was constructed prior to June 12, 2006 and has not been reconstructed or modified since.**	
Is the facility subject to 40 CFR Part 63, MACT Subpart PPPPP?	☐ YES ☒ NO
Why or Why Not: **The engine is not an engine test cell or stand.**	

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
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Questions/Description and Response		
Will the engine or turbine be used as a replacement at an oil and gas site and does it meet all the requirements of the policy memo entitled, "Replacement of All Engine and Turbine Components for Oil and Gas Production?"		☐ YES ☒ NO
If "YES," registration is not required for like-kind replacements of engine or turbine components. *If "NO," please continue.*		
Rule	**Introduction**	
(1)	Is the engine or turbine rated less than 240 hp?	☐ YES ☒ NO
If "YES," then registration is not required, but the facility must comply with conditions (5) and (6) of this rule. *If "NO," then registration is required and the facility must be registered by submitting a completed Form PI-7 and Table 29 or Table 31, as applicable, within 10 days after construction begins.*		
Indicate the type of equipment (pick one): ☒ Engine ☐ Turbine		
If an engine, continue to the questions regarding "Engines." *If a turbine, skip to the questions regarding "Gas Turbines."*		
Rule	**Engines**	
(2)	Is the engine rated at 500 hp or greater?	☒ YES ☐ NO
If "NO," the engine is between 240 hp and 500 hp. The engine must be registered by submitting a completed Form PI-7 and a Table 29 within 10 days after construction begins and must comply with the conditions in §§ 106.512(5) and (6). Skip to the questions regarding § 106.512(4). *If "YES," in addition to registration, the engine must operate in compliance with the following nitrogen (NO_x) emission limit(s). Check the limit(s) applicable to this engine by answering the following:*		
(2)(A)(i)	The engine is a gas-fired, rich-burn engine and will not exceed 2.0 grams per horsepower hour (g/hp-hr) under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x:_____ (g/hp-hr)		
(2)(A)(ii)	The engine is a spark-ignited, gas-fired, lean-burn engine or any compression-ignited, dual fuel-fired engine manufactured new after June 18, 1992, and will not exceed 2.0 g/hp-hr NO_x at manufacturer's rated full load and speed at all times; except, the engine will not exceed 5.0 g/hp-hr NO_x under reduced speed and 80% and 100% of full torque conditions.	☒ YES ☐ NO
Indicate grams per horsepower hour NO_x: **EPN-07: 0.5 g/hp-hr**_____ (g/hp-hr)		

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response		
Rule	**Engines (*continued*)**	
(2)(A)(iii)	The engine is any spark-ignited, lean-burn two-cycle or four-cycle engine or any compression-ignited, dual fuel-fired engine rated 825 hp or greater and manufactured between September 23, 1982 and June 18, 1992, and will not exceed 5.0 g/hp-hr NO_x under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(A)(iv)	The engine is any spark-ignited, gas-fired, lean-burn, four-cycle engine or compression-ignited, dual-fuel-fired engine that was manufactured before June 18, 1992, and is rated less than 825 hp, or was manufactured before September 23, 1982, and will not exceed 5.0 g/hp-hr NO_x at manufacturer's rated full load and speed at all times; except, the engine will not exceed 8.0 g/hp-hr NO_x under reduced speed and 80% and 100% of full torque conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(A)(v)	The engine is any spark-ignited, gas-fired, two-cycle, lean-burn engine that was manufactured before June 18, 1992, and is rated less than 825 hp, or was manufactured before September 23, 1982, and will not exceed 8.0 g/hp-hr NO_x under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(A)(vi)	The engine is any compression-ignited, liquid-fired engine and will not exceed 11.0 g/hp-hr NO_x under all operating conditions.	☐ YES ☒ NO
Indicate grams per horsepower hour NO_x: _____ g/hp-hr		
(2)(B)	Does the engine require an automatic air-fuel ratio controller to meet the NO_x limit(s) above?	☐ YES ☒ NO
(2)(B)	For spark-ignited gas-fired or compression-ignited dual fuel-fired engines, is the engine required to have an automatic air-fuel ratio controller under condition (2)(B) of the PBR? **(Variable Fuel)**	☒ YES ☐ NO
(2)(C)	Are you aware of and accept responsibility for the record and testing requirements as specified in (2)(C) of the PBR?	☒ YES ☐ NO

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response		
Rule	**Gas Turbines**	
(3)	Is the turbine rated 500 hp or more?	☐ YES ☐ NO
If "NO," the turbine is between 240 hp and 500 hp. The engine only needs to be registered by submitting a completed Form PI-7 and a Table 31 within 10 days after construction begins. *If "YES," in addition to registration, the turbine must operate in compliance with the following emission limit(s) and must comply with the conditions in §§ 106.512(5)(6). Skip to questions regarding "Additional Requirements."*		
(3)(A)	Will the emissions of NO_x exceed 3.0 g/hp-hr for gas firing?	☐ YES ☐ NO
(3)(B)	Will the turbine meet all applicable NO_x and sulfur dioxide (or fuel sulfur) emission limitations, monitoring requirements, and reporting requirements of 40 CFR Part 60, NSPS Subpart GG?	☐ YES ☐ NO
Rule	**Additional Requirements**	
(4)	Is the engine or turbine rated less than 500 hp or used for temporary replacement purposes?	☐ YES ☒ NO
If "NO," continue to next question. *If "YES," the equipment does not have to meet the emission limits of §§ 106.512(2) and (3). However, the temporary replacement equipment can only remain in service for a maximum of 90 days.*		
(5)	What type of fuel will be used and will the fuel meet the requirements of the PBR?	☒ YES ☐ NO
Indicate the fuel(s) used. ☐ Natural gas ☐ Liquid Petroleum gas ☒ Field gas ☐ Liquid fuel		
(6)	Does the installation comply with the National Ambient Air Quality Standards (NAAQS)?	☒ YES ☐ NO
Indicate which method is used and attach the modeling report and/or calculations and diagrams to support the selected method. ☒ Modeling ☐ Stack height ☐ Facility emissions and property line distance		
(6)	Have you included a modeling report and/or calculations and diagrams to support the selected NAAQS compliance determination method?	☒ YES ☐ NO
Rule	**Other Applicable Rules and Regulations**	
For the following four questions, please refer to the Electric Generators under Permit by Rule policy memo from October 2006.		
Is the engine or turbine used to generate electricity?		☐ YES ☒ NO
If "NO," the following do not apply.		

Texas Commission on Environmental Quality
Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
Title 30 Texas Administrative Code § 106.512

Questions/Description and Response	
Rule	**Other Applicable Rules and Regulations (continued)**
Will the engine or turbine be used to generate electricity to operate facilities authorized by a New Source Review Permit? ☐ YES ☐ NO	
If "YES," the engine or turbine does not qualify for this PBR and authorization must be obtained through a permit amendment.	
If the engine or turbine is used to generate electricity, will it be exclusively for on-site use at locations which cannot be connected to an electric grid? ☐ YES ☐ NO	
If "YES," describe why access to the electric grid is not available. *If "NO," the engine or turbine does not qualify for this PBR.*	
Has an Electric Generating Unit Standard Permit been issued for one of the following activities for which the engine or turbine will only be used to generate electricity? ☐ YES ☐ NO	
☐ Engines or turbines used to provide power for the operation of facilities registered under the Air Quality Standard Permit for Concrete Batch Plants. ☐ Engines or turbines satisfying the conditions for facilities permitted by rule under 30 TAC Chapter 106, Subchapter E (relating to Aggregate and Pavement). ☐ Engines or turbines used exclusively to provide power to electric pumps used for irrigating crops	
If "NO," the engine or turbine does not qualify for this PBR.	
If the engine or turbine is located in the Houston/Galveston nonattainment area, is the site subject to the Mass Emission Cap and Trade Program? ☐ YES ☐ NO	
Why or Why Not:	
Is the facility subject to 30 TAC Chapter 115? ☐ YES ☒ NO	
Why or Why Not: **The facility is not located in one of the listed non-attainment areas.**	
Is the facility subject to 30 TAC Chapter 117? ☐ YES ☒ NO	
Why or Why Not: **The facility is not located in one of the listed non-attainment areas.**	

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Stationary Engines and Turbines
Air Permits by Rule (PBR) Checklist
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Other Applicable Rules and Regulations (continued)	
Is the facility subject to 40 CFR Part 60, NSPS Subpart D?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart Da?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart Db?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart Dc?	☐ YES ☒ NO
Why or Why Not: **The engine is not a steam-generating unit.**	
Is the facility subject to 40 CFR Part 60, NSPS Subpart GG?	☐ YES ☒ NO
Why or Why Not: **The engine is not a stationary gas turbine.**	
Is the facility subject to 40 CFR Part 63, MACT Subpart YYYY?	☐ YES ☒ NO
Why or Why Not: **The engine is not a stationary gas turbine.**	
Is the facility subject to 40 CFR Part 63, MACT Subpart ZZZZ	☒ YES ☐ NO
Why or Why Not: **The engine will comply with MACT ZZZZ by complying with NSPS JJJJ.**	
Is the facility subject to 40 CFR Part 63, MACT Subpart PPPPP?	☐ YES ☒ NO
Why or Why Not: **The engine is not an engine test cell or stand.**	

Texas Commission on Environmental Quality
Table 29 Reciprocating Engines

I. Engine Data

Manufacturer:	Model No.	Serial No.	Manufacture Date:
Caterpillar	G3516TALE	3RC01060	Pre-June 12, 2006
Rebuilds Date:	**No. of Cylinders:**	**Compression Ratio:**	**EPN:**
NA	16		ENG-05

Application: ☒ Gas Compression ☐ Electric Generation ☐ Refrigeration ☐ Emergency/Stand by

☒ 4 Stroke Cycle ☐ 2 Stroke Cycle ☒ Carbureted ☒ Spark Ignited ☐ Dual Fuel ☐ Fuel Injected

☐ Diesel ☐ Naturally Aspirated ☐ Blower /Pump Scavenged ☐ Turbo Charged and I.C. ☐ Turbo Charged

☐ Intercooled ☐ I.C. Water Temperature ☒ Lean Burn ☐ Rich Burn

Ignition/Injection Timing: Fixed: Yes Variable:

Manufacture Horsepower Rating: 1,085 Proposed Horsepower Rating: 1,085

Discharge Parameters

Stack Height (Feet)	Stack Diameter (Feet)	Stack Temperature (^{o}F)	Exit Velocity (FPS)
24	1.17	842	101

II. Fuel Data

Type of Fuel: ☒ Field Gas ☐ Landfill Gas ☐ LP Gas ☐ Natural Gas ☐ Digester Gas ☐ Diesel

Fuel Consumption (BTU/bhp-hr): 7,450 Heat Value: 1,015.3 (HHV) 923 (LHV)

Sulfur Content (grains/100 scf - weight %): 0.554 gr/100 scf

III. Emission Factors (Before Control)

NO_X		CO		SO_2		VOC		Formaldehyde		PM10	
g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv
2.0		1.86									

Source of Emission Factors: ☒ Manufacturer Data ☒ AP-42 ☐ Other (specify):

IV. Emission Factors (Post Control)

NO_X		CO		SO2		VOC		Formaldehyde		PM10	
g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv

Method of Emission Control: ☐ NSCR Catalyst ☒ Lean Operation ☐ Parameter Adjustment

☐ Stratified Charge ☐ JLCC Catalyst ☐ Other (Specify):_____

Note: *Must submit a copy of any manufacturer control information that demonstrates control efficiency.*

Is Formaldehyde included in the VOCs? ☒ Yes ☐ No

V. Federal and State Standards (Check all that apply)

☐ NSPS JJJJ ☒ MACT ZZZZ ☐ NSPS IIII ☐ Title 30 Chapter 117 - List County: _____

VI. Additional Information

1. Submit a copy of the engine manufacturer's site rating or general rating specification data.
2. Submit a typical fuel gas analysis, including sulfur content and heating value. For gaseous fuels, provide mole percent of constituents.
3. Submit description of air/fuel ratio control system (manufacturer information is acceptable).

Texas Commission on Environmental Quality
Table 29 Reciprocating Engines

I. Engine Data

Manufacturer:	Model No.	Serial No.	Manufacture Date:
Caterpillar	G3516B	JEF03338	2/2/2015
Rebuilds Date:	**No. of Cylinders:**	**Compression Ratio:**	**EPN:**
NA		8:1	ENG-07

Application: ☒ Gas Compression ☐ Electric Generation ☐ Refrigeration ☐ Emergency/Stand by

☒ 4 Stroke Cycle ☐ 2 Stroke Cycle ☐ Carbureted ☒ Spark Ignited ☐ Dual Fuel ☐ Fuel Injected

☐ Diesel ☐ Naturally Aspirated ☐ Blower /Pump Scavenged ☒ Turbo Charged and I.C. ☐ Turbo Charged

☐ Intercooled ☐ I.C. Water Temperature ☒ Lean Burn ☐ Rich Burn

Ignition/Injection Timing: Fixed: Yes Variable:

Manufacture Horsepower Rating: 1,380 Proposed Horsepower Rating: 1,380

Discharge Parameters

Stack Height (Feet)	Stack Diameter (Feet)	Stack Temperature (^{o}F)	Exit Velocity (FPS)
24	1.33	992	109

II. Fuel Data

Type of Fuel: ☒ Field Gas ☐ Landfill Gas ☐ LP Gas ☐ Natural Gas ☐ Digester Gas ☐ Diesel

Fuel Consumption (BTU/bhp-hr): 8,256 Heat Value: 1015.3 (HHV) 923 (LHV)

Sulfur Content (grains/100 scf - weight %): 0.554 gr/100 scf

III. Emission Factors (Before Control)

NO_X		CO		SO_2		VOC		Formaldehyde		PM10	
g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv
0.5		2.43				0.48		0.44			

Source of Emission Factors: ☒ Manufacturer Data ☒ AP-42 ☐ Other (specify):

IV. Emission Factors (Post Control)

NO_X		CO		SO2		VOC		Formaldehyde		PM10	
g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv	g/hp-hr	ppmv
		2				0.48		0.11			

Method of Emission Control: ☐ NSCR Catalyst ☒ Lean Operation ☐ Parameter Adjustment

☐ Stratified Charge ☐ JLCC Catalyst ☒ Other (Specify): Oxidative Catalvst

Note: *Must submit a copy of any manufacturer control information that demonstrates control efficiency.*

Is Formaldehyde included in the VOCs? ☐ Yes ☒ No

V. Federal and State Standards (Check all that apply)

☒ NSPS JJJJ ☒ MACT ZZZZ ☐ NSPS IIII ☐ Title 30 Chapter 117 - List County: _____

VI. Additional Information

1. Submit a copy of the engine manufacturer's site rating or general rating specification data.
2. Submit a typical fuel gas analysis, including sulfur content and heating value. For gaseous fuels, provide mole percent of constituents.
3. Submit description of air/fuel ratio control system (manufacturer information is acceptable).

APPENDIX B EMISSION CALCULATIONS

This appendix contains detailed emission calculations for this PBR authorization.

Oil and Gas Emissions Spreadsheet

Revised 10/2/2014

General Notes

***** Before beginning, make sure to enable macros, so that this spreadsheet will run properly. *** See the links below for more information on creating a trusted location and enabling macros for this spreadsheet.**

Enable Macro Link

Trusted Location Link

See comments in individual cells and other written notes. Cells with red corners contain comments; place cursor anywhere in a cell which has a red corner, to view comment. These were added to guide you through using this spreadsheet and make it as easy as possible to use.

This spreadsheet should be used as follows: (1) Enter information into this Facility Information spreadsheet tab, (2) after running the macro (which is explained below), fill out the emission calculation tabs, (3) populate the Emissions Summary table (you press a button on the Emissions Summary tab and the macro will populate the table with the values from the emission calculation tabs), and (4) go through the impacts review tabs (if applicable). This basically means estimate what each of the individual source emissions are, then summarize them in a table, then evaluate the impact of the emissions (if impacts review is applicable).

If you want to use any of the impacts review tabs, you will need to have answered "Yes" to the initial question of "Are you using this to meet the new Barnett Shale area rule requirements?". You can press the "Reset" button at the bottom of this tab to have the question pop up again.

Yellow cells require information to be entered. Red cells contain calculated values.

Worst case emissions must be estimated on both an hourly and annual basis for air permitting purposes.

Hourly emissions must be based on worst case maximum parameters realistically expected to occur over the course of any one hour. As an example, where ambient temperature is used as a parameter to estimate hourly emissions, the maximum temperature from the hottest day of the year must be used.

Annual emissions can be based on average parameters. As an example, where ambient temperature is used as a parameter to estimate annual emissions, the average ambient temperature may be used.

Planned Maintenance, Start-up, and Shutdown (MSS) : As of January 5, 2014, all planned emissions from oil and gas facilities must be authorized. This includes planned MSS emissions.
Planned MSS emissions may be authorized under 30 TAC § 106.359, 30 TAC § 106.352(a)-(k), or the non-rule standard permit if:
1. the emissions are the direct result of a planned maintenance activity, or
2. the root cause of the emissions is from a planned maintenance activity.

Oil and Gas Site General Information	
Administrative Information	
Company Name	LINN Operating, Inc.
Facility/Well Name	F.R. Hill Compressor Station
Field Name	
Nearest City/Town	Fairfield
API Number/SIC Code	1311
Latitude/Longitude	31.74934; -96.08527
County	Freestone
Are you using a Form PI-7, PI-7-CERT, APD-CERT, PI-7 and APD-CERT, or are you using ePermits?	PI-7-CERT
Customer Number, CNxxxxxxxxx (if known)	CN603395690
Regulated Entity Number, RNxxxxxxxxx (if known)	RN105009245
Technical Information	
Natural Gas Site Throughput (MMSCF/day):	11.270
Oil/Condensate Site Throughput (bbl/day):	0.000
Produced Water Site Throughput (bbl/day):	217.865
Are there any sour gas streams at this site?	No
Is this site currently operational/producing?	Yes
What is the date of the site start of construction or the date that the project changes were implemented (whichever is applicable to this project, anticipated date if in the future)?	n/a
Has this site been registered before?	Yes

Equipment/Processes at Site		
Before entering any numbers into the Equipment/Processes section of the table below, please make sure to review all of the comments in the cells of the table. These should make it clear what numbers need to be entered and where they need to be entered.		
Equipment/Process Types	**How many for this project?**	**How many for this site?**
Fugitives	1	1
IC Engines	2	2
Turbines		
Diesel Engines		
Heaters-Boilers	1	1
Oil / Condensate Tanks		
Produced Water Tanks	4	4
Miscellaneous Tanks	1	1
Loading Jobs	1	1
Glycol Units	1	1
Amine Units		
Vapor Recovery Units		
Flares-Vapor Combustors		
Thermal Oxidizers		
MSS Blowdowns		
MSS FLR Tank Landing Loss		
MSS Tank Non Forced Vent	1	1
MSS Tank Forced Vent Degas		
MSS Defaults	1	1
MSS Paint Blast	1	1
MSS Other	1	1
Other		

When you are finished entering information on this tab, press the "Run" button below. When it is pressed, the spreadsheet tabs needed will be added and the "Emissions Summary" tab will also be added with the number of rows corresponding to the number of emission points in this registration.

Before pressing "Run", please make sure to review all of the comments in the cells of the table above. These should make it clear what numbers need to be entered and where they need to be entered.

The spreadsheet can be reset if needed by pressing the "Reset" button below. If the "Reset" button is pressed, everything will be cleared and you can start over (the added sheets will disappear along with any data entered into the sheets). When the "Reset" button is pressed and there is anything to clear, a question will pop up asking "Delete all macro created worksheets?". Then if you click "Yes", the question will pop back up asking "Are you using this to meet the new Barnett Shale area requirements?".

If the "Run" button is pressed a second time, everything will be cleared and you can start over (the added sheets will disappear along with any data entered into the sheets). When the "Run" button is pressed a second time, a question will pop up asking "Delete all macro created worksheets?". The question will not pop back up asking "Are you using this to meet the new Barnett Shale area requirements?".

Do not press "Run" again or "Reset", unless you intend to clear all of the added sheets (and any data entered into the sheets). This means that it is important to make sure the right numbers of each equipment/process type are entered. If it is possible that an extra piece of equipment could be included, include it because it is better to have too many entered than not enough.

LINN Operating, Inc.
F.R. Hill Compressor Station

Emissions Summary

The table below is a summary of all emission points for this registration. It is separated into *Project Emissions* and *Other Site Wide Emissions* .

The table has separate totals for *Project Total Emission Rates* and *Site Wide Total Emission Rates* .

Any formaldehyde emissions must be included as part of VOC emissions.

Emissions Summary				
Emission Point No. (1)	Source Name (2)	Air Contaminant Name (3)	Emission Rates	
			lbs/hr	TPY (4)
FUG	Fugitive Emissions	Total VOC	0.3109	1.3617
		Benzene	0.0059	0.0260
		H_2S	0.0001	0.0004
ENG-05	Compressor Engine	Total VOC	0.9538	4.1777
		Benzene	0.0033	0.0143
		Formaldehyde	0.4268	1.8694
		H_2S	0.0000	0.0000
		SO_2	0.0048	0.0208
		NO_X	4.7841	20.9542
		CO	4.4492	19.4874
		PM_{10}	0.0807	0.3536
		$PM_{2.5}$	0.0807	0.3536
ENG-07	Compressor Engine	Total VOC	1.7950	7.8622
		Benzene	0.0046	0.0202
		Formaldehyde	0.3347	1.4658
		H_2S	0.0000	0.0000
		SO_2	0.0067	0.0293
		NO_X	1.5212	6.6628
		CO	6.0848	26.6514
		PM_{10}	0.1138	0.4984
		$PM_{2.5}$	0.1138	0.4984
GB-01	Glycol Reboiler	Total VOC	0.0011	0.0047
		Benzene	0.0000	0.0000
		H_2S	0.0000	0.0000
		SO_2	0.0001	0.0005
		NO_X	0.0196	0.0859
		CO	0.0165	0.0721
		PM_{10}	0.0015	0.0065
		$PM_{2.5}$	0.0011	0.0049
WST-01	210-BBL Produced Water Tank Flash Emissions	Total VOC	0.0938	0.4110
		Benzene	0.0015	0.0064
		H_2S	0.0000	0.0000
WST-02	210-BBL Produced Water Tank Flash Emissions	Total VOC	0.0938	0.4110
		Benzene	0.0015	0.0064
		H_2S	0.0000	0.0000

WST-03	210-BBL Produced Water Tank Flash Emissions	**Total VOC**	0.0938	0.4110
		Benzene	0.0015	0.0064
		H_2S	0.0000	0.0000
WST-04	210-BBL Produced Water Tank Flash Emissions	**Total VOC**	0.0938	0.4110
		Benzene	0.0015	0.0064
		H_2S	0.0000	0.0000
WST-01	210-BBL Produced Water Tank Working and Breathing	**Total VOC**	0.0089	0.0005
		Benzene	0.0003	0.0000
		H_2S	0.0000	0.0000
WST-02	210-BBL Produced Water Tank Working and Breathing	**Total VOC**	0.0089	0.0005
		Benzene	0.0003	0.0000
		H_2S	0.0000	0.0000
WST-03	210-BBL Produced Water Tank Working and Breathing	**Total VOC**	0.0089	0.0005
		Benzene	0.0003	0.0000
		H_2S	0.0000	0.0000
WST-04	210-BBL Produced Water Tank Working and Breathing	**Total VOC**	0.0089	0.0005
		Benzene	0.0003	0.0000
		H_2S	0.0000	0.0000
SST-01	210BBL - Slop Tank	**Total VOC**	0.0098	0.0000
		Benzene	0.0000	0.0000
		H_2S	0.0000	0.0000
WTL-01	Produced Water Loading Station	**Total VOC**	0.1122	0.0234
		Benzene	0.0034	0.0007
		H_2S	0.0001	0.0000
SC-01	Glycol Dehydrator Unit	**Total VOC**	0.2996	1.3123
		Benzene	0.1077	0.4716
		H_2S	0.0016	0.0071
MSS	MSS - Tanks (Non-Forced Vent)	**Total VOC**	0.1335	0.0014
		Benzene	0.0040	0.0000
		H_2S	0.0000	0.0000
MSS	Miscellaneous MSS Activities	**Total VOC**	0.0572	0.2505
		Benzene	0.0000	0.0000
		H_2S	0.0000	0.0000
MSS	Painting and Blasting MSS	**Total VOC**	0.1926	0.8438
		Benzene	0.0000	0.0000
		H_2S	0.0000	0.0000
		PM_{10}	0.0069	0.0304
		$PM_{2.5}$	0.0011	0.0048
MSS	F.R. Hill Compressor Station	**Total VOC**	0.2121	0.1548
		Benzene	0.0081	0.0059
		H_2S	0.0001	0.0001

Project Total Emission Rates (Note that these totals are simply the sum of the emission rates from each emission point. For the hourly rates, if the worst case combination of continuously and periodically emitting sources is less than this, then please input the values in this table to the right. Please explain below which emission points are included in this worst case combination.)	**Air Contaminant Name (3)**	**Emission Rates**	
		lbs/hr	**TPY (4)**
	Total VOC	4.49	17.64
	Benzene	0.14	0.56
	Formaldehyde	0.76	3.34
	H_2S	0.00	0.01
	SO_2	0.01	0.05
	NO_X	6.32	27.70
	CO	10.55	46.21
	PM_{10}	0.20	0.89
	$PM_{2.5}$	0.20	0.86

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.

(2) Specific point source name. For fugitive sources, use area name or fugitive source name.

(3)

VOC	volatile organic compounds as defined in Title 30 Texas Administrative Code § 101.1
H_2S	hydrogen sulfide
SO_2	sulfur dioxide
NO_X	total oxides of nitrogen
CO	carbon monoxide
PM_{10}	total particulate matter equal to or less than 10 microns in diameter, including $PM_{2.5}$
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns in diameter

(4) Compliance with annual emission limits (tons per year) is based on a 12 month rolling period.

(5) If emissions from a source are:

(A) uncontrolled, then the uncontrolled emissions are reported in this table as being emitted from the source.

(B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU), then the controlled emissions are reported on this table as being emitted from the control device.

(C) controlled by another type of control device, then the controlled emissions are reported on this table for the source (even though emissions are actually being emitted at the control device).

(6) For controlled tank, glycol/amine flash tank and regenerator, and MSS emissions, it is assumed that all vapors make it to the control device (100% collection efficiency). For controlled loading emissions, a 100% collection efficiency is not assumed.

(7) A VRU itself is not actually considered an emission point; however, this table associates unrecovered (uncontrolled) emissions from sources controlled by a VRU at the VRU.

(8) Benzene emissions are not required for sites not being registered under the new Barnett Shale area requirements; therefore, the benzene emissions reflected on this table will not be treated as emission limits (while it is not required, it is encouraged that benzene emissions are are estimated).

For the gas sample, I am inputting (pick from list):	weight percents	Select whether weight percents or mole percents are being entered for this gas sample.

Then fill out this table **OR** fill out this table.

Gas Analysis - Use if the Inputs are Weight Percents

Analysis Identifier/Name	Inlet to Facility Gas
What site is the sample from?	Hill FR Facility
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	Sample from nearby site that produces from the same field/formation and processes stream in a similar manner
Where in the process was the sample taken?	Inlet Separator
What is the temperature and pressure of the sample (include units)?	40 psig , 87 °F
Who analyzed the sample?	FESCO, Ltd.
Date of sample:	8/27/2015

Component	**weight %**
hydrogen	0.0000
helium	0.0000
nitrogen	0.2600
CO2	6.7350
H2S	0.0020
methane (C1)	85.8590
ethane (C2)	3.9850
propane (C3)	0.9450
butanes (C4)	0.6920
pentanes (C5)	0.3040
benzene	0.1200
other hexanes (C6)	0.4760
toluene	0.1000
other heptanes (C7)	0.2890
ethylbenzene	0.0060
xylenes (o, m, p)	0.0360
other octanes (C8)	0.1080
nonanes (C9)	0.0430
decanes plus (C10+)	0.0400
Totals:	100.0000

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	3.1590
VOC weight fraction =	0.0316

VOC content of hydrocarbon fraction only

VOC weight% =	3.3967
VOC weight fraction =	0.0340

Hydrogen Sulfide

		Constants:	
H2S weight% =	0.0020	453.59237	mol/lb-mol
H2S weight fraction =	2.00E-05	0.06479891	grams/grain
H2S ppm_v =	0	385.48	scf/lb-mol
H2S ppm_{WT}=	20.00	34.08188	g/mol, lb/lb-mol
H_2S grains/100 SCF =	0.0000		H2S mw

SWEET GAS

Benzene

Benzene content of total sample

Benzene weight% =	0.1200
Benzene weight fraction =	0.0012

Benzene content of hydrocarbon fraction only

Benzene weight% =	0.1281
Benzene weight fraction =	0.0013

		Constants:	
Gas Molecular Weight =	17.55	28.97	air mw
Gas Specific Gravity =	0.61	385.48	scf/lb-mol
Gas Throughput (MMscf/day)=	11.268181		
Long Tons Sulfur Compounds per Day =	0.0045805		

Gas Analysis - Use if the Inputs are Mole Percents

Analysis Identifier/Name	
Where was the sample taken?	
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	**mole %**	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	**weight %**
hydrogen		2.01588	0	#DIV/0!
helium		4.0026	0	#DIV/0!
nitrogen		28.01340	0	#DIV/0!
CO2		44.00950	0	#DIV/0!
H2S		34.08188	0	#DIV/0!
methane (C1)		16.04246	0	#DIV/0!
ethane (C2)		30.06904	0	#DIV/0!
propane (C3)		44.09562	0	#DIV/0!
butanes (C4)		58.12220	0	#DIV/0!
pentanes (C5)		72.14878	0	#DIV/0!
benzene		78.110000	0	#DIV/0!
other hexanes (C6)		86.18000	0	#DIV/0!
toluene		92.140000	0	#DIV/0!
other heptanes (C7)		100.20000	0	#DIV/0!
ethylbenzene		106.170000	0	#DIV/0!
xylenes (o, m, p)		106.170000	0	#DIV/0!
other octanes (C8)		114.23000	0	#DIV/0!
nonanes (C9)		128.26000	0	#DIV/0!
decanes plus (C10+)			0	#DIV/0!
Totals:	0.0000	0.00	0	#DIV/0!

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	#DIV/0!
VOC weight fraction =	#DIV/0!

VOC content of hydrocarbon fraction only

VOC weight% =	#DIV/0!
VOC weight fraction =	#DIV/0!

Hydrogen Sulfide

		Constants:	
H2S weight% =	#DIV/0!	453.59237	mol/lb-mol
H2S weight fraction =	#DIV/0!	0.06479891	grams/grain
H2S ppm_v =	0	385.48	scf/lb-mol
H2S ppm_{WT}=	#DIV/0!		
H_2S grains/100 SCF =	0.0000		

SWEET GAS

Benzene

Benzene content of total sample

Benzene weight% =	#DIV/0!
Benzene weight fraction =	#DIV/0!

Benzene content of hydrocarbon fraction only

Benzene weight% =	#DIV/0!
Benzene weight fraction =	#DIV/0!

		Constants:	
Gas Molecular Weight =	0.00	28.97	air mw
Gas Specific Gravity =	0.00	385.48	scf/lb-mol
Gas Throughput (MMscf/day)=	11.268181		
Long Tons Sulfur Compounds per Day =	#DIV/0!		

For the liquid sample, I am inputting (pick from list):	weight percents

Select whether weight percents or mole percents are being entered for this liquid sample.

Then fill out this table **OR** fill out this table.

Liquid Analysis - Use if the Inputs are Weight Percents

Analysis Identifier/Name	
What site is the sample from?	
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	**weight %**
hydrogen	
helium	
nitrogen	
CO2	
H2S	
methane (C1)	
ethane (C2)	
propane (C3)	
butanes (C4)	
pentanes (C5)	
benzene	
other hexanes (C6)	
toluene	
other heptanes (C7)	
ethylbenzene	
xylenes (o, m, p)	
other octanes (C8)	
nonanes (C9)	
decanes plus (C10+)	
Totals:	0.0000

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% = 0.0000
VOC weight fraction = 0.0000

VOC content of hydrocarbon fraction only

VOC weight% = #DIV/0!
VOC weight fraction = #DIV/0!

Hydrogen Sulfide

H2S weight% = 0.0000
H2S weight fraction = 0.00E+00
H2S ppm_V = 0.00
H2S ppm_{WT} = 0.00

Benzene

Benzene content of total sample

Benzene weight% = 0.0000
Benzene weight fraction = 0.0000

Benzene content of hydrocarbon fraction only

Benzene weight% = #DIV/0!
Benzene weight fraction = #DIV/0!

Liquid Analysis - Use if the Inputs are Mole Percents

Analysis Identifier/Name	
What site is the sample from?	
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	**mole %**	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	**weight %**
hydrogen		2.01588	0	#DIV/0!
helium		4.0026	0	#DIV/0!
nitrogen		28.01340	0	#DIV/0!
CO2		44.00950	0	#DIV/0!
H2S		34.08188	0	#DIV/0!
methane (C1)		16.04246	0	#DIV/0!
ethane (C2)		30.06904	0	#DIV/0!
propane (C3)		44.09562	0	#DIV/0!
butanes (C4)		58.12220	0	#DIV/0!
pentanes (C5)		72.14878	0	#DIV/0!
benzene		78.110000	0	#DIV/0!
other hexanes (C6)		86.18000	0	#DIV/0!
toluene		92.140000	0	#DIV/0!
other heptanes (C7)		100.20000	0	#DIV/0!
ethylbenzene		106.170000	0	#DIV/0!
xylenes (o, m, p)		106.170000	0	#DIV/0!
other octanes (C8)		114.23000	0	#DIV/0!
nonanes (C9)		128.26000	0	#DIV/0!
decanes plus (C10+)			0	#DIV/0!
Totals:	0.0000	0.00	0	#DIV/0!

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% = #DIV/0!
VOC weight fraction = #DIV/0!

VOC content of hydrocarbon fraction only

VOC weight% = #DIV/0!
VOC weight fraction = #DIV/0!

Hydrogen Sulfide

H2S weight% = #DIV/0!
H2S weight fraction = #DIV/0!
H2S ppm_V = 0.00
H2S ppm_{WT} = #DIV/0!

Benzene

Benzene content of total sample

Benzene weight% = #DIV/0!
Benzene weight fraction = #DIV/0!

Benzene content of hydrocarbon fraction only

Benzene weight% = #DIV/0!
Benzene weight fraction = #DIV/0!

Enter any notes here:	The facility does not produce or process any oil or condensate. No sample is available.

LINN Operating, Inc.
F.R. Hill Compressor Station

Fugitives Emissions

EPN	FUG
Name	Fugitive Emissions

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (as applicable for reductions from leak detection and repair programs).

C) The vapor VOC, benzene, and H_2S weight percents may be entered. The weight percents from the Analyses tab are displayed below.

D) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

E) This sheet has five parts to it. Part (1) is for Gas Service, (2) is for Heavy Oil Service, (3) is for Light Oil Service, (4) is for Water/Oil Service, and (5) is for a combination of all the results. Fill out all applicable yellow cells in parts (1)-(4) and the final results will be in part (5).

The five parts are set up in this arrangement:

(1)	(2)
(3)	(4)
(5)	

Gas Weight Percents From Analyses Tab:

VOC wt %	3.3967
Benzene wt %	0.1281
H_2S wt %	0.0020

(1) Gas

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
345	Valve	0.009920	3.4224	14.990112
0	Pump Seal	0.005290	0	0
257	Connector	0.000440	0.11308	0.4952904
770	Flange	0.000860	0.6622	2.900436
28	Open-ended Line	0.004410	0.12348	0.5408424
16	Other	0.019400	0.3104	1.359552
	Total:		4.63156	20.2862328

	VOC content (wt %)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	3.3967	0.1281	0.0020	0.0000
Pump Seal	3.3967	0.1281	0.0020	0.0000
Connector	3.3967	0.1281	0.0020	0.0000
Flange	3.3967	0.1281	0.0020	0.0000
Open-ended Line	3.3967	0.1281	0.0020	0.0000
Other	3.3967	0.1281	0.0020	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.12	0.51	0.00	0.00	0.00	0.02
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.00	0.02	0.00	0.00	0.00	0.00
Flange	0.02	0.10	0.00	0.00	0.00	0.00
Open-ended Line	0.00	0.02	0.00	0.00	0.00	0.00
Other	0.01	0.05	0.00	0.00	0.00	0.00
Total:	0.16	0.69	0.00	0.00	0.01	0.03

Liquid Weight Percents From Analyses Tab:

VOC wt %	#DIV/0!
Benzene wt %	#DIV/0!
H_2S wt %	0.0000

(2) Heavy Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
	Valve	0.0000185	0	0
	Pumps	0.0011300	0	0
	Connector	0.0000165	0	0
	Flange	0.00000086	0	0
	Open-ended Line	0.0003090	0	0
	Other	0.0000683	0	0
	Total:		0	0

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves				
Pump Seal				
Connector				
Flange				
Open-ended Line				
Other				

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.00	0.00	0.00	0.00	0.00	0.00
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.00	0.00	0.00	0.00	0.00	0.00
Flange	0.00	0.00	0.00	0.00	0.00	0.00
Open-ended Line	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total:	0.00	0.00	0.00	0.00	0.00	0.00

Liquid Weight Percents From Analyses Tab:

VOC wt %	#DIV/0!
Benzene wt %	#DIV/0!
H_2S wt %	0.0000

(3) Light Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
	Valve	0.005500	0	0
	Pump Seal	0.028660	0	0
	Connector	0.000463	0	0
	Flange	0.000243	0	0
	Open-ended Line	0.003090	0	0
	Other	0.016500	0	0
	Total:		0	0

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves				
Pump Seal				
Connector				
Flange				
Open-ended Line				
Other				

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.00	0.00	0.00	0.00	0.00	0.00
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.00	0.00	0.00	0.00	0.00	0.00
Flange	0.00	0.00	0.00	0.00	0.00	0.00
Open-ended Line	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.00	0.00	0.00	0.00
Total:	0.00	0.00	0.00	0.00	0.00	0.00

(4) Water/Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
57	Valve	0.000216	0.012312	0.05392656
3	Pump Seal	0.000052	0.000156	0.00068328
46	Connector	0.000243	0.011178	0.04895964
137	Flange	0.000006	0.000822	0.00360036
10	Open-ended Line	0.000550	0.0055	0.02409
4	Other	0.030900	0.1236	0.541368
	Total:		0.153568	0.67262784

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	100.0000	0.0000	0.0000	0.0000
Pump Seal	100.0000	0.0000	0.0000	0.0000
Connector	100.0000	0.0000	0.0000	0.0000
Flange	100.0000	0.0000	0.0000	0.0000
Open-ended Line	100.0000	0.0000	0.0000	0.0000
Other	100.0000	0.0000	0.0000	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	0.01	0.05	0.00	0.00	0.00	0.00
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.01	0.05	0.00	0.00	0.00	0.00
Flange	0.00	0.00	0.00	0.00	0.00	0.00
Open-ended Line	0.01	0.02	0.00	0.00	0.00	0.00
Other	0.12	0.54	0.00	0.00	0.00	0.00
Total:	0.15	0.67	0.00	0.00	0.00	0.00

(5) Fugitive Total Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	0.31	1.36
benzene	0.01	0.03
H_2S	0.00	0.00

Notes:

Reference to Emission factors used:

1. Emission factors are for oil and gas production facilities (not refineries) come from the EPA's "Protocol for Equipment Leak Emission Estimates" November 1995, EPA 453/1, R-95-017, Table 2-4.

2. Emission factors that are not based on the EPA document are from the TCEQ "Air Permit Technical Guidance for Chemical Source Equipment Leak Fugitives (Draft October 2000)

3. For fugitive calculations, VOC content should be VOC content of total hydrocarbons, not of total sample.

Enter any notes here:	Component counts are estimated based on Table W-1B for onshore natural gas production from Title 40 of the Code of Federal Regulations (40 CFR) Part 98, Subpart W. These counts conservatively assume that all 8 well heads within 0.25 miles of the facility are considered part of the facility.

LINN Operating, Inc.
F.R. Hill Compressor Station

Internal Combustion Engine Emissions

A) Enter information into the yellow boxes.

B) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

Engine Emission Calculations

Note: The TCEQ prefers the following basis for calculating emissions (in order of preference):
1. Stack test data from the engine
2. Manufacturer's specification sheet and control specification sheet (if control used)
3. AP-42 emission factors

Site Location

County	Freestone
Region	Region 9, Waco
Existing or new source:	existing
Installation date:	

Discharge Parameters

Stack height (feet)	24
Stack diameter (feet)	1.17
Stage Temperature (°F)	842
Exit Velocity (fps)	101

Fuel Data

Fuel Type	field gas
Fuel Consumption (BTU/bhp-hr)	7450
Heat Value (HHV)	1015.3
Heat Value (LHV)	923
Sulfur Content (grains/100scf)	5

Engine Data

EPN	ENG-05
Name	Compressor Engine
Manufacturer	Caterpillar
Model Number	G3516TALE
Serial Number	3RC01060
Manufacture Date	Pre-June 12, 2006
Last Rebuild Date	N/A
Application	gas compression
Ignition/Injection Timing	fixed
Horsepower:	1,085
Fuel consumption (Btu/hp-hr)	7,450
Hours of operation per year:	8,760
Engine Type:	4 Stroke, Lean-Burn

Method of Emission Control

	Yes/No
NSCR Catalyst	No
SCR Catalyst	No
JLCC Catalyst	No
Parameter Adjustment	No
Stratified Charge	No
Other (Specify)	Lean Burn

Federal/State Standards

	Yes/No
NSPS Subpart JJJJ	No
MACT Subpart ZZZZ	Yes
30 TAC, Chapter 117	No

Additional Required Information

1. Submit a copy of the engine manufacturer's site rating or general rating specification data.
2. Submit a typical fuel analysis, including sulfur content and heating value. For gaseous fuels, provide mole percent of constituents.
3. Submit a description of the air/fuel ratio control system (manufactuer's information is acceptable).

SO_2 Mass Balance calculation for sour gas fuel:

Fuel Heat Value (Btu/SCF)	
Fuel H_2S content (mol%)	
SO_2 produced (lb/hr) =	0.00
SO_2 produced (tpy) =	0.00

MW SO_2 =	64.06	grams/mole
Ideal Gas Law	378.61	SCF/lb-mole

Calculation:

VOC (tpy) emissions: (g/hp-hr)*(%VOC)*(hp)*(8760hr/yr)/454/2000
CO (tpy) emissions: (g/hp-hr)*(hp)*(8760hr/yr)/454/2000
NOx (tpy) emissions: CO (tpy) emissions: (g/hp-hr)*(hp)*(8760hr/yr)/454/2000
For emission factors in terms of lb/MMBtu
(Emission factor) * (Fuel Consumption) * (Horsepower) * (Conversion factor)
(lb/MMBtu) * (Btu/hp-hr) * (hp) * (1 MMBtu/1,000,000 Btu)

Does the VOC emission factor being used below include formaldehyde? (pick Yes or No from list)	Yes

To Determine Emissions for Air Permitting

	If available, enter the test results or manufacturer's emission factors before control (g/hp-hr)	from AP-42: Table 3.2-1 2 stroke, lean-burn engine emission factors (lb/MMBtu)	Table 3.2-2 4 stroke, lean-burn engine emission factors (lb/MMBtu)	Table 3.2-3 4 stroke, rich burn engine emission factors (lb/MMBtu)	appropriate AP-42 factor	emission factor used	units	Uncontrolled lb/hr	Uncontrolled tpy	If present, enter the efficiency of any control device (as a %)	If present, enter the controlled emission factor (as g/hp-hr)	control factor used	lb/hr	tpy
VOC		0.12	0.118	0.0296	0.118	0.118	lb/MMBtu	0.954	4.178			0	0.95	4.18
NOx	2	3.17	4.08	2.21	4.08	2	g/hp-hr	4.784	20.954			0	4.78	20.95
CO	1.86	0.386	0.317	3.72	0.317	1.86	g/hp-hr	4.449	19.487			0	4.45	19.49
PM_{10}		0.04831	0.0099871	0.01941	0.0099871	0.0099871	lb/MMBtu	0.081	0.354			0	0.08	0.35
$PM_{2.5}$		0.04831	0.0099871	0.01941	0.0099871	0.0099871	lb/MMBtu	0.081	0.354			0	0.08	0.35
SO_2		0.000588	0.000588	0.000588	0.000588	0.000588	lb/MMBtu	0.005	0.021			0	0.00	0.02
Formaldehyde		0.0552	0.0528	0.0205	0.0528	0.0528	lb/MMBtu	0.427	1.869			0	0.43	1.87
Benzene		0.00194	0.000404	0.00158	0.000404	0.000404	lb/MMBtu	0.003	0.014			0	0.00	0.01

Enter any notes here:	Exhaust gas velocity is based on maximum design exhaust gas flow of 6,460 cfm.

Next Tab

LINN Operating, Inc.
F.R. Hill Compressor Station

Internal Combustion Engine Emissions

A) Enter information into the yellow boxes.

B) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

Engine Emission Calculations

Note: The TCEQ prefers the following basis for calculating emissions (in order of preference):
1. Stack test data from the engine
2. Manufacturer's specification sheet and control specification sheet (if control used)
3. AP-42 emission factors

Site Location

County	Freestone
Region	Region 9, Waco
Existing or new source:	existing
Installation date:	2/15/2016

Discharge Parameters

Stack height (feet)	24
Stack diameter (feet)	1.33
Stage Temperature (°F)	992
Exit Velocity (fps)	109

Fuel Data

Fuel Type	pick from list
Fuel Consumption (BTU/bhp-hr)	8,256
Heat Value (HHV)	1015.3
Heat Value (LHV)	923
Sulfur Content (grains/100scf)	5

Engine Data

EPN	ENG-07
Name	Compressor Engine
Manufacturer	Caterpillar
Model Number	G3516B
Serial Number	JEF03338
Manufacture Date	2/2/2015
Last Rebuild Date	N/A
Application	gas compression
Ignition/Injection Timing	fixed
Horsepower:	1,380
Fuel consumption (Btu/hp-hr)	8,256
Hours of operation per year:	8,760
Engine Type:	4 Stroke, Lean-Burn

Method of Emission Control

	Yes/No
NSCR Catalyst	No
SCR Catalyst	No
JLCC Catalyst	No
Parameter Adjustment	No
Stratified Charge	No
Other (Specify)	Lean Burn, Oxidative Catalyst

Federal/State Standards

	Yes/No
NSPS Subpart JJJJ	Yes
MACT Subpart ZZZZ	Yes
30 TAC, Chapter 117	No

Additional Required Information

1. Submit a copy of the engine manufacturer's site rating or general rating specification data.
2. Submit a typical fuel analysis, including sulfur content and heating value. For gaseous fuels, provide mole percent of constituents.
3. Submit a description of the air/fuel ratio control system (manufactuer's information is acceptable).

SO_2 Mass Balance calculation for sour gas fuel:

Fuel Heat Value (Btu/SCF)			
Fuel H_2S content (mol%)			
SO_2 produced (lb/hr) =	0.00		
SO_2 produced (tpy) =	0.00		
MW SO_2 =	64.06	grams/mole	
Ideal Gas Law	378.61	SCF/lb-mole	

Calculation:

VOC (tpy) emissions: (g/hp-hr)*(%VOC)*(hp)*(8760hr/yr)/454/2000
CO (tpy) emissions: (g/hp-hr)*(hp)*(8760hr/yr)/454/2000
NOx (tpy) emissions: CO (tpy) emissions: (g/hp-hr)*(hp)*(8760hr/yr)/454/2000
For emission factors in terms of lb/MMBtu
(Emission factor) * (Fuel Consumption) * (Horsepower) * (Conversion factor)
(lb/MMBtu) * (Btu/hp-hr) * (hp) * (1 MMBtu/1,000,000 Btu)

Does the VOC emission factor being used below include formaldehyde? (pick Yes or No from list)	No

To Determine Emissions for Air Permitting

	If available, enter the test results or manufacturer's emission factors before control (g/hp-hr)	from AP-42: Table 3.2-1 2 stroke, lean-burn engine emission factors (lb/MMBtu)	Table 3.2-2 4 stroke, lean-burn engine emission factors (lb/MMBtu)	Table 3.2-3 4 stroke, rich burn engine emission factors (lb/MMBtu)	appropriate AP-42 factor	emission factor used	units	Uncontrolled lb/hr	Uncontrolled tpy	If present, enter the efficiency of any control device (as a %)	If present, enter the controlled emission factor (as g/hp-hr)	control factor used	lb/hr	tpy
VOC	0.48	0.12	0.118	0.0296	0.118	0.48	g/hp-hr	1.460	6.396		0.48	0.48	1.80	7.86
NOx	0.5	3.17	4.08	2.21	4.08	0.5	g/hp-hr	1.521	6.663			0	1.52	6.66
CO	2.43	0.386	0.317	3.72	0.317	2.43	g/hp-hr	7.393	32.381		2	2	6.08	26.65
PM_{10}		0.04831	0.0099871	0.01941	0.0099871	0.0099871	lb/MMBtu	0.114	0.498			0	0.11	0.50
$PM_{2.5}$		0.04831	0.0099871	0.01941	0.0099871	0.0099871	lb/MMBtu	0.114	0.498			0	0.11	0.50
SO_2		0.000588	0.000588	0.000588	0.000588	0.000588	lb/MMBtu	0.007	0.029			0	0.01	0.03
Formaldehyde	0.44	0.0552	0.0528	0.0205	0.0528	0.44	g/hp-hr	1.339	5.863		0.11	0.11	0.33	1.47
Benzene		0.00194	0.000404	0.00158	0.000404	0.000404	lb/MMBtu	0.005	0.020			0	0.00	0.02

Enter any notes here:	Exhaust gas velocity is based on a maximum design exhaust gas flow of 9,126 cfm.

Next Tab

LINN Operating, Inc.
F.R. Hill Compressor Station

Heaters-Boilers Emissions

A) Enter information into the yellow boxes.

B) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

Heater and Boiler Emission Calculations (fueled by natural gas)

EPN	GB-01	
Name	Glycol Reboiler	
Heater/Boiler rating (MMBtu/hr):	0.2	
Rating above is **(select from list)**:	below 100 MMBtu/hr, uncontrolled	(assume uncontrolled, unless specifically stated otherwise)
Operating hours/year:	8760	
Fuel Heat Value (Btu/SCF):	1020	

Pollutant	Emission Factor (lb/MMCF)	lb/hr	tpy
VOC	5.5	0.001	0.005
NOx	100	0.020	0.086
CO	84	0.016	0.072
PM_{10}	7.6	0.001	0.007
$PM_{2.5}$	5.7	0.001	0.005
SO_2	0.6	0.000	0.001

If the heater/boiler is fueled by Sour Gas, cannot use emission factors above to calculate SO_2 emissions, must use SO_2 mass balance:

SO_2 Mass Balance calculation:	
Fuel H_2S content (mol %) =	
SO_2 produced (lb/hr) =	**0.0000**
SO_2 produced (tpy) =	**0.0000**

assumptions:		
SO2 MW	64.06	lb/lb-mole
Ideal Gas Law	378.61	SCF/lb-mole

Enter any notes here:	Assumed heating value of 1020 Btu/scf as per AP-42 Chapter 1.4 (July 1998).

Next Tab

LINN Operating, Inc.
F.R. Hill Compressor Station

Tank Emissions - Lab Gas Water Ratio (GWR) Method

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (if applicable).

C) The tank vapor VOC, benzene, and H_2S weight percents may be entered.

D) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

E) The table below can be used to calculate the flash gas molecular weight and the component weight percents if needed.

F) Make sure to answer the control device question.

GWR [FOR ESTIMATING FLASH LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Flash Initial Press. (psig)	Flash Initial Temp. (°F)	Flash Final Press. (psig)	Flash Final Temp. (°F)	GWR (scf of flash gas/bbl of water produced)	Barrels of Water per day (bbl/day)	Flash Gas Molecular Weight	Flash Gas VOC wt%	Flash Gas Benzene wt%	Flash Gas H_2S wt%	Are tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	VOC Control Efficiency (%)	H_2S Control Efficiency (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
WST-01	BL Produced Water Tank Flash Emi	40	84	0	70	3.81	54.47	22.8070	18.0555	0.2808	0.0015	(A) uncontrolled			0.09	0.41	0.00	0.01	0.00	0.00
WST-02	BL Produced Water Tank Flash Emi	40	84	0	70	3.81	54.47	22.8070	18.0555	0.2808	0.0015	(A) uncontrolled			0.09	0.41	0.00	0.01	0.00	0.00
WST-03	BL Produced Water Tank Flash Emi	40	84	0	70	3.81	54.47	22.8070	18.0555	0.2808	0.0015	(A) uncontrolled			0.09	0.41	0.00	0.01	0.00	0.00
WST-04	BL Produced Water Tank Flash Emi	40	84	0	70	3.81	54.47	22.8070	18.0555	0.2808	0.0015	(A) uncontrolled			0.09	0.41	0.00	0.01	0.00	0.00
												Totals:			**0.38**	**1.64**	**0.01**	**0.03**	**0.00**	**0.00**

Enter any notes here:	

GWR Calculator

This table can be used to calculate the flash gas molecular weight and the component weight percents if needed, if the flash gas mole percents are entered. It can also calculate the overall VOC, benzene, and H2S flash emissions if the GWR and the oil/condensate throughput are entered.

Gas Water Ratio:	3.81	in standard cubic feet of flash gas per barrel (SCF/bbl) of water produced
Barrels of Oil or Condensate per day:	217.8653333	

Flash Gas Speciation:

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	weight %
hydrogen	0.0000	2.01588	0	0.0000
helium	0.0000	4.0026	0	0.0000
nitrogen	0.1530	28.01340	4	0.1879
CO2	10.6680	44.00950	469	20.5855
H2S	0.0010	34.08188	0	0.0015
methane (C1)	77.0790	16.04246	1237	54.2175
ethane (C2)	5.2730	30.06904	159	6.9520
propane (C3)	1.2890	44.09562	57	2.4922
butanes (C4)	4.2970	58.12220	250	10.9507
pentanes (C5)	0.4930	72.14878	36	1.5596
benzene	0.0820	78.110000	6	0.2808
other hexanes (C6)	0.3370	86.18000	29	1.2734
toluene	0.0390	92.140000	4	0.1576
other heptanes (C7)	0.1960	100.20000	20	0.8611
ethylbenzene	0.0020	106.170000	0	0.0093
xylenes (o, m, p)	0.0080	106.170000	1	0.0372
other octanes (C8)	0.0630	114.23000	7	0.3155
nonanes (C9)	0.0210	128.26000	3	0.1181
decanes plus (C10+)	0.0000	142.28000	0	0.0000
	100.0010		2280.7	100.0000

Flash Gas MW =	22.80696
Total gas emitted:	
lb/hr:	2.0786277
tpy:	9.1043893
VOC wt% =	18.0555
VOC, lb/hr:	0.3753072
VOC, tpy:	1.6438455
Benzene wt% =	0.2808
Benzene, lb/hr:	0.0058375
Benzene, tpy:	0.0255684
H_2S wt% =	0.0015
H_2S, lb/hr:	3.106E-05
H_2S, tpy:	0.0001361

LINN Operating, Inc.
F.R. Hill Compressor Station

Tank Emissions - Tanks 4.0

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (if applicable).

C) A reduction for produced water tank emissions calculated as oil/condensate may be entered.

D) The tank vapor VOC, benzene, and H_2S weight percents may be entered.

E) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

F) Make sure to answer the control device question.

Tanks 4.0 Software TANKS 4.0 SOFTWARE [FOR ESTIMATING WORKING AND BREATHING LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Throughput (gal/year)	Turnovers per year	Mixture/Component	Basis for VP Calculations	Vapor MW	Total Uncontrolled Emissions (lb/hr)	Total Uncontrolled Emissions (ton/yr)	Tank Vapor VOC wt%	Tank Vapor Benzene wt%	Tank Vapor H_2S wt%	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	Are tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	VOC Control Efficiency (%)	H_2S Control Efficiency (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
WST-01	210-BBL Produced Water Tank Working and Breathing	2,287.59	0.2781	Crude Oil	Option 4	50	0.89	0.050				99	(A) uncontrolled			0.01	0.00	0.00	0.00	0.00	0.00
WST-02	210-BBL Produced Water Tank Working and Breathing	2,287.59	0.2781	Crude Oil	Option 4	50	0.89	0.050				99	(A) uncontrolled			0.01	0.00	0.00	0.00	0.00	0.00
WST-03	210-BBL Produced Water Tank Working and Breathing	2,287.59	0.2781	Crude Oil	Option 4	50	0.89	0.050				99	(A) uncontrolled			0.01	0.00	0.00	0.00	0.00	0.00
WST-04	210-BBL Produced Water Tank Working and Breathing	2,287.59	0.2781	Crude Oil	Option 4	50	0.89	0.050				99	(A) uncontrolled			0.01	0.00	0.00	0.00	0.00	0.00
															Totals:	0.04	0.00	0.00	0.00	0.00	0.00

Enter any notes here:	Tank emissions were calculated using USEPA's TANKS 4.0.9d program using crude oil properties. Hourly emissions were calculated using Equation 1 from TCEQ's "Technical Guidance Package for Chemical Sources - Estimating Short Term Emission Rates from Tanks". The hourly fill rate was assumed to be the the daily production rate divided by 24.

LINN Operating, Inc.
Oil and Gas Production Site
Short-Term Emissions from Tanks

FIN	EPN	Description	Vapor Molecular Wt. (lb/lb-mol)	RVP[(1)] (psia)	Maximum Liquid Surface Temperature F	True Vapor Pressure at Max Temp (psia)	Max Fill Rate (gal/hr)	Maximum Uncontrolled Hourly Emissions (lb/hr)
WST-01	WST-01	210-BBL Produced Water Tank Working and Breathing	50.00	2.27	95	2.08	381	**0.89**
WST-02	WST-02	210-BBL Produced Water Tank Working and Breathing	50.00	2.27	95	2.08	381	**0.89**
WST-03	WST-03	210-BBL Produced Water Tank Working and Breathing	50.00	2.27	95	2.08	381	**0.89**
WST-04	WST-04	210-BBL Produced Water Tank Working and Breathing	50.00	2.27	95	2.08	381	**0.89**

Notes:
1) RVP of the produced water at the FR Hill Compressor Station is assumed, as a worst case, to be equivalent to the RVP of the produced fluids sampled from the Dew Compressor Site, which is located in the same area as the FR Hill Compressor Station.

Example Calculations for Hourly Emissions:
Material true vapor pressure is estimated based on the relationship presented in U.S. EPA AP-42 Chapter 7.1 Figure 7.1-13b, using the RVP from the laboratory data, and a worst-case operating temperature of 95°F. The equation is as follows:

$$P = exp\left\{\left[\left(\frac{2{,}799}{T+459.6}\right) - 2.227\right] log_{10}(RVP) - \left(\frac{7{,}261}{T+459.6}\right) + 12.82\right\}$$

where: P = True vapor pressure at 95°F, psia, AP-42 Chapter 7.1, Figure 7.1-13b
T = Temperature of Liquid Loaded, °F, assumed to be 95°F as a worst case.
RVP = Reid vapor pressure, psia

Short term emissions are estimated by performing a vapor displacement calculation at the maximum fill rate. Starting with the ideal gas law, and subsittuting n = m/MW, when rearranged, yields:

$$L_{ST} = \frac{P \cdot MW \cdot Q}{R\ (T + 459.67)}$$

where: L_{ST} = Maximum Hourly Emissions, lb/hr
P = True vapor pressure at 95°F, psia
MW = Molecular Weight of Vapors, lb/lb-mol
Q = Maximum Fill Rate, gal/hr
7.4805 = Conversion Factor from gallons to Cubic Feet, gal/ft^3
R = Ideal Gas Law Constant, 10.73 psi-ft^3/lb mole-°R

LINN Operating, Inc.
F.R. Hill Compressor Station

Tank Emissions - Tanks 4.0

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (if applicable).

C) A reduction for produced water tank emissions calculated as oil/condensate may be entered.

D) The tank vapor VOC, benzene, and H_2S weight percents may be entered.

E) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

F) Make sure to answer the control device question.

Tanks 4.0 Software TANKS 4.0 SOFTWARE [FOR ESTIMATING WORKING AND BREATHING LOSSES FROM STORAGE TANKS]

EPN	Tank Identifier	Throughput (gal/year)	Turnovers per year	Mixture/Component	Basis for VP Calculations	Vapor MW	Total Uncontrolled Emissions (lb/hr)	Total Uncontrolled Emissions (ton/yr)	Tank Vapor VOC wt%	Tank Vapor Benzene wt%	Tank Vapor H_2S wt%	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	Are tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	VOC Control Efficiency (%)	H_2S Control Efficiency (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
SST-01	210BBL - Slop Tank	105,000.00	12.7655	Distillate Fuel Oil No. 2/Water	Option 1	130	0.49	0.002	100	0	0	98	(A) uncontrolled			0.01	0.00	0.00	0.00	0.00	0.00
															Totals:	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Enter any notes here:	Slop oil is mostly comprised of rain water with up to 2% heavy oils from engine grease and other lubricating-type oils. Tank emissions were calculated using USEPA's TANKS 4.0.9d program using distillate fuel oil no. 2 properties and then taking a 98% reduction (similar to produced water). Hourly emissions were calculated using Equation 1 from TCEQ's "Technical Guidance Package for Chemical Sources - Estimating Short Term Emission Rates from Tanks". The hourly fill rate was assumed to be the the slop tank volume.

LINN Operating, Inc.
Oil and Gas Production Site
Short-Term Emissions from Tanks

FIN	EPN	Description	Vapor Molecular Wt.	Maximum Liquid Surface Temperature	True Vapor Pressure at Max Temp	Max Fill Rate	Maximum Uncontrolled Hourly Emissions
			(lb/lb-mol)	F	(psia)	(gal/hr)	(lb/hr)
SST-01	SST-01	210BBL - Slop Tank	130.00	95	0.02	8,820	**0.489**

Notes

1) Slop oil is mostly comprised of rain water with up to 2% heavy oils from engine grease and other lubricating-type oils. Emissions were calculated assuming 100% distillate fuel oil no. 2 and then taking a 98% reduction (similar to produced water).

Example Calculations for Hourly Emissions:

Short term emissions are estimated by performing a vapor displacement calculation at the maximum fill rate. Starting with the ideal gas law, and substituting n = m/MW, when rearranged, yields:

$$L_{ST} = \frac{P \cdot MW \cdot Q}{R\ (T + 459.67)}$$

where: L_{ST} = Maximum Hourly Emissions, lb/hr
P = True vapor pressure at 95°F, psia (interpolated for distillate fuel oil no. 2 at 95F from AP-42 Chapter 7.1, Table
MW = Molecular Weight of Vapors, lb/lb-mol
Q = Maximum Fill Rate, gal/hr (based on tank capacity)
7.4805 = Conversion Factor from gallons to Cubic Feet, gal/ft^3
R = Ideal Gas Law Constant, 10.73 psi-ft^3/lb mole-°R

LINN Operating, Inc.
F.R. Hill Compressor Station

Loading Emissions

A) Enter information into the yellow boxes.

B) VOC and H_2S control and collection efficiencies may be entered (if applicable).

C) The vapor VOC, benzene, and H_2S weight percents may be entered.

D) There are two separate areas below to calculate hourly and annual loading emissions. Then underneath, there is a table summarizing the hourly and annual loading emissions.

E) Use the box provided below for entering any notes necessary (such as the source/justification for any calculation inputs).

F) If vapor balancing is being performed and the tank is not being controlled, contact TCEQ about the appropriate tank working loss calculation.

G) Make sure to answer the control device question.

EPN	WTL-01
Identifier	Produced Water Loading Station

Truck Hourly Loading Emission Calculations

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

S =	**0.60**	**Saturation Factor**
P =	**2.08**	**True vapor pressure of liquid loaded (psia)**
M =	**50.00**	**Molecular Weight of Vapors (lb/lb-mole)**
T =	**554.67**	**Temperature of bulk liquid loaded (in degrees Rankine)**
Hourly Loading Rate	**8,000**	**Gallons Loaded per Hour**
L_L =	**1.40**	**Loading Loss (lb VOC released/1000 gal liquid loaded)**
	11.22	**VOC Uncontrolled Emissions (lb/hr)**

Are loading vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	(A) uncontrolled

Vapor Weight Percents

VOC		**Vapor VOC wt%**
benzene		**Vapor Benzene wt%**
H_2S		**Vapor H_2S wt%**

Produced Water Reduction

	99.00	**Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)**

Uncontrolled Emissions

VOC	**0.11**	**Emissions Uncontrolled VOC (lb/hr)**
benzene	**0.00**	**Emissions Uncontrolled Benzene (lb/hr)**
H_2S	**0.00**	**Emissions Uncontrolled H_2S (lb/hr)**

Enter temperature in Fahrenheit °F):	**Temperature in Rankine (°R):**
95	554.67

Enter Barrels of Liquid	**Gallons of liquid:**
	0

Enter gallons per year	**Barrels per day:**
	0

Enter any notes here:

Truck Annual Loading Emission Calculations

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

S =	0.60	= Saturation Factor
P =	2.08	= True vapor pressure of liquid loaded (psia)
M =	50.00	= Molecular Weight of Vapors (lb/lb-mole)
T =	554.67	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	3,339,876	= Gallons Loaded per Year
L_L =	1.40	Loading Loss (lb VOC released/1000 gal liquid loaded)
	2.34	VOC Uncontrolled Emissions (ton/yr)
Vapor Weight Percents		
VOC		Vapor VOC wt%
benzene		Vapor Benzene wt%
H_2S		Vapor H_2S wt%
Produced Water Reduction		
	99.00	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	0.02	Emissions Uncontrolled VOC (ton/yr)
benzene	0.00	Emissions Uncontrolled Benzene (ton/yr)
H_2S	0.00	Emissions Uncontrolled H_2S (ton/yr)
Control Efficiency		
VOC		VOC Control Efficiency (%)
H_2S		H_2S Control Efficiency (%)
Vapors Uncontrolled by Control Device (Controlled Emissions)		
VOC	0.00	VOC Results (ton/yr)
benzene	0.00	Benzene Results (ton/yr)
H_2S	0.00	H_2S Results (ton/yr)

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):

Enter Barrels of Liquid	Gallons of liquid:
79520.84667	3339875.56

Enter gallons per year	Barrels per day:
	0

Enter any notes here:

Loading Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	0.11	0.02
benzene	0.00	0.00
H_2S	0.00	0.00

LINN Operating, Inc.

F.R. Hill Compressor Station

Glycol Dehydrator Emissions

EPN	SC-01
Identifier	Glycol Dehydrator Unit

Glycol Dehydrator Unit Information	
Are you using GLYCalc or a Process Simulator?	GLYCalc
GLYCalc Calculation Method (if using GLYCalc)	Gas Analysis and Process Data
Type of Glycol Used:	TEG
Annual Hours of Operation (hrs/yr):	8760
Dry Gas Flow Rate (MMscf/day)	2
Laboratory Wet Gas Analysis Provided? If not, explain why. (Use notes box below if more space needed.)	Yes
Date of Sample:	
Is sample site specific or representative? If representative, please justify. (Use notes box below if more space needed.)	
At what point in the process was the sample taken?	Dehy Inlet
Wet Gas Temperature (°F)	110
Wet Gas Pressure (psig)	1214.7
Lean Glycol Pump Type	pneumatic
Lean Glycol Pump Make and Model	Kimray 4020
Lean Glycol Flow Rate (gpm)	0.67
Number of Pump Stokes per Minute for the Lean Glycol Pump (pump strokes/min, if applicable)	
Flash Tank Temperature (°F)	120
Flash Tank Pressure (psig)	35

LINN Operating, Inc.

F.R. Hill Compressor Station

Glycol Dehydrator Emissions

Flash Tank		
Is there a flash tank? (If no, leave the inputs in this block blank.)	Yes	-
	lb/hr	**tpy**
Emissions Uncontrolled VOC,(lb/hr, tpy)	0.1787	0.7828
Emissions Uncontrolled Benzene, (lb/hr, tpy)	0.0139	0.061
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0.0005	0.0021
Are flash tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	(C) cont. by other control device	-
VOC Control Efficiency (%)	50	-
H_2S Control Efficiency (%)	50	-
VOC Results, (lb/hr, tpy)	0.08935	0.3914
Benzene Results, (lb/hr, tpy)	0.00695	0.0305
H_2S Results, (lb/hr, tpy)	0.00025	0.00105

LINN Operating, Inc.

F.R. Hill Compressor Station

Glycol Dehydrator Emissions

Regenerator		
	lb/hr	**tpy**
Emissions Uncontrolled VOC (lb/hr, tpy)	2.4194	10.5971
Emissions Uncontrolled Benzene, (lb/hr, tpy)	0.7107	3.1131
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0.0015	0.0066
Are regenerator vapors controlled by a condenser?	Yes	-
VOC Condenser Efficiency (%) - *if applicable*	91.31	-
Benzene Condenser Efficiency (%) - *if applicable*	85.83	-
H_2S Condenser Efficiency (%) - *if applicable*	7.96	-
Are regenerator vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	(A) uncontrolled	-
VOC Results, (lb/hr, tpy)	0.21024586	0.92088799
Benzene Results, (lb/hr, tpy)	0.10070619	0.44112627
H_2S Results, (lb/hr, tpy)	0.0013806	0.00607464

LINN Operating, Inc.

F.R. Hill Compressor Station

Glycol Dehydrator Emissions

Sum of Flash Tank and Regenerator Results		
	lb/hr	**tpy**
VOC Results	0.29959586	1.31228799
Benzene Results	0.10765619	0.47162627
H_2S Results	0.0016306	0.00712464

Federal Applicability	
40 CFR Part 63 - Subpart HH	
All area sources, with TEG dehydration units, will have some requirements under the rule. Emission reduction requirements may apply or only recordkeeping requirements may apply.	
Is this subpart applicable?	Yes
If yes, how will compliance be achieved? If no, please explain why.	Emissions of benzene are less than 1.0 tpy; therefore, there are no further requirements under MACT HH except for an annual flowrate/emission rate demonstration

Enter any notes here:
The requested throughput for the glycol dehydration unit is for the total gas throughput at the site. This is overly conservative as only a portion of the gas is routed to the glycol dehydration unit and then to the fuel system.

Planned MSS - Degassing due to Passive Expansion / Thermal Expansion / Non Forced Ventilation

Company Name:	LINN Operating, Inc.
Site Name.:	F.R. Hill Compressor Station
EPN No:	MSS
Name	MSS - Tanks (Non-Forced Vent)
Tank No.:	All
Product stored:	Produced Water
Type of tank roof	Fixed Roof
Tank Capacity (bbl)	400
Tank Diameter (ft) (D)	12.00
Vapor Molecular Wt. (lb/lb mol) (M_v)	50
Number of events/yr	4
Height of the roof (ft)	15.00
Saturation factor (S)	1.0

Vapor Space Volume (ft^3) (V_v)	1696.46
Height of Vapor Space under roof (ft)* (h_v)	15.00

	Max. hourly emissions lb/hr	Avg.Annual emissions tpy	
Duration of activity (hrs/event)	12	12	
True Vapor Pressure (psia) (P)	2.27	1.13	Max > Avg
Day time temperature (°F)	100.00	77.74	Max > Avg
Night time temperature (°F)	72.00	55.58	
Temperature Expansion %	5	4.120627935	
Emissions (lb/event)	32.0413844	16.65643171	
Max. Hourly Emissions (lb/hr)	0.13		
Avg. Hourly Emissions (lb/hr)		0.06	
Avg. Annual emissions (tpy)		0.00	

VOC Wt%	
H_2S Wt%	
Benzene Wt%	

Type of Control Device	
Are tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	(A) uncontrolled

VOC Type: (pick from list)
Crude Oil or Condensate VOC

Emission Type: (pick from list)
Low Pressure Periodic

Emissions before control and before wt% reduction		
Type of Losses	Max. hourly emissions lb/hr	Avg.Annual emissions tpy
Thermal / Passive Expansion	0.13	0.00
Planned MSS Emissions		
Air Contaminant	**Max. hourly emissions lb/hr**	**Avg.Annual emissions tpy**
Total VOC	**0.13**	**0.00**
Total H_2S	**0.00**	**0.00**
Total Benzene	**0.00**	**0.00**

Default VOC emissions for Miscellaneous MSS activities

Company Name	LINN Operating, Inc.
Site Name	F.R. Hill Compressor Station

Source Name	Miscellaneous MSS Activities
EPN	MSS

Date of MSS activity	**NA**
Default VOC emissions (tpy) associated with miscellaneous MSS activities	**0.250**
Add default VOC emissions from miscellaneous MSS activities to the emissions summary	Yes

#	Activity	Description / comments	Default parameters		Equation used		Input parameters		Annual emissions (tpy)
1	***(b)(1) Engine Oil changes / Filter changes*** The emissions associated with an engine oil/filter change occur during the draining of the used engine oil into oil pan or container.	-Engine has been isolated and blow down occurs prior to oil change. The emissions associated with the blow down [106.359 (b) (8)] need to be accounted for in the oil and gas emission calculation spreadsheet. -Oil is drained into a 4 ft x 4 ft open pan and transferred to a closed container per Best Management Practice (BMP). -Input parameters based on manufacturer specifications of engine oil SAE 10W (a). -Used a 1380 hp Caterpillar G3516B LE engine (b) as basis for calculation. In order to account for emissions from larger horse power engines, the emissions are doubled. An average engine uses 112 gallons of motor oil and manufacturer recommends changing oil every 1000 hrs. We used 10 changes of oil per year as a conservative estimate. -Emission estimates for 1380 hp engine are being doubled to be conservative and to accommodate engines with higher hp.	Temperature (°F)	212	Loading loss L_L (lb/1000 gal)	0.009	Number of engines	10	0.103
			Vapor pressure (psia)	0.001					
			Saturation factor	1	Loading loss per activity (lb/activity)	0.001			
			Molecular weight (lb/lbmol)	500					
			Motor oil (gal/activity)	112					
			U wind speed (m/s)	3.52	Evaporation Loss (lb/activity)	1.027			
			Vapor pressure P_v (Pa)	10					
			Molecular weight (lb/lbmol)	500					
			Surface Area A_p (m^2) (4ft * 4ft)	1.48					
			Evaporation time t (hrs)	10					
			Number of activities per year (Number of oil changes per engine per year)	10	Total (lbs/yr/engine)	20.565			
			Factor used to account for larger horsepower engines	2					
2	***(b)(1) & (b)(4) Changing Engine Rod Packings*** Emissions from changing of the rod would be from clingage of lubricant in the casing.	-Engine has been isolated and blow down occurs prior to changing rod packing. The emissions associated with the blow down [106.359 (b) (8)] need to be accounted for in the oil and gas emission calculation spreadsheet. -Emissions from clingage are the evaporation of the lubricant adhered to the rod packing casing. -Casing volume for calculations is based on field observation of casing for a 1380hp G3516B LE engine(b). -Input parameters based on material specifications for AP 101(c) grease.	Temperature (°F)	104	Clingage loss (lb/activity)	0.0001	Number of engines	10	5.83718E-06
			Vapor pressure (psia)	0.001					
			Molecular weight (lb/lb-mole)	500					
			V_V Casing volume (ft^3) (1ft * 3ft)	2.355					
			Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year (Number of rod packing changes per year per engine)	10	Total (lbs/yr/engine)	0.0012			
3	***(b)(3) Changing wet and dry seals*** Emissions from changing seals would be from clingage of lubricant in the casing.	-Engine has been isolated and blow down occurs prior to changing seals. The emissions associated with the blow down [106.359 (b) (8)] need to be accounted for in the oil and gas emission calculation spreadsheet. -Emissions from clingage are the evaporation of the lubricant adhered to the rod packing casing. -Casing volume for calculations is based on field observation of casing for a 1380 hp Caterpillar G3516B LE engine (b). -Input parameters based on material specifications for AP 101(c) grease.	Temperature (°F)	104	Clingage loss (lb/activity)	0.0001	Number of engines	10	0.000001
			Vapor pressure of material stored (psia)	0.001					
			Molecular weight (lb/lb-mole)	500					
			V_V Casing volume (ft^3) (1ft * 3ft)	2.355					
			Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year (Number of seal changes per year)	2	Total (lbs/yr/engine)	0.0002			
4	***(b)(2) Glycol dehydration unit*** Emissions associated with replacement of glycol solution used in dehydration unit. There are two vessels in a dehydration unit: contactor and regenerator	-Calculations based on physical properties of mono ethylene glycol (MEG)(d) because of its low molecular weight and high vapor pressure which gives the most conservative emissions estimate. -Typically the glycol solution used in dehydration unit is not entirely replaced but it is conservatively assumed that the glycol solution is drained once per year for vessel maintenance. -Per field experience, 4000 gal of glycol solution is used in a large dehydration unit.	Temperature (°F)	68	Loading loss L_L (lb/1000 gal)	0.0015	Number of Dehy units	2	0.000021
			Vapor pressure (psia)	0.001					
			Saturation factor	1	Loading loss per activity (lb/activity)	0.0059			
			Molecular weight (lb/lbmol)	62.07					
			Glycol solution (gal/activity)	4000					
			Temperature (°F)	68	Clingage loss (lb/activity)	0.0155			
			Vapor pressure (psia)	0.001					
			Molecular weight (lb/lb-mole)	62.07					
			V_V Vessel volume (ft^3) (5 ft radii * 30 ft height)	2355					

	regenerator.		Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year	1	Total (lbs/yr/unit)	0.0213			
5	***(b)(2) Amine unit*** Emissions associated with replacement of solution used in the amine unit. There are two vessels in an amine unit: Contactor and regenerator.	-Calculations based on physical properties of mono ethanol amine (MEA)(e) because of its low molecular weight and high vapor pressure which gives the most conservative emissions estimate. -Typically the solution used in amine unit is not entirely replaced but it is conservatively assumed that the amine solution is drained once per year for vessel maintenance. -Per field experience, 4000 gal of solution is used in a large amine unit.	Temperature (°F)	68	Loading loss L_L (lb/1000 gal)	0.0058	Number of Dehy units	2	0.000084
			Vapor pressure (psia)	0.004					
			Saturation factor	1	Loading loss per activity (lb/activity)	0.0231			
			Molecular weight (lb/lbmol)	61.08					
			Amine solution (gal/activity)	4000					
			Temperature (°F)	68	Clingage loss (lb/activity)	0.0609			
			Vapor pressure (psia)	0.004					
			Molecular weight (lb/lb-mole)	61.08					
			V_V Vessel volume (ft^3) (5 ft radii * 30 ft height)	2355					
			Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year	1	Total (lbs/yr/unit)	0.0840			
6	***(b)(2) Heater Treater***	-Calculations based on condensate (RVP 10) because it has higher vapor pressure than crude oil (RVP 5) and results in a more conservative emission estimate. -Emission estimates are based on a large site that typically has 4 heater treaters.	Temperature (°F)	100	Clingage loss (lb/activity)	8.6913	Number of Heater Treaters	4	0.017
			Vapor pressure (psia)	10.5					
			Molecular weight (lb/lb-mole)	66					
			V_V Vessel volume (ft^3) (2ft radii * 10 ft height)	125.6					
			Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year	1	Total (lbs/yr/unit)	8.6913			
7	***(b)(2) Aerosol Lubricants***	-45-50% VOC by weight volatilizes. -Material specification per Lubricant MSDS (f). -VOC evaporation is based off standard engineering judgment consistent with product specification. - Standard Industrial Size Cans (oz.) 16			Pounds of emissions per can (lb/can)	0.5	Number of 16 oz cans used	100	0.025
8	***(b)(3) Piping Components***	-Calculations based on condensate (RVP 10) because it has higher vapor pressure than crude oil (RVP 5) and results in a more conservative emission estimate. -100 foot long pipe sections conservatively assumed for emission calculations.	Temperature (°F)	100	Clingage loss (lb/activity)	5.4321	Number of 100 ft in length of pipes	10	0.027
			Vapor pressure (psia)	10.5					
			Molecular weight (lb/lb-mole)	66					
			V_V Vessel volume (ft^3) (0.5 ft radii * 100 ft height)	78.50					
			Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year	1	Total (lbs/yr)	5.4321			
9	***(b)(3) Pneumatic controllers***	Based on field experience and recent site visits to two plants in Central Texas area, changing pneumatic controllers of equipment under pressure requires isolation of pipe section or process equipment and a blow down. There are no emissions associated with changing the controller.							
10	***(b)(2) Calibration***	-Per Monitoring Division's Laboratory and Quality Assurance Section - One cylinder of pentane or other calibration gas used per year and a typical cylinder contains 100 lbs.	Pounds of pentane in one cylinder (lb)	100	Pounds of pentane in one cylinder (lb/cylinder)	100	Number of cylinders	1	0.050
11	***(b)(6)*** Safety factor to account for MSS activities with the same character and quantity of emissions as those listed in paragraphs (b) (1) - (5) of §106.359.							1	0.028

		TPY	lbs/hr
	Total VOC emissions	**0.250**	**0.057**

MSS emissions associated with painting and blasting operations

Company Name	LINN Operating, Inc.
Site Name	F.R. Hill Compressor Station

Source Name	Painting and Blasting MSS
EPN	MSS

1. Input variables such as amount of paint used (gallons) or number of hours blasting operation occurs in the yellow box.
2. Default numbers are included for your convenience but may be edited

#	Activity	Description / comments	Default parameters		Input parameters		Annual emissions (tpy)
1	***(b)(2) Aerosol Cans*** Includes spray paints and primers, degreasers, cleaners and other solvents, rust inhibitors	- 90% VOC content is an average obtained from a survey of MSDS sheets (c)(d)(e) for spray paints and primers, degreasers, cleaners and other solvents, rust inhibitors. This does not include lubricants. -VOC is propellant. 100% VOC evaporates.	Standard Industrial Size Cans (oz.)	16	Number of 16 oz cans used	1000	0.450 VOC (tpy)
			VOC emissions (lb/can)	0.9			
2	***(b)(2) Manual application of paints, primer*** Touch up paint	-100% VOC evaporates - Survey of MSDS sheets (a) (b) indicates VOC content varies from 2 lb/gallon to 7 lb/gallon. As Chapter 115 limits VOC content to 3.5 lb/gal in nonattainment areas this was used as a conservative amount -Usage of paint based on technical expertise and NSR permit section reviews.	VOC content (lb/gal)	3.5	Paint used (gallons)	25	0.044 VOC (tpy)
3	***(b)(2) Painting Tanks and Other Immovable Fixed Structures*** Spray Painting	-100% VOC evaporates -Painting used on 1 tank or 1 vessel per year - Survey of MSDS sheets (a)(b) indicates VOC content varies from 2 lb/gallon to 7 lb/gallon. As Chapter 115 limits VOC content to 3.5 lb/gal in nonattainment areas this was used as a conservative amount. -Input parameters based on TCEQ Surface Coating Guidance Document for Air Quality Permit Applications. -Per field research in 2012, company indicated that a large site uses around 100 gallons to paint pipes and tanks in 6 month period.	VOC content (lb/gal)	3.5	Paint used (gallons)	200	0.350 VOC (tpy)
			$PM_{10\ \&\ 2.5}$ content (lb/gal)	8			
			Transfer Efficiency $PM_{10\ \&\ 2.5}$ (%)	65			0.017 PM_{10} (tpy)
			Droplet factor for $PM_{2.5}$ overspray (%)	99			
			Droplet factor for PM_{10} overspray (%)	94			0.003 $PM_{2.5}$ (tpy)
4	***(b)(2) Sandblasting***	-An application rate of 2,000 lb/hr. -Per industry expertise and BMP, blasting occurs for 5 days per year and 8 hrs per day -Emission factors for PM10 based on TCEQ Abrasive Blast Cleaning technical guidance document. Emission factor for PM2.5 is based on 15% of PM10 emission factor.	Emission factor for PM_{10} (lb/lb of usage)	0.00034	Number of hours blasting operation occurs	40	0.0136 PM_{10} (tpy)
			Application rate (lb/hr)	2000			
			PM_{10} Emissions (lb/hr)	0.68			
			Emission factor for $PM_{2.5}$ (lb/lb of usage)	0.00005			0.002 $PM_{2.5}$ (tpy)
			Application rate (lb/hr)	2000			
			$PM_{2.5}$ Emissions (lb/hr)	0.1			

	TPY	lbs/hr
Total VOC emissions	**0.844**	**0.193**
Total PM_{10} emissions	**0.030**	**0.007**
Total $PM_{2.5}$ emissions	**0.005**	**0.001**

Planned MSS - Other Emissions

Any other planned MSS activity or tank cleaning operation needs to be reported in this section. Please briefly explain all the calculations involved in the notes section.

Notes:

1. Enter information into the yellow boxes.

2. Please provide a separate detailed calculation for these emissions; also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).

3. VOC, Benzene and H2S control efficiencies may be entered (if applicable).

4. Make sure to answer the control device question.

5. Make sure to select the correct VOC Type and Emission Type from the pull down menus below.

Company Name	LINN Operating, Inc.
EPN No:	MSS
Site name:	F.R. Hill Compressor Station
Type of MSS activity	Compressor Blowdowns/Startups

VOC Wt%	3.16
H_2S Wt%	0.00
Benzene Wt%	0.12
Type of Control Device	None
Are tank vapors (A) uncontrolled; (B) controlled by a flare, vapor combustor, thermal oxidizer, or vapor recovery unit (VRU); or (C) controlled by another type of control device?	(A) uncontrolled

VOC Type: (pick from list)
Natural Gas VOC

Emission Type: (pick from list)
Low Pressure Periodic

Emissions before control and before wt% reduction

Type of Losses	Max. hourly emissions lb/hr	Avg.Annual emissions tpy
Compressor Blowdown/Startups	6.71	4.90

Planned MSS Emissions

Air contaminant	Max. hourly emissions lb/hr	Avg.Annual emissions tpy
Total VOC	**0.21**	**0.15**
Total H_2S	**0.00**	**0.00**
Total Benzene	**0.01**	**0.01**

Notes: See table called "Planned MSS Emissions - Compressor Blowdowns/Startups" for detailed emission calculations.

Planned MSS Emissions - Compressor Blowdowns/Startups
LINN Operating, Inc.

Parameter Name & Variable		Value & Units	Basis/Calculation/Notes
1. General Values and Calculations			
Gas Stream Type	--	Inlet Gas	Inlet gas/field gas
Standard Molar Volume	MV	379.0 ft^3/lb-mole	Standard molar volume
Volume per event	V	145 ft^3	Conservatively estimate 1,000 ft^3/engine blowdown/startup
Inlet Gas MW	MW	17.6 lb/lb-mole	Gas molecular weight
VOC Weight Percent	C_{VOC}	3.2 %	Gas VOC weight percent
Benzene Weight Percent	$C_{Benzene}$	0.1 %	Gas benzene weight percent
H2S Weight Percent	C_{H2S}	0.0 %	Gas H2S weight percent
Duration of Event	D	1.00 hrs	Conservatively assume entire event can occur in one hour
Number of Events	N	730	Conservatively assume 730 blowdowns (and associated startup) per engine per year
Number of Engines	N_{ENG}	2	Number of engines onsite
Total Hourly Emissions	ER_H	6.71 lb/hr	= V * MW / MV / D
Total Event Emissions	ER_E	6.71 lb/event	= V * MW / MV
Total Event Emissions	ER_A	4.90 tpy	= ER_E * N * N_{ENG} / 2,000 lb/ton

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tons/year)
VOC	0.21	0.15
Benzene	0.01	0.01
H2S	0.00	0.00

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	HIll FR Fac - 210BBL Slop Tank
City:	Fairfield
State:	TEXAS
Company:	LINN Operating, Inc.
Type of Tank:	Vertical Fixed Roof Tank
Description:	SLOP OIL TANK

Tank Dimensions

Shell Height (ft):	15.00
Diameter (ft):	10.00
Liquid Height (ft) :	14.00
Avg. Liquid Height (ft):	7.50
Volume (gallons):	8,225.29
Turnovers:	12.77
Net Throughput(gal/yr):	105,000.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.06

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Waco, Texas (Avg Atmospheric Pressure = 14.47 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

HIll FR Fac - 210BBL Slop Tank - Vertical Fixed Roof Tank
Fairfield, TEXAS

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	68.75	62.92	74.57	66.68	0.0087	0.0072	0.0104	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

HIll FR Fac - 210BBL Slop Tank - Vertical Fixed Roof Tank
Fairfield, TEXAS

Annual Emission Calcaulations	
Standing Losses (lb):	1.7374
Vapor Space Volume (cu ft):	597.2299
Vapor Density (lb/cu ft):	0.0002
Vapor Space Expansion Factor:	0.0402
Vented Vapor Saturation Factor:	0.9965
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	597.2299
Tank Diameter (ft):	10.0000
Vapor Space Outage (ft):	7.6042
Tank Shell Height (ft):	15.0000
Average Liquid Height (ft):	7.5000
Roof Outage (ft):	0.1042
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.1042
Roof Height (ft):	0.0000
Roof Slope (ft/ft):	0.0625
Shell Radius (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0087
Daily Avg. Liquid Surface Temp. (deg. R):	528.4163
Daily Average Ambient Temp. (deg. F):	66.6625
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	526.3525
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,543.2542
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0402
Daily Vapor Temperature Range (deg. R):	23.2999
Daily Vapor Pressure Range (psia):	0.0031
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0087
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0072
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0104
Daily Avg. Liquid Surface Temp. (deg R):	528.4163
Daily Min. Liquid Surface Temp. (deg R):	522.5913
Daily Max. Liquid Surface Temp. (deg R):	534.2413
Daily Ambient Temp. Range (deg. R):	22.1583
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9965
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0087
Vapor Space Outage (ft):	7.6042

Working Losses (lb):	2.8231
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0087
Annual Net Throughput (gal/yr.):	105,000.0000
Annual Turnovers:	12.7655
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	8,225.2880
Maximum Liquid Height (ft):	14.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	4.5606

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

HIll FR Fac - 210BBL Slop Tank - Vertical Fixed Roof Tank
Fairfield, TEXAS

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	2.82	1.74	4.56

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Hill FR Fac - 210BBL Water Tank
City:	Fairfield
State:	TEXAS
Company:	LINN Operating, Inc.
Type of Tank:	Vertical Fixed Roof Tank
Description:	PRODUCED WATER TANK

Tank Dimensions

Shell Height (ft):	15.00
Diameter (ft):	10.00
Liquid Height (ft) :	14.00
Avg. Liquid Height (ft):	7.50
Volume (gallons):	8,225.29
Turnovers:	0.28
Net Throughput(gal/yr):	2,287.59
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.06

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Waco, Texas (Avg Atmospheric Pressure = 14.47 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Hill FR Fac - 210BBL Water Tank - Vertical Fixed Roof Tank
Fairfield, TEXAS

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Crude Oil (RVP 2.27)	All	68.75	62.92	74.57	66.68	1.1883	1.0412	1.3523	50.0000			149.10	Option 4: RVP=2.27

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Hill FR Fac - 210BBL Water Tank - Vertical Fixed Roof Tank
Fairfield, TEXAS

Annual Emission Calcaulations	
Standing Losses (lb):	97.2923
Vapor Space Volume (cu ft):	597.2299
Vapor Density (lb/cu ft):	0.0105
Vapor Space Expansion Factor:	0.0630
Vented Vapor Saturation Factor:	0.6762
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	597.2299
Tank Diameter (ft):	10.0000
Vapor Space Outage (ft):	7.6042
Tank Shell Height (ft):	15.0000
Average Liquid Height (ft):	7.5000
Roof Outage (ft):	0.1042
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.1042
Roof Height (ft):	0.0000
Roof Slope (ft/ft):	0.0625
Shell Radius (ft):	5.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0105
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.1883
Daily Avg. Liquid Surface Temp. (deg. R):	528.4163
Daily Average Ambient Temp. (deg. F):	66.6625
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	526.3525
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,543.2542
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0630
Daily Vapor Temperature Range (deg. R):	23.2999
Daily Vapor Pressure Range (psia):	0.3110
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.1883
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	1.0412
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	1.3523
Daily Avg. Liquid Surface Temp. (deg R):	528.4163
Daily Min. Liquid Surface Temp. (deg R):	522.5913
Daily Max. Liquid Surface Temp. (deg R):	534.2413
Daily Ambient Temp. Range (deg. R):	22.1583
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.6762
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	1.1883
Vapor Space Outage (ft):	7.6042

Working Losses (lb):	2.4271
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	1.1883
Annual Net Throughput (gal/yr.):	2,287.5860
Annual Turnovers:	0.2781
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	8,225.2880
Maximum Liquid Height (ft):	14.0000
Tank Diameter (ft):	10.0000
Working Loss Product Factor:	0.7500
Total Losses (lb):	99.7194

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Hill FR Fac - 210BBL Water Tank - Vertical Fixed Roof Tank
Fairfield, TEXAS

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude Oil (RVP 2.27)	2.43	97.29	99.72

APPENDIX C TECHNICAL DATA

This appendix contains technical support data for this PBR authorization.

September 08, 2015

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

For: Linn Energy, LLC
P. O. Box 1119
Portland, Texas 78374

Sample: Hill FR Facility
Inlet to Facility Gas
Sampled @ 40 psig and 87 °F

Date Sampled: 08/27/15 Job Number: 53954.011

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2286

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	0.001	
Nitrogen	0.163	
Carbon Dioxide	2.686	
Methane	93.936	
Ethane	2.326	0.619
Propane	0.376	0.103
Isobutane	0.131	0.043
n-Butane	0.078	0.024
2-2 Dimethylpropane	0.007	0.003
Isopentane	0.048	0.017
n-Pentane	0.019	0.007
Hexanes	0.085	0.035
Heptanes Plus	0.144	0.057
Totals	100.000	0.907

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity	3.374	(Air=1)
Molecular Weight	97.51	
Gross Heating Value	5005	BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity	0.607	(Air=1)
Compressibility (Z)	0.9977	
Molecular Weight	17.55	
Gross Heating Value		
Dry Basis	1020	BTU/CF
Saturated Basis	1003	BTU/CF

*Hydrogen Sulfide tested on location by: Stain Tube Method (GPA 2377)
Results: 0.566 Gr/100 CF, 9.0 PPMV or 0.001 Mol %

Base Conditions: 14.650 PSI & 60 Deg F

Sampled By: (16) E. Garza
Analyst: MR
Processor: OA
Cylinder ID: T-5155

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2286
TOTAL REPORT

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	0.001		0.002
Nitrogen	0.163		0.260
Carbon Dioxide	2.686		6.735
Methane	93.936		85.859
Ethane	2.326	0.619	3.985
Propane	0.376	0.103	0.945
Isobutane	0.131	0.043	0.434
n-Butane	0.078	0.024	0.258
2,2 Dimethylpropane	0.007	0.003	0.029
Isopentane	0.048	0.017	0.197
n-Pentane	0.019	0.007	0.078
2,2 Dimethylbutane	0.016	0.007	0.079
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.010	0.004	0.049
2 Methylpentane	0.029	0.012	0.142
3 Methylpentane	0.016	0.006	0.079
n-Hexane	0.014	0.006	0.069
Methylcyclopentane	0.006	0.002	0.029
Benzene	0.027	0.008	0.120
Cyclohexane	0.006	0.002	0.029
2-Methylhexane	0.009	0.004	0.051
3-Methylhexane	0.008	0.004	0.046
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.017	0.007	0.096
n-Heptane	0.006	0.003	0.034
Methylcyclohexane	0.011	0.004	0.062
Toluene	0.019	0.006	0.100
Other C8's	0.014	0.006	0.088
n-Octane	0.003	0.002	0.020
Ethylbenzene	0.001	0.000	0.006
M & P Xylenes	0.005	0.002	0.030
O-Xylene	0.001	0.000	0.006
Other C9's	0.005	0.003	0.036
n-Nonane	0.001	0.001	0.007
Other C10's	0.003	0.002	0.024
n-Decane	0.001	0.001	0.008
Undecanes (11)	0.001	0.001	0.008
Totals	100.000	0.907	100.000

Computed Real Characteristics of Total Sample

Specific Gravity	0.607	(Air=1)
Compressibility (Z)	0.9977	
Molecular Weight	17.55	

Gross Heating Value

Dry Basis	1020	BTU/CF
Saturated Basis	1003	BTU/CF

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

Sample: Hill FR Facility
Inlet to Facility Gas
Sampled @ 40 psig and 87 °F

Date Sampled: 08/27/15 Job Number: 53954.011

GLYCALC FORMAT

COMPONENT	MOL%	GPM	Wt %
Carbon Dioxide	2.686		6.735
Hydrogen Sulfide	0.001		0.002
Nitrogen	0.163		0.260
Methane	93.936		85.859
Ethane	2.326	0.619	3.985
Propane	0.376	0.103	0.945
Isobutane	0.131	0.043	0.434
n-Butane	0.085	0.027	0.287
Isopentane	0.048	0.017	0.197
n-Pentane	0.019	0.007	0.078
Cyclopentane	0.000	0.000	0.000
n-Hexane	0.014	0.006	0.069
Cyclohexane	0.006	0.002	0.029
Other C6's	0.071	0.029	0.349
Heptanes	0.046	0.020	0.256
Methylcyclohexane	0.011	0.004	0.062
2,2,4 Trimethylpentane	0.000	0.000	0.000
Benzene	0.027	0.008	0.120
Toluene	0.019	0.006	0.100
Ethylbenzene	0.001	0.000	0.006
Xylenes	0.006	0.002	0.036
Octanes Plus	0.028	0.014	0.191
Totals	100.000	0.907	100.000

Real Characteristics Of Octanes Plus:

Specific Gravity	4.150	(Air=1)
Molecular Weight	119.94	
Gross Heating Value	6186	BTU/CF

Real Characteristics Of Total Sample:

Specific Gravity	0.607	(Air=1)
Compressibility (Z)	0.9977	
Molecular Weight	17.55	
Gross Heating Value		
Dry Basis	1020	BTU/CF
Saturated Basis	1003	BTU/CF

September 08, 2015

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

For: Linn Energy, LLC
P. O. Box 1119
Portland, Texas 78374

Sample: Hill FR Facility
Inlet to Dehydrator Gas
Sampled @ 1000 psig and 98 °F

Date Sampled: 08/27/15 Job Number: 53954.021

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2286

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	0.001	
Nitrogen	0.135	
Carbon Dioxide	2.605	
Methane	94.022	
Ethane	2.389	0.635
Propane	0.391	0.107
Isobutane	0.135	0.044
n-Butane	0.084	0.026
2-2 Dimethylpropane	0.005	0.002
Isopentane	0.062	0.023
n-Pentane	0.017	0.006
Hexanes	0.057	0.023
Heptanes Plus	0.097	0.038
Totals	100.000	0.905

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity	3.370	(Air=1)
Molecular Weight	97.38	
Gross Heating Value	5004	BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity	0.605	(Air=1)
Compressibility (Z)	0.9977	
Molecular Weight	17.49	
Gross Heating Value		
Dry Basis	1019	BTU/CF
Saturated Basis	1002	BTU/CF

*Hydrogen Sulfide tested on location by: Stain Tube Method (GPA 2377)
Results: 0.629 Gr/100 CF, 10.0 PPMV or 0.001 Mol %

Base Conditions: 14.650 PSI & 60 Deg F

Sampled By: (16) E. Garza
Analyst: MR
Processor: OA
Cylinder ID: T-3562

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

CHROMATOGRAPH EXTENDED ANALYSIS - GPA 2286
TOTAL REPORT

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	0.001		0.002
Nitrogen	0.135		0.216
Carbon Dioxide	2.605		6.555
Methane	94.022		86.242
Ethane	2.389	0.635	4.107
Propane	0.391	0.107	0.986
Isobutane	0.135	0.044	0.449
n-Butane	0.084	0.026	0.279
2,2 Dimethylpropane	0.005	0.002	0.021
Isopentane	0.062	0.023	0.256
n-Pentane	0.017	0.006	0.070
2,2 Dimethylbutane	0.011	0.005	0.054
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.007	0.003	0.034
2 Methylpentane	0.019	0.008	0.094
3 Methylpentane	0.011	0.004	0.054
n-Hexane	0.009	0.004	0.044
Methylcyclopentane	0.004	0.001	0.019
Benzene	0.018	0.005	0.080
Cyclohexane	0.004	0.001	0.019
2-Methylhexane	0.006	0.003	0.034
3-Methylhexane	0.006	0.003	0.034
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.012	0.005	0.068
n-Heptane	0.004	0.002	0.023
Methylcyclohexane	0.007	0.003	0.039
Toluene	0.012	0.004	0.063
Other C8's	0.009	0.004	0.057
n-Octane	0.002	0.001	0.013
Ethylbenzene	0.001	0.000	0.006
M & P Xylenes	0.004	0.002	0.024
O-Xylene	0.001	0.000	0.006
Other C9's	0.004	0.002	0.029
n-Nonane	0.001	0.001	0.007
Other C10's	0.000	0.000	0.000
n-Decane	0.001	0.001	0.008
Undecanes (11)	0.001	0.001	0.008
Totals	100.000	0.905	100.000

Computed Real Characteristics of Total Sample

Specific Gravity	0.605	(Air=1)
Compressibility (Z)	0.9977	
Molecular Weight	17.49	

Gross Heating Value

Dry Basis	1019	BTU/CF
Saturated Basis	1002	BTU/CF

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

Sample: Hill FR Facility
Inlet to Dehydrator Gas
Sampled @ 1000 psig and 98 °F

Date Sampled: 08/27/15 Job Number: 53954.021

GLYCALC FORMAT

COMPONENT	MOL%	GPM	Wt %
Carbon Dioxide	2.605		6.555
Hydrogen Sulfide	0.001		0.002
Nitrogen	0.135		0.216
Methane	94.022		86.242
Ethane	2.389	0.635	4.107
Propane	0.391	0.107	0.986
Isobutane	0.135	0.044	0.449
n-Butane	0.089	0.028	0.300
Isopentane	0.062	0.023	0.256
n-Pentane	0.017	0.006	0.070
Cyclopentane	0.000	0.000	0.000
n-Hexane	0.009	0.004	0.044
Cyclohexane	0.004	0.001	0.019
Other C6's	0.048	0.020	0.236
Heptanes	0.032	0.014	0.178
Methylcyclohexane	0.007	0.003	0.039
2,2,4 Trimethylpentane	0.000	0.000	0.000
Benzene	0.018	0.005	0.080
Toluene	0.012	0.004	0.063
Ethylbenzene	0.001	0.000	0.006
Xylenes	0.005	0.002	0.030
Octanes Plus	0.018	0.009	0.122
Totals	100.000	0.905	100.000

Real Characteristics Of Octanes Plus:

Specific Gravity	4.120	(Air=1)
Molecular Weight	119.05	
Gross Heating Value	6158	BTU/CF

Real Characteristics Of Total Sample:

Specific Gravity	0.605	(Air=1)
Compressibility (Z)	0.9977	
Molecular Weight	17.49	
Gross Heating Value		
Dry Basis	1019	BTU/CF
Saturated Basis	1002	BTU/CF

September 08, 2015

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

For: Linn Energy, LLC
P. O. Box 1119
Portland, Texas 78374

Sample: Hill FR Facility
Gas Liberated from Separator Water
From 40 psig & 84 °F to 0 psig & 70 °F

Date Sampled: 08/27/15 Job Number: 53954.001

CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT - GPA 2286

COMPONENT	MOL%	GPM
Hydrogen Sulfide*	< 0.001	
Nitrogen	0.153	
Carbon Dioxide	10.668	
Methane	77.079	
Ethane	5.273	1.402
Propane	1.289	0.353
Isobutane	3.908	1.272
n-Butane	0.389	0.122
2-2 Dimethylpropane	0.024	0.009
Isopentane	0.344	0.125
n-Pentane	0.125	0.045
Hexanes	0.292	0.120
Heptanes Plus	0.455	0.181
Totals	100.000	3.629

Computed Real Characteristics Of Heptanes Plus:

Specific Gravity	3.341	(Air=1)
Molecular Weight	96.42	
Gross Heating Value	4974	BTU/CF

Computed Real Characteristics Of Total Sample:

Specific Gravity	0.790	(Air=1)
Compressibility (Z)	0.9964	
Molecular Weight	22.80	
Gross Heating Value		
Dry Basis	1101	BTU/CF
Saturated Basis	1082	BTU/CF

*Hydrogen Sulfide tested in laboratory by: Stained Tube Method (GPA 2377)
Results: 0.031 Gr/100 CF, 0.5 PPMV or 0.0001 Mol %

Base Conditions: 14.650 PSI & 60 Deg F

Sampled By: (16) O. Almaguer
Analyst: MR
Processor: OA
Cylinder ID: WF# 8S

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

CHROMATOGRAPH EXTENDED ANALYSIS
TOTAL REPORT - GPA 2286

COMPONENT	MOL %	GPM	WT %
Hydrogen Sulfide*	< 0.001		< 0.001
Nitrogen	0.153		0.188
Carbon Dioxide	10.668		20.590
Methane	77.079		54.229
Ethane	5.273	1.402	6.954
Propane	1.289	0.353	2.493
Isobutane	3.908	1.272	9.961
n-Butane	0.389	0.122	0.992
2,2 Dimethylpropane	0.024	0.009	0.077
Isopentane	0.344	0.125	1.089
n-Pentane	0.125	0.045	0.396
2,2 Dimethylbutane	0.052	0.022	0.197
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.035	0.014	0.132
2 Methylpentane	0.096	0.040	0.364
3 Methylpentane	0.059	0.024	0.223
n-Hexane	0.050	0.021	0.190
Methylcyclopentane	0.022	0.008	0.082
Benzene	0.082	0.023	0.280
Cyclohexane	0.023	0.008	0.085
2-Methylhexane	0.035	0.016	0.155
3-Methylhexane	0.033	0.015	0.147
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C7's	0.065	0.028	0.281
n-Heptane	0.022	0.010	0.098
Methylcyclohexane	0.041	0.016	0.176
Toluene	0.039	0.013	0.156
Other C8's	0.054	0.025	0.261
n-Octane	0.009	0.005	0.046
Ethylbenzene	0.002	0.001	0.008
M & P Xylenes	0.008	0.003	0.036
O-Xylene	0.000	0.000	0.000
Other C9's	0.018	0.009	0.100
n-Nonane	0.003	0.001	0.014
Other C10's	0.000	0.000	0.000
n-Decane	0.000	0.000	0.000
Undecanes (11)	0.000	0.000	0.000
Totals	100.000	3.629	100.000

Computed Real Characteristics Of Total Sample:

Specific Gravity	0.790	(Air=1)
Compressibility (Z)	0.9964	
Molecular Weight	22.80	
Gross Heating Value		
Dry Basis	1101	BTU/CF
Saturated Basis	1082	BTU/CF

September 23, 2015

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

For: Linn Energy, LLC
P. O. Box 1119
Portland, Texas 78374

Date Sampled: 08/27/15

Date Analyzed: 09/04/15

Job Number: J53954

Sample: Hill FR Facility

FLASH LIBERATION OF SEPARATOR WATER		
	Separator	**Stock Tank**
Pressure, psig	40	0
Temperature, °F	84	70
Gas Water Ratio (1)	------	3.81
Gas Specific Gravity (2)	------	0.790

(1) - Scf of water saturated vapor per barrel of stock tank water
(2) - Air = 1.000
(3) - Separator volume / Stock tank volume
Analyst: O.A.

Piston No.: PW 0145

Base Conditions: 14.65 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

September 16, 2015

FESCO Ltd.
1100 Fesco Avenue - Alice, Texas 78332

For: Linn Energy, LLC
P. O. Box 1119
Portland, Texas 78374

LABORATORY TEST RESULTS

Lease/Well .....Hill FR Facility Job Number J53954
Date Sampled 8/27/2015

Sample ID	Test	Results	Units	Test Method
Production Gas	H2S	4.00	PPM	GPA-2377
		0.25	Gr/100cf	
		0.0004	Mol%	
Water Tank	H2S	<0.2	PPM	GPA-2377
		<0.013	Gr/100cf	
		<0.001	Mol%	

FESCO Ltd. - Alice, Texas

David Dannhaus 361-661-7015

September 21, 2015

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

For: Linn Energy, LLC
P. O. Box 1119
Portland, Texas 78374

Date Sampled: 08/27/15

Date Analyzed: 09/05/15

Sample: Dew Compressor Site

Job Number: J53949

FLASH LIBERATION OF HYDROCARBON LIQUID		
	Separator HC Liquid	**Stock Tank**
Pressure, psig	28	0
Temperature, °F	80	70
Gas Oil Ratio (1)	------	7.8
Gas Specific Gravity (2)	------	0.828
Separator Volume Factor (3)	1.0153	1.000

STOCK TANK FLUID PROPERTIES	
Shrinkage Recovery Factor (4)	0.9849
Oil API Gravity at 60 °F	52.39
Reid Vapor Pressure Equivalent (D-6377), psi (5)	2.27

Quality Control Check			
	Sampling Conditions	**Test Samples**	
Cylinder No.	------	W-2683*	W-2097
Pressure, psig	28	33	34
Temperature, °F	80	80	80

(1) - Scf of flashed vapor per barrel of stock tank oil
(2) - Air = 1.000
(3) - Separator volume / Stock tank volume
(4) - Fraction of first stage separator liquid
(5) - Absolute pressure at 100 deg F
Analyst: T. G.
* Sample used for flash study
Base Conditions: 14.65 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus 361-661-7015

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Hill FR Facility Gycol Dehy Emission
File Name: C:\Dropbox (TC)\CP\LINN Energy\P1212 - FR Hill Permit\2_1st Deliverable\2 Working Files\GLYCALC\Hill FR Facility.ddf
Date: February 05, 2016

DESCRIPTION:

Description: 2.0 MMscf/day maximum throughput, regenerator still vent routed to condenser for control. flash tank routed to reboiler at 50% control and glycol pump rate maximized at 0.67 gpm

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Hydrogen Sulfide	0.0014	0.033	0.0061
Methane	0.0474	1.138	0.2078
Ethane	0.0207	0.497	0.0908
Propane	0.0119	0.286	0.0522
Isobutane	0.0087	0.208	0.0380
n-Butane	0.0079	0.190	0.0346
Isopentane	0.0039	0.093	0.0169
n-Pentane	0.0021	0.050	0.0092
n-Hexane	0.0019	0.047	0.0085
Cyclohexane	0.0037	0.088	0.0161
Other Hexanes	0.0090	0.217	0.0396
Heptanes	0.0063	0.150	0.0274
Methylcyclohexane	0.0043	0.103	0.0187
Benzene	0.1028	2.468	0.4504
Toluene	0.0412	0.990	0.1807
Ethylbenzene	0.0010	0.023	0.0042
Xylenes	0.0056	0.135	0.0246
C8+ Heavies	0.0001	0.002	0.0003
Total Emissions	0.2799	6.717	1.2259
Total Hydrocarbon Emissions	0.2785	6.684	1.2199
Total VOC Emissions	0.2104	5.049	0.9214
Total HAP Emissions	0.1526	3.662	0.6684
Total BTEX Emissions	0.1507	3.616	0.6599

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Hydrogen Sulfide	0.0015	0.036	0.0066
Methane	0.0476	1.143	0.2086
Ethane	0.0212	0.508	0.0928
Propane	0.0133	0.320	0.0585
Isobutane	0.0108	0.259	0.0473
n-Butane	0.0108	0.258	0.0472

Isopentane	0.0077	0.184	0.0336
n-Pentane	0.0044	0.105	0.0191
n-Hexane	0.0077	0.184	0.0335
Cyclohexane	0.0199	0.478	0.0872
Other Hexanes	0.0272	0.653	0.1191
Heptanes	0.0600	1.440	0.2628
Methylcyclohexane	0.0434	1.041	0.1901
Benzene	0.7107	17.058	3.1131
Toluene	0.7946	19.070	3.4803
Ethylbenzene	0.0545	1.307	0.2386
Xylenes	0.4271	10.250	1.8707
C8+ Heavies	0.2274	5.458	0.9962
Total Emissions	2.4897	59.754	10.9050
Total Hydrocarbon Emissions	2.4882	59.718	10.8985
Total VOC Emissions	2.4194	58.066	10.5971
Total HAP Emissions	1.9945	47.869	8.7361
Total BTEX Emissions	1.9869	47.685	8.7026

FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Hydrogen Sulfide	0.0002	0.006	0.0011
Methane	0.6314	15.154	2.7657
Ethane	0.0762	1.829	0.3338
Propane	0.0219	0.525	0.0959
Isobutane	0.0114	0.273	0.0499
n-Butane	0.0085	0.205	0.0374
Isopentane	0.0052	0.124	0.0226
n-Pentane	0.0024	0.056	0.0103
n-Hexane	0.0022	0.053	0.0097
Cyclohexane	0.0014	0.034	0.0062
Other Hexanes	0.0104	0.250	0.0456
Heptanes	0.0081	0.195	0.0356
Methylcyclohexane	0.0024	0.057	0.0103
Benzene	0.0070	0.167	0.0305
Toluene	0.0048	0.116	0.0211
Ethylbenzene	0.0002	0.004	0.0008
Xylenes	0.0010	0.024	0.0044
C8+ Heavies	0.0025	0.061	0.0111
Total Emissions	0.7972	19.134	3.4919
Total Hydrocarbon Emissions	0.7970	19.128	3.4908
Total VOC Emissions	0.0894	2.145	0.3914
Total HAP Emissions	0.0152	0.364	0.0664
Total BTEX Emissions	0.0130	0.311	0.0568

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Hydrogen Sulfide	0.0005	0.012	0.0021
Methane	1.2629	30.309	5.5313
Ethane	0.1524	3.658	0.6675
Propane	0.0438	1.050	0.1917
Isobutane	0.0228	0.547	0.0998
n-Butane	0.0171	0.410	0.0749

Isopentane	0.0103	0.248	0.0453
n-Pentane	0.0047	0.113	0.0206
n-Hexane	0.0044	0.106	0.0193
Cyclohexane	0.0028	0.068	0.0124
Other Hexanes	0.0208	0.500	0.0913
Heptanes	0.0163	0.390	0.0712
Methylcyclohexane	0.0047	0.113	0.0206
Benzene	0.0139	0.334	0.0610
Toluene	0.0096	0.231	0.0422
Ethylbenzene	0.0004	0.009	0.0016
Xylenes	0.0020	0.048	0.0087
C8+ Heavies	0.0051	0.121	0.0221
Total Emissions	1.5945	38.267	6.9838
Total Hydrocarbon Emissions	1.5940	38.256	6.9817
Total VOC Emissions	0.1787	4.290	0.7828
Total HAP Emissions	0.0303	0.728	0.1328
Total BTEX Emissions	0.0259	0.622	0.1135

EQUIPMENT REPORTS:

CONDENSER

Condenser Outlet Temperature:	105.00 deg. F
Condenser Pressure:	15.00 psia
Condenser Duty:	9.98e-003 MM BTU/hr
Hydrocarbon Recovery:	0.18 bbls/day
Produced Water:	0.37 bbls/day
VOC Control Efficiency:	91.31 %
HAP Control Efficiency:	92.35 %
BTEX Control Efficiency:	92.42 %
Dissolved Hydrocarbons in Water:	996.21 mg/L

Component	Emitted	Condensed
Water	0.40%	99.60%
Carbon Dioxide	97.93%	2.07%
Hydrogen Sulfide	92.04%	7.96%
Nitrogen	98.96%	1.04%
Methane	99.59%	0.41%
Ethane	97.81%	2.19%
Propane	89.32%	10.68%
Isobutane	80.18%	19.82%
n-Butane	73.40%	26.60%
Isopentane	50.44%	49.56%
n-Pentane	47.93%	52.07%
n-Hexane	25.41%	74.59%
Cyclohexane	18.44%	81.56%
Other Hexanes	33.20%	66.80%
Heptanes	10.44%	89.56%
Methylcyclohexane	9.85%	90.15%
Benzene	14.47%	85.53%
Toluene	5.19%	94.81%
Ethylbenzene	1.78%	98.22%
Xylenes	1.32%	98.68%
C8+ Heavies	0.03%	99.97%

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages:	1.25
Calculated Dry Gas Dew Point:	3.33 lbs. H2O/MMSCF
Temperature:	110.0 deg. F
Pressure:	1200.0 psig
Dry Gas Flow Rate:	2.0000 MMSCF/day
Glycol Losses with Dry Gas:	0.0639 lb/hr
Wet Gas Water Content:	Saturated
Calculated Wet Gas Water Content:	68.15 lbs. H2O/MMSCF
Specified Lean Glycol Recirc. Ratio:	6.78 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	4.87%	95.13%
Carbon Dioxide	99.54%	0.46%
Hydrogen Sulfide	97.35%	2.65%
Nitrogen	99.95%	0.05%
Methane	99.96%	0.04%
Ethane	99.89%	0.11%
Propane	99.84%	0.16%
Isobutane	99.80%	0.20%
n-Butane	99.74%	0.26%
Isopentane	99.76%	0.24%
n-Pentane	99.70%	0.30%
n-Hexane	99.55%	0.45%
Cyclohexane	97.95%	2.05%
Other Hexanes	99.64%	0.36%
Heptanes	99.25%	0.75%
Methylcyclohexane	97.97%	2.03%
Benzene	84.36%	15.64%
Toluene	79.10%	20.90%
Ethylbenzene	76.51%	23.49%
Xylenes	69.39%	30.61%
C8+ Heavies	97.78%	2.22%

FLASH TANK

Flash Control:	Combustion device
Flash Control Efficiency:	50.00 %
Flash Temperature:	120.0 deg. F
Flash Pressure:	35.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.96%	0.04%
Carbon Dioxide	32.05%	67.95%
Hydrogen Sulfide	75.70%	24.30%
Nitrogen	3.55%	96.45%
Methane	3.63%	96.37%
Ethane	12.21%	87.79%

Propane	23.37%	76.63%
Isobutane	32.18%	67.82%
n-Butane	38.64%	61.36%
Isopentane	42.85%	57.15%
n-Pentane	48.36%	51.64%
n-Hexane	63.64%	36.36%
Cyclohexane	87.91%	12.09%
Other Hexanes	57.05%	42.95%
Heptanes	78.78%	21.22%
Methylcyclohexane	90.60%	9.40%
Benzene	98.17%	1.83%
Toluene	98.90%	1.10%
Ethylbenzene	99.40%	0.60%
Xylenes	99.59%	0.41%
C8+ Heavies	98.09%	1.91%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	48.78%	51.22%
Carbon Dioxide	0.00%	100.00%
Hydrogen Sulfide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	1.17%	98.83%
n-Pentane	1.03%	98.97%
n-Hexane	0.79%	99.21%
Cyclohexane	3.64%	96.36%
Other Hexanes	1.75%	98.25%
Heptanes	0.63%	99.37%
Methylcyclohexane	4.42%	95.58%
Benzene	5.09%	94.91%
Toluene	7.97%	92.03%
Ethylbenzene	10.42%	89.58%
Xylenes	12.84%	87.16%
C8+ Heavies	12.23%	87.77%

STREAM REPORTS:

WET GAS STREAM

Temperature: 110.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 8.35e+004 scfh

Component	Conc.	Loading

	(vol%)	(lb/hr)
Water	1.44e-001	5.69e+000
Carbon Dioxide	2.68e+000	2.60e+002
Hydrogen Sulfide	9.99e-004	7.49e-002
Nitrogen	1.63e-001	1.00e+001
Methane	9.38e+001	3.31e+003
Ethane	2.32e+000	1.54e+002
Propane	3.75e-001	3.64e+001
Isobutane	1.31e-001	1.67e+001
n-Butane	8.49e-002	1.09e+001
Isopentane	4.79e-002	7.61e+000
n-Pentane	1.90e-002	3.01e+000
n-Hexane	1.40e-002	2.65e+000
Cyclohexane	5.99e-003	1.11e+000
Other Hexanes	7.09e-002	1.34e+001
Heptanes	4.59e-002	1.01e+001
Methylcyclohexane	1.10e-002	2.37e+000
Benzene	2.70e-002	4.63e+000
Toluene	1.90e-002	3.85e+000
Ethylbenzene	9.99e-004	2.33e-001
Xylenes	5.99e-003	1.40e+000
C8+ Heavies	2.80e-002	1.05e+001
Total Components	100.00	3.87e+003

DRY GAS STREAM

Temperature: 110.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 8.33e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.01e-003	2.77e-001
Carbon Dioxide	2.68e+000	2.59e+002
Hydrogen Sulfide	9.74e-004	7.29e-002
Nitrogen	1.63e-001	1.00e+001
Methane	9.40e+001	3.31e+003
Ethane	2.32e+000	1.54e+002
Propane	3.76e-001	3.64e+001
Isobutane	1.31e-001	1.67e+001
n-Butane	8.48e-002	1.08e+001
Isopentane	4.79e-002	7.59e+000
n-Pentane	1.90e-002	3.00e+000
n-Hexane	1.39e-002	2.64e+000
Cyclohexane	5.88e-003	1.09e+000
Other Hexanes	7.08e-002	1.34e+001
Heptanes	4.57e-002	1.01e+001
Methylcyclohexane	1.08e-002	2.33e+000
Benzene	2.28e-002	3.91e+000
Toluene	1.50e-002	3.04e+000
Ethylbenzene	7.66e-004	1.79e-001
Xylenes	4.17e-003	9.71e-001
C8+ Heavies	2.74e-002	1.02e+001
Total Components	100.00	3.85e+003

LEAN GLYCOL STREAM

Temperature: 110.00 deg. F
Flow Rate: 6.10e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	3.38e+002
Water	1.50e+000	5.15e+000
Carbon Dioxide	3.49e-011	1.20e-010
Hydrogen Sulfide	5.79e-014	1.99e-013
Nitrogen	1.34e-013	4.59e-013
Methane	1.28e-017	4.41e-017
Ethane	2.39e-008	8.20e-008
Propane	6.76e-010	2.32e-009
Isobutane	2.93e-010	1.01e-009
n-Butane	2.01e-010	6.90e-010
Isopentane	2.63e-005	9.04e-005
n-Pentane	1.33e-005	4.55e-005
n-Hexane	1.76e-005	6.06e-005
Cyclohexane	2.19e-004	7.53e-004
Other Hexanes	1.41e-004	4.85e-004
Heptanes	1.12e-004	3.83e-004
Methylcyclohexane	5.85e-004	2.01e-003
Benzene	1.11e-002	3.81e-002
Toluene	2.00e-002	6.88e-002
Ethylbenzene	1.84e-003	6.33e-003
Xylenes	1.83e-002	6.29e-002
C8+ Heavies	9.23e-003	3.17e-002
Total Components	100.00	3.43e+002

RICH GLYCOL STREAM

Temperature: 110.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 6.32e-001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.55e+001	3.38e+002
Water	2.98e+000	1.06e+001
Carbon Dioxide	3.38e-001	1.20e+000
Hydrogen Sulfide	5.62e-004	1.99e-003
Nitrogen	1.31e-003	4.62e-003
Methane	3.70e-001	1.31e+000
Ethane	4.90e-002	1.74e-001
Propane	1.61e-002	5.71e-002
Isobutane	9.49e-003	3.36e-002
n-Butane	7.87e-003	2.79e-002
Isopentane	5.11e-003	1.81e-002
n-Pentane	2.57e-003	9.11e-003
n-Hexane	3.42e-003	1.21e-002
Cyclohexane	6.64e-003	2.35e-002
Other Hexanes	1.37e-002	4.85e-002
Heptanes	2.17e-002	7.66e-002
Methylcyclohexane	1.42e-002	5.01e-002

Benzene	2.15e-001	7.63e-001
Toluene	2.47e-001	8.73e-001
Ethylbenzene	1.73e-002	6.12e-002
Xylenes	1.39e-001	4.92e-001
C8+ Heavies	7.46e-002	2.64e-001
Total Components	100.00	3.54e+002

FLASH TANK OFF GAS STREAM

Temperature: 120.00 deg. F
Pressure: 49.70 psia
Flow Rate: 4.00e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	2.44e-001	4.63e-003
Carbon Dioxide	1.75e+001	8.14e-001
Hydrogen Sulfide	1.34e-002	4.83e-004
Nitrogen	1.51e-001	4.46e-003
Methane	7.46e+001	1.26e+000
Ethane	4.81e+000	1.52e-001
Propane	9.41e-001	4.38e-002
Isobutane	3.72e-001	2.28e-002
n-Butane	2.79e-001	1.71e-002
Isopentane	1.36e-001	1.03e-002
n-Pentane	6.18e-002	4.71e-003
n-Hexane	4.85e-002	4.41e-003
Cyclohexane	3.20e-002	2.84e-003
Other Hexanes	2.29e-001	2.08e-002
Heptanes	1.54e-001	1.63e-002
Methylcyclohexane	4.55e-002	4.71e-003
Benzene	1.69e-001	1.39e-002
Toluene	9.91e-002	9.64e-003
Ethylbenzene	3.29e-003	3.69e-004
Xylenes	1.78e-002	1.99e-003
C8+ Heavies	2.81e-002	5.05e-003
Total Components	100.00	2.42e+000

FLASH TANK GLYCOL STREAM

Temperature: 120.00 deg. F
Flow Rate: 6.27e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.61e+001	3.38e+002
Water	3.00e+000	1.06e+001
Carbon Dioxide	1.09e-001	3.84e-001
Hydrogen Sulfide	4.28e-004	1.50e-003
Nitrogen	4.67e-005	1.64e-004
Methane	1.35e-002	4.76e-002
Ethane	6.03e-003	2.12e-002
Propane	3.80e-003	1.33e-002
Isobutane	3.07e-003	1.08e-002
n-Butane	3.06e-003	1.08e-002

Isopentane	2.21e-003	7.75e-003
n-Pentane	1.25e-003	4.41e-003
n-Hexane	2.19e-003	7.72e-003
Cyclohexane	5.88e-003	2.07e-002
Other Hexanes	7.87e-003	2.77e-002
Heptanes	1.72e-002	6.04e-002
Methylcyclohexane	1.29e-002	4.54e-002
Benzene	2.13e-001	7.49e-001
Toluene	2.46e-001	8.63e-001
Ethylbenzene	1.73e-002	6.08e-002
Xylenes	1.39e-001	4.90e-001
C8+ Heavies	7.37e-002	2.59e-001
Total Components	100.00	3.52e+002

FLASH GAS EMISSIONS

Flow Rate: 7.83e+001 scfh
Control Method: Combustion Device
Control Efficiency: 50.00

Component	Conc. (vol%)	Loading (lb/hr)
Water	4.54e+001	1.69e+000
Carbon Dioxide	3.35e+001	3.04e+000
Hydrogen Sulfide	3.44e-003	2.42e-004
Nitrogen	7.72e-002	4.46e-003
Methane	1.91e+001	6.31e-001
Ethane	1.23e+000	7.62e-002
Propane	2.41e-001	2.19e-002
Isobutane	9.50e-002	1.14e-002
n-Butane	7.13e-002	8.55e-003
Isopentane	3.47e-002	5.17e-003
n-Pentane	1.58e-002	2.35e-003
n-Hexane	1.24e-002	2.20e-003
Cyclohexane	8.18e-003	1.42e-003
Other Hexanes	5.86e-002	1.04e-002
Heptanes	3.93e-002	8.13e-003
Methylcyclohexane	1.16e-002	2.36e-003
Benzene	4.32e-002	6.96e-003
Toluene	2.54e-002	4.82e-003
Ethylbenzene	8.42e-004	1.84e-004
Xylenes	4.55e-003	9.97e-004
C8+ Heavies	7.19e-003	2.53e-003
Total Components	100.00	5.53e+000

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
Pressure: 14.70 psia
Flow Rate: 1.29e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.86e+001	5.41e+000
Carbon Dioxide	2.57e+000	3.84e-001
Hydrogen Sulfide	1.30e-002	1.50e-003

Nitrogen	1.73e-003	1.64e-004
Methane	8.76e-001	4.76e-002
Ethane	2.08e-001	2.12e-002
Propane	8.93e-002	1.33e-002
Isobutane	5.49e-002	1.08e-002
n-Butane	5.47e-002	1.08e-002
Isopentane	3.13e-002	7.66e-003
n-Pentane	1.78e-002	4.36e-003
n-Hexane	2.62e-002	7.65e-003
Cyclohexane	6.98e-002	1.99e-002
Other Hexanes	9.31e-002	2.72e-002
Heptanes	1.77e-001	6.00e-002
Methylcyclohexane	1.30e-001	4.34e-002
Benzene	2.68e+000	7.11e-001
Toluene	2.54e+000	7.95e-001
Ethylbenzene	1.51e-001	5.45e-002
Xylenes	1.19e+000	4.27e-001
C8+ Heavies	3.94e-001	2.27e-001
Total Components	100.00	8.28e+000

CONDENSER VENT GAS STREAM

Temperature: 105.00 deg. F
Pressure: 15.00 psia
Flow Rate: 6.14e+000 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.44e+000	2.17e-002
Carbon Dioxide	5.28e+001	3.76e-001
Hydrogen Sulfide	2.51e-001	1.39e-003
Nitrogen	3.58e-002	1.62e-004
Methane	1.83e+001	4.74e-002
Ethane	4.26e+000	2.07e-002
Propane	1.67e+000	1.19e-002
Isobutane	9.22e-001	8.67e-003
n-Butane	8.41e-001	7.90e-003
Isopentane	3.31e-001	3.86e-003
n-Pentane	1.79e-001	2.09e-003
n-Hexane	1.40e-001	1.94e-003
Cyclohexane	2.70e-001	3.67e-003
Other Hexanes	6.48e-001	9.03e-003
Heptanes	3.87e-001	6.27e-003
Methylcyclohexane	2.69e-001	4.27e-003
Benzene	8.14e+000	1.03e-001
Toluene	2.77e+000	4.12e-002
Ethylbenzene	5.64e-002	9.68e-004
Xylenes	3.27e-001	5.62e-003
C8+ Heavies	2.48e-003	6.82e-005
Total Components	100.00	6.77e-001

CONDENSER PRODUCED WATER STREAM

Temperature: 105.00 deg. F
Flow Rate: 1.08e-002 gpm

Component	Conc. (wt%)	Loading (lb/hr)	(ppm)
Water	9.98e+001	5.39e+000	998443.
Carbon Dioxide	5.55e-002	2.99e-003	555.
Hydrogen Sulfide	6.59e-004	3.55e-005	7.
Nitrogen	5.65e-007	3.05e-008	0.
Methane	3.30e-004	1.78e-005	3.
Ethane	1.71e-004	9.24e-006	2.
Propane	9.06e-005	4.89e-006	1.
Isobutane	3.66e-005	1.97e-006	0.
n-Butane	4.52e-005	2.44e-006	0.
Isopentane	1.59e-005	8.58e-007	0.
n-Pentane	9.34e-006	5.04e-007	0.
n-Hexane	7.44e-006	4.01e-007	0.
Cyclohexane	8.32e-005	4.49e-006	1.
Other Hexanes	2.75e-005	1.48e-006	0.
Heptanes	1.36e-005	7.33e-007	0.
Methylcyclohexane	4.69e-005	2.53e-006	0.
Benzene	7.07e-002	3.81e-003	707.
Toluene	2.40e-002	1.30e-003	240.
Ethylbenzene	4.36e-004	2.35e-005	4.
Xylenes	3.57e-003	1.93e-004	36.
C8+ Heavies	8.83e-008	4.76e-009	0.
Total Components	100.00	5.39e+000	1000000.

CONDENSER RECOVERED OIL STREAM

Temperature: 105.00 deg. F
Flow Rate: 5.20e-003 gpm

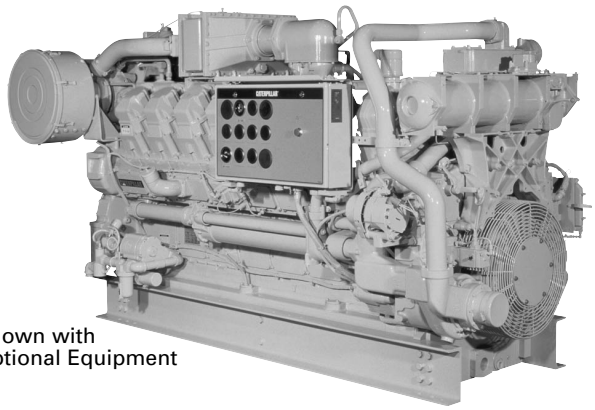
Component	Conc. (wt%)	Loading (lb/hr)
Water	5.36e-002	1.18e-003
Carbon Dioxide	2.24e-001	4.96e-003
Hydrogen Sulfide	3.81e-003	8.42e-005
Nitrogen	7.55e-005	1.67e-006
Methane	7.93e-003	1.75e-004
Ethane	2.06e-002	4.55e-004
Propane	6.43e-002	1.42e-003
Isobutane	9.68e-002	2.14e-003
n-Butane	1.29e-001	2.86e-003
Isopentane	1.72e-001	3.80e-003
n-Pentane	1.03e-001	2.27e-003
n-Hexane	2.58e-001	5.71e-003
Cyclohexane	7.34e-001	1.62e-002
Other Hexanes	8.22e-001	1.82e-002
Heptanes	2.43e+000	5.37e-002
Methylcyclohexane	1.77e+000	3.91e-002
Benzene	2.73e+001	6.04e-001
Toluene	3.40e+001	7.52e-001
Ethylbenzene	2.42e+000	5.35e-002
Xylenes	1.91e+001	4.21e-001
C8+ Heavies	1.03e+001	2.27e-001
Total Components	100.00	2.21e+000

CATERPILLAR®

Gas Petroleum Engine

G3516

1085-1340 bhp
809-1000 bkW
1200-1400 rpm



Shown with
Optional Equipment

CATERPILLAR® ENGINE SPECIFICATIONS

V-16, 4-Stroke-Cycle
Bore — in (mm) 6.7 (170)
Stroke — in (mm)..... 7.5 (190)
Displacement — cu in (L)..... 4,210 (69)
Aspiration ..... Turbocharged-Aftercooled
Capacity for Liquids — U.S. gal (L)
  Cooling System[1]..... 54 (205)
  Lube Oil System (refill) 112 (423)
Package Shipping Weight
  (Dry) — lb (kg) 17,670 (8015)

[1]Engine only.

FEATURES

■ **FULL RANGE OF ATTACHMENTS**
- Wide range of bolt-on system expansion attachments, factory designed and tested

■ **UNMATCHED PRODUCT SUPPORT OFFERED THROUGH WORLDWIDE CATERPILLAR DEALER NETWORK**
- More than 1,500 dealer outlets
- Caterpillar factory-trained dealer technicians service every aspect of your petroleum engine
- 99.7% of parts orders filled within 24 hours — worldwide
- Caterpillar parts and labor warranty
- Preventive maintenance agreements available for "repair before failure" options
- Scheduled Oil Sampling (S•O•S℠) program matches your oil sample against Caterpillar set standards to determine:
  – internal engine component condition
  – presence of unwanted fluids
  – presence of combustion by-products

■ **SINGLE-SOURCE SUPPLIER**
- Caterpillar:
  – casts engine blocks, heads, cylinder liners, and flywheel housings
  – machines critical components
  – assembles complete engine
  Ownership of these manufacturing processes enables Caterpillar to produce high quality, dependable product.
- Factory-designed systems built at Caterpillar ISO certified facilities

■ **G3516**
- Standard and low emission ratings available
- Broad operating speed range and ability to burn a wide spectrum of gaseous fuels
- Cat® Electronic Ignition System (EIS)
- Robust diesel strength design provides prolonged life and lower owning and operating costs.

■ **TESTING**
- Prototype testing on every model:
  – proves computer design
  – verifies system torsional stability
  – functionality tests every model
- Every Caterpillar engine is dynamometer tested under full load to ensure proper engine performance.

■ **WEB SITE**
- For additional information on all your petroleum power requirements, visit www.cat-oilandgas.com.

CATERPILLAR FACILITIES ISO 9001 CERTIFIED

CE

LEHW0749-01

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

SYSTEM	STANDARD	OPTIONAL
Air Inlet	Air cleaner — intermediate-duty with service indicator	Remote air inlet adapters Precleaner
Charging System		Battery chargers Charging alternators
Control System	Governor — 3161 mechanical, RH with positive lock (PA5319 & PA4871 only) Air-fuel ratio control (LA2031 & LA2030 only	2301A speed control governor CSA 700 speed control governor 3161 mechanical governor Vernier and positive locking control (PA5319 & PA4871 only)
Cooling System	Thermostats and housing Jacket water pump Aftercooler water pump Aftercooler core for sea-air atmosphere Aftercooler thermostats and housing	Aftercooler core Thermostatic valve Temperature switch Connections Expansion and overflow tank Water level switch gauge
Exhaust System	Watercooled exhaust manifolds	Flexible fittings Elbows Flange Flange and exhaust expanders Rain cap Mufflers
Flywheel/ Flywheel Housing	SAE No. 00 flywheel SAE No. 00 flywheel housing SAE standard rotation	
Fuel System	Gas pressure regulator Natural gas carburetor	Low pressure gas conversions (PA5319 & PA4871 only) Propane gas valve and jet kits (PA5319 & PA4871 only) Air/fuel ratio interconnect wiring harness (LA2031 & LA2030) Fuel filter
Ignition System	Caterpillar Electronic Ignition System (E.I.S.)	CSA ignition (PA5319 & PA4871) CSA ignition with AFRC (LA2030, LA2031)
Instrumentation	Instrument panel, RH, 12 hole service meter	Alarm module Customer communications modules Instrument panel gauges (PA5319 & PA4871) Instrument panel gauges f/u/w CSA electronic ignition system (LA2031 & LA2030)
Lube System	Crankcase breathers (top mounted) Oil cooler Oil filter, RH Oil bypass filter Shallow oil pan Oil sampling valve	Oil bypass filter removal and oil pan accessories Sump pump Air prelube pump Manual prelube pump Turbo oil accumulator Lubricating oil
Mounting System	Rails, engine mounting — 10 in. (254 mm)	Rails Vibration isolators
Power Take-Offs	Front housing, two-sided	Front accessory drives Auxiliary drive shafts and pulleys Front stub shaft Pulleys
Protection	Electronic shutoff system	PA5319 & PA4871: gas valve, explosion relief valves, status control box interconnect wiring harness
Starting System		Air starting motor Air pressure regulator Air silencer Electric air start controls Electric starting motors — dual 24-volt Starting aids Battery sets (24-volt dry), cables, and rack
General	Paint, Caterpillar yellow Vibration damper and guard (dual 23-inch)	Flywheel inertia weight Guard removal Engine barring group Premium 8:1 pistons Premium cylinder heads

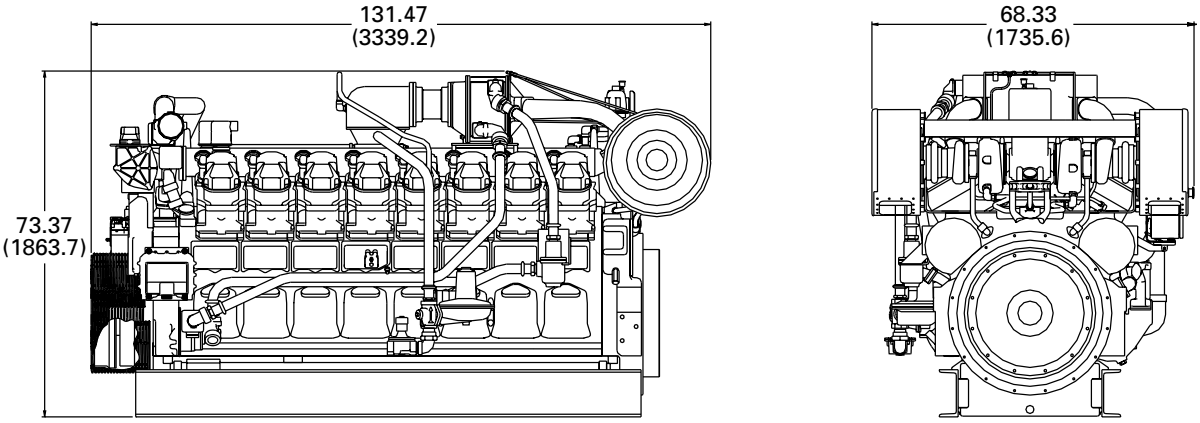
TECHNICAL DATA

G3516 Gas Petroleum Engine — 1200-1400 rpm

		DM0107-04	DM5154-01	DM5168-01	DM5155-01
Arrangement Number		PA4871 w/o AFRC	LA2030 with AFRC	PA5319 w/o AFRC	PA2031 with AFRC
Engine Power					
@ 100% Load	bhp (bkW)	1085 (809)	1151 (859)	1265 (944)	1340 (1000)
@ 75% Load	bhp (bkW)	814 (607)	863 (644)	949 (708)	1005 (750)
Engine Speed	rpm	**1200**	**1200**	**1400**	**1400**
SCAC Temperature	°F (°C)	129 (54)	129 (54)	129 (54)	129 (54)
Compression Ratio		8.0:1	8.0:1	8.0:1	8.0:1
Emissions*					
NO_x	g/bhp-hr	2.0	1.5	2.0	1.5
CO	g/bhp-hr	1.8	1.8	1.9	1.9
Total Hydrocarbons	g/bhp-hr	3.2	3.3	2.9	3.1
Fuel Consumption					
@ 100% Load	Btu/bhp-hr (MJ/bkW-hr)	7,450 (10.66)	7,414 (10.49)	7,548 (10.68)	7,541 (10.67)
@ 75% Load	Btu/bhp-hr (MJ/bkW-hr)	7,534 (10.93)	7,591 (10.74)	7,711 (10.91)	7,803 (11.04)
Heat Balance					
Heat Rejection to Jacket Water					
@ 100% Load	Btu/mn (bkW)	40,605 (687)	41,174 (724)	46,747 (822)	47,828 (841)
@ 75% Load	Btu/mn (bkW)	32,928 (546)	33,838 (595)	39,752 (699)	39,980 (703)
Heat Rejection to Aftercooler					
@ 100% Load	Btu/mn (bkW)	6,142 (109)	7,564 (133)	8,246 (145)	10,350 (182)
@ 75% Load	Btu/mn (bkW)	3,981 (62)	5,118 (90)	5,118 (90)	6,995 (123)
Heat Rejection to Exhaust					
@ 100% Load	Btu/mn (bkW)	37,307 (942)	39,980 (703)	45,155 (794)	48,055 (845)
@ 75% Load	Btu/mn (bkW)	26,956 (700)	29,857 (525)	32,359 (569)	36,624 (644)
Exhaust System					
Exhaust Gas Flow Rate					
@ 100% Load	cfm (m^3/min)	5,975 (180.0)	6,413 (181.6)	7,179 (203.3)	7,684 (217.6)
@ 75% Load	cfm (m^3/min)	4,368 (129.1)	4,828 (136.7)	5,177 (146.6)	5,880 (166.5)
Exhaust Stack Temperature					
@ 100% Load	°F (°C)	842 (462)	840 (449)	869 (465)	855 (457)
@ 75% Load	°F (°C)	820 (462)	817 (436)	862 (461)	840 (449)
Intake System					
Air Inlet Flow Rate					
@ 100% Load	cfm (m^3/min)	2,264 (72.8)	2,433 (68.9)	2,666 (75.5)	2,885 (81.7)
@ 75% Load	cfm (m^3/min)	1,681 (52.1)	1,865 (52.8)	1,928 (54.6)	2,232 (63.2)
Gas Pressure		High	High	High	High

*at 100% load and speed

GAS PETROLEUM ENGINE



DIMENSIONS		
Length	in (mm)	131.47 (3339.2)
Width	in (mm)	68.33 (1735.6)
Height	in (mm)	73.37 (1863.7)
Shipping Weight	lb (kg)	17,670 (8015)

Note: General configuration not to be used for installation. See general dimension drawings for detail.

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 905 Btu/cu ft (33.74 kJ/L) at 29.91 in. Hg (101 kPa) and 59° F (15° C). Fuel rate is based on a cubic meter at 29.61 in. Hg (100 kPa) and 60.1° F (15.6° C). Air flow is based on a cubic foot at 29.61 in. Hg (100 kPa) and 77° F (25° C). Exhaust flow is based on a cubic foot at 29.61 in. Hg (100 kPa) and stack temperature.

TMI Reference No.: DM0107-04, DM5154-01, DM5168-01, DM5155-01
Materials and specifications are subject to change without notice.
The International System of Units (SI) is used in this publication.
LEHW0749-01 (4-01)
Printed in U.S.A.

G3516B

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED (rpm):	1400	FUEL SYSTEM:	CAT WIDE RANGE WITH AIR FUEL RATIO CONTROL
COMPRESSION RATIO:	8:1		
AFTERCOOLER - STAGE 2 INLET (°F):	130	**SITE CONDITIONS:**	
AFTERCOOLER - STAGE 1 INLET (°F):	201	FUEL:	Nat Gas
JACKET WATER OUTLET (°F):	210	FUEL PRESSURE RANGE(psig):	7.0-50.0
ASPIRATION:	TA	FUEL METHANE NUMBER:	84.8
COOLING SYSTEM:	JW+OC+1AC, 2AC	FUEL LHV (Btu/scf):	905
IGNITION SYSTEM:	ADEM3	ALTITUDE(ft):	500
EXHAUST MANIFOLD:	DRY	MAXIMUM INLET AIR TEMPERATURE(°F):	77
COMBUSTION:	Ultra Lean Burn	STANDARD RATED POWER:	1380 bhp@1400rpm
NOx EMISSION LEVEL (g/bhp-hr NOx):	0.5		
SET POINT TIMING:	30		

			MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
RATING	**NOTES**	**LOAD**	**100%**	**100%**	**75%**	**50%**
ENGINE POWER (WITHOUT FAN)	(1)	bhp	1380	1380	1035	690
INLET AIR TEMPERATURE		°F	77	77	77	77
ENGINE DATA						
FUEL CONSUMPTION (LHV)	(2)	Btu/bhp-hr	7443	7443	7972	8562
FUEL CONSUMPTION (HHV)	(2)	Btu/bhp-hr	8256	8256	8843	9498
AIR FLOW (77°F, 14.7 psia) (WET)	(3)(4)	scfm	3126	3126	2452	1715
AIR FLOW (WET)	(3)(4)	lb/hr	13862	13862	10874	7602
INLET MANIFOLD PRESSURE	(5)	in Hg(abs)	94.6	94.6	76.8	54.0
EXHAUST TEMPERATURE - ENGINE OUTLET	(6)	°F	992	992	986	1006
EXHAUST GAS FLOW (@engine outlet temp, 14.5 psia) (WET)	(7)(4)	ft3/min	9126	9126	7138	5065
EXHAUST GAS MASS FLOW (WET)	(7)(4)	lb/hr	14380	14380	11290	7900
EMISSIONS DATA - ENGINE OUT						
NOx (as NO2)	(8)(9)	g/bhp-hr	0.50	0.50	0.50	0.50
CO	(8)(9)	g/bhp-hr	2.43	2.43	2.61	2.56
THC (mol. wt. of 15.84)	(8)(9)	g/bhp-hr	4.77	4.77	5.11	5.19
NMHC (mol. wt. of 15.84)	(8)(9)	g/bhp-hr	0.72	0.72	0.77	0.78
NMNEHC (VOCs) (mol. wt. of 15.84)	(8)(9)(10)	g/bhp-hr	0.48	0.48	0.51	0.52
HCHO (Formaldehyde)	(8)(9)	g/bhp-hr	0.44	0.44	0.43	0.42
CO2	(8)(9)	g/bhp-hr	474	474	506	549
EXHAUST OXYGEN	(8)(11)	% DRY	9.0	9.0	8.7	8.3
HEAT REJECTION						
HEAT REJ. TO JACKET WATER (JW)	(12)	Btu/min	23412	23412	21533	19930
HEAT REJ. TO ATMOSPHERE	(12)	Btu/min	6110	6110	5092	4074
HEAT REJ. TO LUBE OIL (OC)	(12)	Btu/min	4475	4475	3978	3363
HEAT REJ. TO A/C - STAGE 1 (1AC)	(12)(13)	Btu/min	10046	10046	8308	2813
HEAT REJ. TO A/C - STAGE 2 (2AC)	(12)(13)	Btu/min	5358	5358	5063	3334

COOLING SYSTEM SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+OC+1AC)	(13)(14)	Btu/min	41672
TOTAL AFTERCOOLER CIRCUIT (2AC)	(13)(14)	Btu/min	5626
A cooling system safety factor of 0% has been added to the cooling system sizing criteria.			

CONDITIONS AND DEFINITIONS

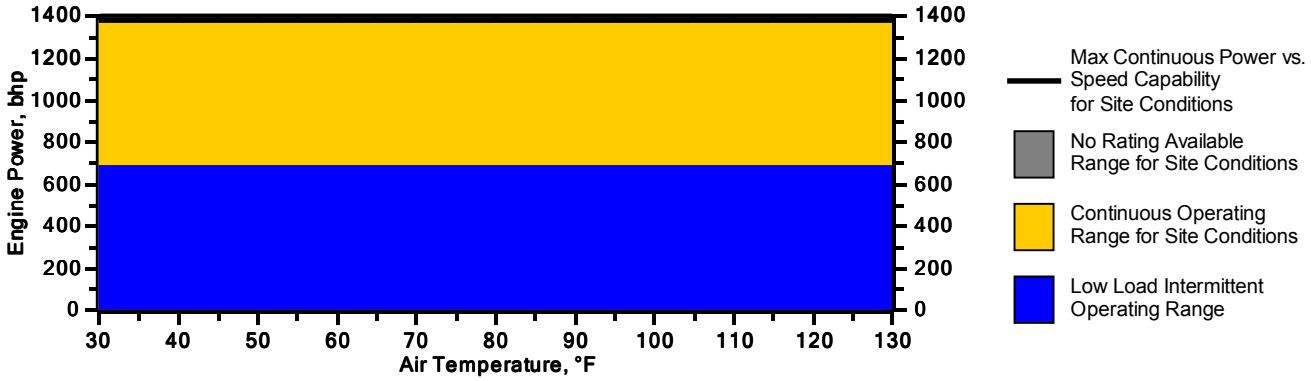
Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature. 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature. Max. rating is the maximum capability for the specified fuel at site altitude and reduced inlet air temperature. Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

For notes information consult page three.

PREPARED BY:
Data generated by Gas Engine Rating Pro Version 4.01.00
Ref. Data Set DM8800-05-001, Printed 05Jan2012

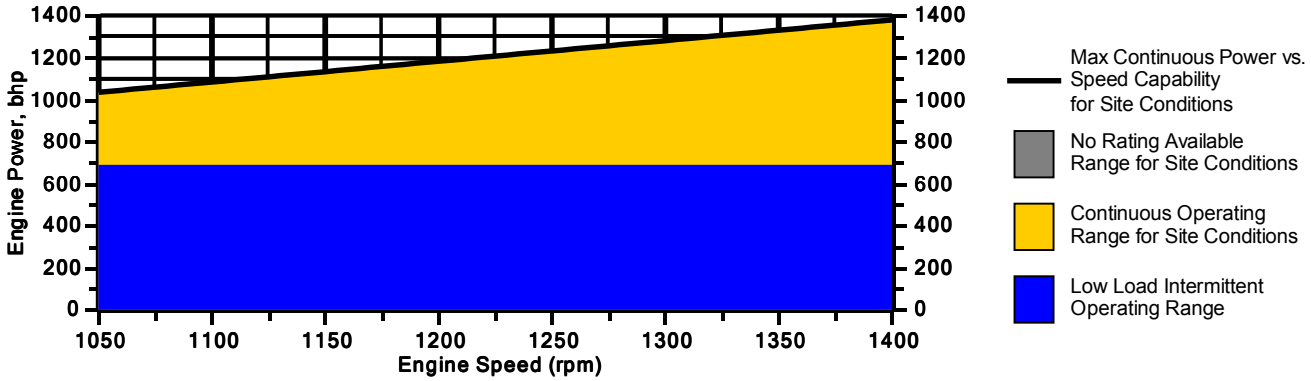
Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 500 ft and 1400 rpm



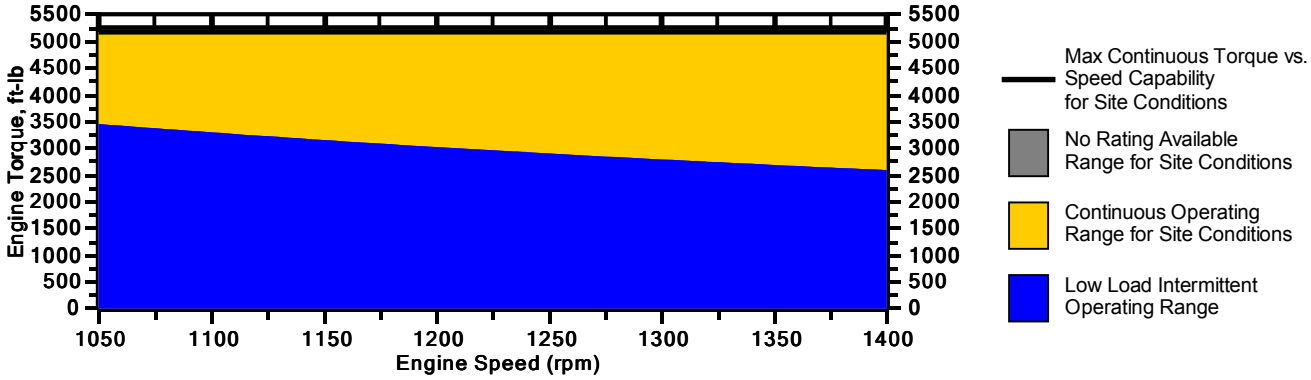
Engine Power vs. Engine Speed

Data represents speed sweep at 500 ft and 77 ºF



Engine Torque vs. Engine Speed

Data represents speed sweep at 500 ft and 77 ºF



Note: At site conditions of 500 ft and 77°F inlet air temp., constant torque can be maintained down to 1050 rpm. The minimum speed for loading at these conditions is 1050 rpm.

NOTES

1. Engine rating is with two engine driven water pumps. Tolerance is ± 3% of full load.

2. Fuel consumption tolerance is ± 3.0% of full load data.

3. Air flow value is on a 'wet' basis. Flow is a nominal value with a tolerance of ± 5 %.

4. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.

5. Inlet manifold pressure is a nominal value with a tolerance of ± 5 %.

6. Exhaust temperature is a nominal value with a tolerance of (+)63°F, (-)54°F.

7. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of ± 6 %.

8. Emissions data is at engine exhaust flange prior to any after treatment.

9. Emission values are based on engine operating at steady state conditions. Fuel methane number cannot vary more than ± 3. Values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate "Not to Exceed" values. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.

10. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ

11. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5.

12. Heat rejection values are nominal. Tolerances, based on treated water, are ± 10% for jacket water circuit, ± 50% for radiation, ± 20% for lube oil circuit, and ± 5% for aftercooler circuit.

13. Aftercooler heat rejection includes an aftercooler heat rejection factor for the site elevation and inlet air temperature specified. Aftercooler heat rejection values at part load are for reference only. Do not use part load data for heat exchanger sizing.

14. Cooling system sizing criteria are maximum circuit heat rejection for the site, with applied tolerances.

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	92.2700	92.2700
Ethane	C2H6	2.5000	2.5000
Propane	C3H8	0.5000	0.5000
Isobutane	iso-C4H1O	0.0000	0.0000
Norbutane	nor-C4H1O	0.2000	0.2000
Isopentane	iso-C5H12	0.0000	0.0000
Norpentane	nor-C5H12	0.1000	0.1000
Hexane	C6H14	0.0500	0.0500
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	3.4800	3.4800
Carbon Dioxide	CO2	0.9000	0.9000
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0000	0.0000
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup:	Nat Gas
Unit of Measure:	English

Calculated Fuel Properties

Caterpillar Methane Number:	84.8
Lower Heating Value (Btu/scf):	905
Higher Heating Value (Btu/scf):	1004
WOBBE Index (Btu/scf):	1168
THC: Free Inert Ratio:	21.83
Total % Inerts (% N2, CO2, He):	4.38%
RPC (%) (To 905 Btu/scf Fuel):	100%
Compressibility Factor:	0.998
Stoich A/F Ratio (Vol/Vol):	9.45
Stoich A/F Ratio (Mass/Mass):	15.75
Specific Gravity (Relative to Air):	0.600
Specific Heat Constant (K):	1.313

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

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riames@emittechnologies.com

Prepared For:
Don Jarrett
CDM RESOURCE MANAGEMENT, LTD

QUOTE: QUO-16633-H8W6

INFORMATION PROVIDED BY CATERPILLAR

Engine:	G3516B
Horsepower:	1380
RPM:	1400
Compression Ratio:	8.0
Exhaust Flow Rate:	9154 CFM
Exhaust Temperature:	997 °F
Reference:	DM8800-04
Fuel:	Natural Gas
Annual Operating Hours:	8760

Uncontrolled Emissions

	g/bhp-hr	Lb/Hr	Tons/Year
NOx:	0.50	1.52	6.66
CO:	2.60	7.91	34.65
THC:	4.76	14.48	63.43
NMHC	0.71	2.16	9.46
NMNEHC:	0.48	1.46	6.40
HCHO:	0.43	1.31	5.73
O2:	9.00 %		

POST CATALYST EMISSIONS

	% Reduction	g/bhp-hr	Lb/Hr	Tons/Year
NOx:	Unaffected by Oxidation Catalyst			
CO:	>23 %	<2.00	<6.08	<26.65
VOC:	>0 %	<0.48	<1.46	<6.40
HCHO:	>81 %	<0.08	<0.25	<1.08

CONTROL EQUIPMENT

Catalyst Element

Model:	RT-2415-Z
Catalyst Type:	Oxidation, Standard Precious Group Metals
Substrate Type:	BRAZED
Manufacturer:	EMIT Technologies, Inc
Element Quantity:	2
Element Size:	Rectangle 24" x 15" x 3.5"

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WARRANTY

EMIT Technologies, Inc. warrants that the goods supplied will be free from defects in workmanship by EMIT Technologies, Inc. for a period of two (2) years from date of shipment. EMIT Technologies, Inc. will not be responsible for any defects which result from improper use, neglect, failure to properly maintain or which are attributable to defects, errors or omissions in any drawings, specifications, plans or descriptions, whether written or oral, supplied to EMIT Technologies, Inc. by Buyer.

Catalyst performance using an EMIT Air/Fuel ratio controller is dependent upon properly defined set-points, variable with engine and fuel gas composition. Air/fuel ratio controller performance is guaranteed, but not limited, to fuel gas with a HHV content of 1400 BTU/SCF.

Catalyst performance will be guaranteed for a period of 1 year from installation, or 8760 operating hours, whichever comes first. The catalyst shall be operated with an automatic air/fuel ratio controller. The performance guarantee shall not cover the effects of excessive ash masking due to operation at low load, improper engine maintenance, or inappropriate lubrication oil. The performance guarantee shall not cover the effects of continuous engine misfires (cylinder or ignition) exposing the catalyst to excessive exothermic reaction temperatures. In most cases, excluding thermal deactivation, catalyst performance is redeemable by means of proper washing (refer to EMIT Catalyst/Silencer Housing Manual for element wash information, or contact a local EMIT Sales representative).

The exhaust temperature operating range at the converter inlet is a minimum of 600°F for oxidation catalyst and 750 ˚F for NSCR catalyst, and a maximum of 1250°F.

If a properly functioning, high temperature shut down switch is not installed, thermal deactivation of catalyst at sustained temperatures above 1250˚F is not covered. If excessive exposure to over oxygenation of NSCR catalyst occurs due to improperly functioning or non-existent Air/Fuel ratio control, then deactivation of catalyst is not warranted.

The catalyst conversion efficiencies (% reduction) will be guaranteed for engine loads of 50 to 100 percent. Standard Oxidation Catalyst conversion efficiencies (% reduction) will be guaranteed for fuel gas containing less than 1.5% mole fraction of non-methane, non-ethane hydrocarbons. Applications where fuel gas exceeds this level will require a Premium Oxidation Catalyst to maintain guaranteed VOC conversion efficiencies.

Engine lubrication oil shall contain less than 0.5 wt% Sulfated Ash with a maximum allowable specific oil consumption of 0.7 g/bhp-hr. The catalyst shall be limited to a maximum ash loading of 0.022 lb/ft3. Phosphorous and zinc additives are limited to 0.03 wt%. New or Reconstructed engines must operate for a minimum of 50 hours prior to catalyst installation, otherwise the warranty is void.

The catalyst must not be exposed to the following know poisoning agents, including: antimony, arsenic, chromium, copper, iron, lead, lithium, magnesium, mercury, nickel, phosphorous, potassium, silicon, sodium, sulfur, tin, and zinc. Total poison concentrations in the fuel gas must be limited to 0.25 ppm or less for catalyst to function properly.

Shipment - Promised shipping dates are approximate lead times from the point of manufacture and are not guaranteed. EMIT Technologies, Inc. will not be liable for any loss, damage or delay in manufacture or delivery resulting from any cause beyond its control including, but not limited to a period equal to the time lost by reason of that delay. All products will be crated as per best practice to prevent any damage during shipment. Unless otherwise specified, Buyer will pay for any special packing and shipping requirements. Acceptance of goods by common carrier constitutes delivery to Buyer. EMIT Technologies, Inc. shall not be responsible for goods damaged or lost in transit.

Terms: Credit is extended to purchaser for net 30 time period. If payment is not received in the net 30 timeframe, interest on the unpaid balance will accrue at a rate of 1.5% per month from the invoice date.

Order Cancellation Terms: Upon cancellation of an order once submittal of a Purchase Order has occurred, the customer will pay a 25% restocking fee for Catalyst Housings, Catalyst Elements, and Air/Fuel Ratio Controllers; 50% restocking fee for Cooler Top Solutions Exhaust System Accessories, and other Custom Built Products; 100% of all associated shipping costs incurred by EMIT; 100% of all project expenses incurred by EMIT for Field Services.

APPENDIX D COPY OF CURRENT PBR TEXT

The following attachment is included in this appendix:

- Permit by Rule §106.512 text; and
- Permit by Rule §106.352(l) text.

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 106	PERMITS BY RULE
SUBCHAPTER W	TURBINES AND ENGINES
RULE §106.512	Stationary Engines and Turbines

1. Gas or liquid fuel-fired stationary internal combustion reciprocating engines or gas turbines that operate in compliance with the following conditions of this section are permitted by rule.
    (1) The facility shall be registered by submitting the commission's Form PI-7, Table 29 for each proposed reciprocating engine, and Table 31 for each proposed gas turbine to the commission's Office of Permitting, Remediation, and Registration in Austin within ten days after construction begins. Engines and turbines rated less than 240 horsepower (hp) need not be registered, but must meet paragraphs (5) and (6) of this section, relating to fuel and protection of air quality. Engine hp rating shall be based on the engine manufacturer's maximum continuous load rating at the lesser of the engine or driven equipment's maximum published continuous speed. A rich-burn engine is a gas-fired spark-ignited engine that is operated with an exhaust oxygen content less than 4.0% by volume. A lean-burn engine is a gas-fired spark-ignited engine that is operated with an exhaust oxygen content of 4.0% by volume, or greater.
    (2) For any engine rated 500 hp or greater, subparagraphs (A) - (C) of this paragraph shall apply.
        (A) The emissions of nitrogen oxides (NO_x) shall not exceed the following limits:
            (i) 2.0 grams per horsepower-hour (g/hp-hr) under all operating conditions for any gas-fired rich-burn engine;
            (ii) 2.0 g/hp-hr at manufacturer's rated full load and speed, and other operating conditions, except 5.0 g/hp-hr under reduced speed, 80-100% of full torque conditions, for any spark-ignited, gas-fired lean-burn engine, or any compression-ignited dual fuel-fired engine manufactured new after June 18, 1992;
            (iii) 5.0 g/hp-hr under all operating conditions for any spark-ignited, gas-fired, lean-burn two-cycle or four-cycle engine or any compression-ignited dual fuel-fired engine rated 825 hp or greater and manufactured after

September 23, 1982, but prior to June 18, 1992;

(iv) 5.0 g/hp-hr at manufacturer's rated full load and speed and other operating conditions, except 8.0 g/hp-hr under reduced speed, 80-100% of full torque conditions for any spark-ignited, gas-fired, lean-burn four-cycle engine, or any compression-ignited dual fuel-fired engine that:

2. was manufactured prior to June 18, 1992, and is rated less than 825 hp; or
3. (II) was manufactured prior to September 23, 1982;
4. (v) 8.0 g/hp-hr under all operating conditions for any spark-ignited, gas-fired, two-cycle lean-burn engine that:
5. was manufactured prior to June 18, 1992, and is rated less than 825 hp; or
6. (II) was manufactured prior to September 23, 1982;
7. (vi) 11.0 g/hp-hr for any compression-ignited liquid-fired engine.
8. (B) For such engines which are spark-ignited gas-fired or compression-ignited dual fuel-fired, the engine shall be equipped as necessary with an automatic air-fuel ratio (AFR) controller which maintains AFR in the range required to meet the emission limits of subparagraph (A) of this paragraph. An AFR controller shall be deemed necessary for any engine controlled with a non-selective catalytic reduction (NSCR) converter and for applications where the fuel heating value varies more than ± 50 British thermal unit/standard cubic feet from the design lower heating value of the fuel. If an NSCR converter is used to reduce NO_x , the automatic controller shall operate on exhaust oxygen control.
9. (C) Records shall be created and maintained by the owner or operator for a period of at least two years, made available, upon request, to the commission and any local air pollution control agency having jurisdiction, and shall include the following:

(i) documentation for each AFR controller, manufacturer's, or supplier's recommended maintenance that has been performed, including replacement of the oxygen sensor as necessary for oxygen sensor-based controllers. The oxygen sensor shall be replaced at least quarterly in the absence of a specific written recommendation;

(ii) documentation on proper operation of the engine by recorded measurements of NO_x and carbon monoxide (CO) emissions as soon as practicable, but no later than seven days following each occurrence of engine maintenance which may reasonably be expected to increase emissions, changes of fuel quality in engines without oxygen sensor-based AFR controllers which

may reasonably be expected to increase emissions, oxygen sensor replacement, or catalyst cleaning or catalyst replacement. Stain tube indicators specifically designed to measure NO_x and CO concentrations shall be acceptable for this documentation, provided a hot air probe or equivalent device is used to prevent error due to high stack temperature, and three sets of concentration measurements are made and averaged. Portable NO_x and CO analyzers shall also be acceptable for this documentation;

(iii) documentation within 60 days following initial engine start-up and biennially thereafter, for emissions of NO_x and CO, measured in accordance with United States Environmental Protection Agency (EPA) Reference Method 7E or 20 for NO_x and Method 10 for CO. Exhaust flow rate may be determined from measured fuel flow rate and EPA Method 19. California Air Resources Board Method A-100 (adopted June 29, 1983) is an acceptable alternate to EPA test methods. Modifications to these methods will be subject to the prior approval of the Source and Mobile Monitoring Division of the commission. Emissions shall be measured and recorded in the as-found operating condition; however, compliance determinations shall not be established during start-up, shutdown, or under breakdown conditions. An owner or operator may submit to the appropriate regional office a report of a valid emissions test performed in Texas, on the same engine, conducted no more than 12 months prior to the most recent start of construction date, in lieu of performing an emissions test within 60 days following engine start-up at the new site. Any such engine shall be sampled no less frequently than biennially (or every 15,000 hours of elapsed run time, as recorded by an elapsed run time meter) and upon request of the executive director. Following the initial compliance test, in lieu of performing stack sampling on a biennial calendar basis, an owner or operator may elect to install and operate an elapsed operating time meter and shall test the engine within 15,000 hours of engine operation after the previous emission test. The owner or operator

who elects to test on an operating hour schedule shall submit in writing, to the appropriate regional office, biennially after initial sampling, documentation of the actual recorded hours of engine operation since the previous emission test, and an estimate of the date of the next required sampling.

(2) For any gas turbine rated 500 hp or more, subparagraphs (A) and (B) of this paragraph shall apply.

(A) The emissions of NO_x shall not exceed 3.0 g/hp-hr for gas-firing.

(B) The turbine shall meet all applicable NO_x and sulfur dioxide (SO_2) (or fuel sulfur) emissions limitations, monitoring requirements, and reporting requirements of EPA New Source Performance Standards Subpart GG--Standards of Performance for Stationary Gas Turbines. Turbine hp rating shall be based on turbine base load, fuel lower heating value, and International Standards Organization Standard Day Conditions of 59 degrees Fahrenheit, 1.0 atmosphere and 60% relative humidity.

(3) Any engine or turbine rated less than 500 hp or used for temporary replacement purposes shall be exempt from the emission limitations of paragraphs (2) and (3) of this section. Temporary replacement engines or turbines shall be limited to a maximum of 90 days of operation after which they shall be removed or rendered physically inoperable.

(4) Gas fuel shall be limited to: sweet natural gas or liquid petroleum gas, fuel gas containing no more than ten grains total sulfur per 100 dry standard cubic feet, or field gas. If field gas contains more than 1.5 grains hydrogen sulfide or 30 grains total sulfur compounds per 100 standard cubic feet (sour gas), the engine owner or operator shall maintain records, including at least quarterly measurements of fuel hydrogen sulfide and total sulfur content, which demonstrate that the annual SO_2 emissions from the facility do not exceed 25 tons per year (tpy). Liquid fuel shall be petroleum distillate oil that is not a blend containing waste oils or solvents and contains less than 0.3% by weight sulfur.

(5) There will be no violations of any National Ambient Air Quality Standard (NAAQS) in the area of the proposed facility. Compliance with this condition shall be demonstrated by one of the following three methods:

(A) ambient sampling or dispersion modeling accomplished pursuant to guidance obtained from the executive director. Unless otherwise documented by actual test data, the following

nitrogen dioxide (NO_2)/NO_x ratios shall be used for modeling NO_2NAAQS;

10. Attached Graphic
11. (B) all existing and proposed engine and turbine exhausts are released to the atmosphere at a height at least twice the height of any surrounding obstructions to wind flow. Buildings, open-sided roofs, tanks, separators, heaters, covers, and any other type of structure are considered as obstructions to wind flow if the distance from the nearest point on the obstruction to the nearest exhaust stack is less than five times the lesser of the height, Hb, and the width, Wb, where:
12. Attached Graphic
13. (C) the total emissions of NO_x (nitrogen oxide plus NO_2) from all existing and proposed facilities on the property do not exceed the most restrictive of the following:
    - (i) 250 tpy;
    - (ii) the value (0.3125 D) tpy, where D equals the shortest distance in feet from any existing or proposed stack to the nearest property line.
14. (7) Upon issuance of a standard permit for electric generating units, registrations under this section for engines or turbines used to generate electricity will no longer be accepted, except for:
    - (A) engines or turbines used to provide power for the operation of facilities registered under the Air Quality Standard Permit for Concrete Batch Plants;
    - (B) engines or turbines satisfying the conditions for facilities permitted by rule under Subchapter E of this title (relating to Aggregate and Pavement); or
15. (C) engines or turbines used exclusively to provide power to electric pumps used for irrigating crops.

Source Note: The provisions of this §106.512 adopted to be effective March 14, 1997, 22 TexReg 2439; amended to be effective September 4, 2000, 25 TexReg 8653; amended to be effective June 13, 2001, 26 TexReg 4108

Texas Administrative Code

TITLE 30	ENVIRONMENTAL QUALITY
PART 1	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
CHAPTER 106	PERMITS BY RULE
SUBCHAPTER O	OIL AND GAS
RULE §106.352	Oil and Gas Handling and Production Facilities

(a) Applicability. This section applies to all stationary facilities, or groups of facilities, at a site which handle gases and liquids associated with the production, conditioning, processing, and pipeline transfer of fluids or gases found in geologic formations on or beneath the earth's surface including, but not limited to, crude oil, natural gas, condensate, and produced water with the following conditions:

(1) The requirements in subsections (a) - (k) of this section are applicable only for new projects and related facilities located in the Barnett Shale (Cooke, Dallas, Denton, Ellis, Erath, Hill, Hood, Jack, Johnson, Montague, Palo Pinto, Parker, Somervell, Tarrant, and Wise Counties) on or after April 1, 2011. For all other new projects and related facilities in all other counties of the state, subsection (l) of this section is applicable.

(l) The requirements in this subsection are applicable to new and modified facilities except those specified in subsection (a)(1) of this section. Any oil or gas production facility, carbon dioxide separation facility, or oil or gas pipeline facility consisting of one or more tanks, separators, dehydration units, free water knockouts, gunbarrels, heater treaters, natural gas liquids recovery units, or gas sweetening and other gas conditioning facilities, including sulfur recovery units at facilities conditioning produced gas

containing less than two long tons per day of sulfur compounds as sulfur are permitted by rule, provided that the following conditions of this subsection are met. This subsection applies only to those facilities named which handle gases and liquids associated with the production, conditioning, processing, and pipeline transfer of fluids found in geologic formations beneath the earth's surface.

(1) Compressors and flares shall meet the requirements of §106.492 and §106.512 of this title (relating to Flares; and Stationary Engines and Turbines, respectively). Oil and gas facilities which are authorized under historical standard exemptions and remain unchanged maintain that authorization and the remainder of this subsection does not apply.

(2) Total emissions, including process fugitives, combustion unit stacks, separator, or other process vents, tank vents, and loading emissions from all such facilities constructed at a site under this subsection shall not exceed 25 tpy each of SO_2, all other sulfur compounds combined, or all VOCs combined; and 250 tpy each of NO_X and CO. Emissions of VOC and sulfur compounds other than SO_2 must include gas lost by equilibrium flash as well as gas lost by conventional evaporation.

(3) Any facility handling sour gas shall be located at least one-quarter mile from any recreational area or residence or other structure not occupied or used solely by the owner or operator of the facility or the owner of the property upon which the facility is located.

(4) Total emissions of sulfur compounds, excluding sulfur oxides, from all vents shall not exceed 4.0 pounds per hour (lb/hr) and the height of each vent emitting sulfur compounds shall meet the following requirements, except in no case shall the height be less than 20 feet, where the total emission rate as H_2 S, lb/hr, and minimum vent height (feet), and other values may be interpolated:

(A) 0.27 lb/hr at 20 feet;

(B) 0.60 lb/hr at 30 feet;

(C) 1.94 lb/hr at 50 feet;

(D) 3.00 lb/hr at 60 feet; and

(E) 4.00 lb/hr at 68 feet.

(5) Before operation begins, facilities handling sour gas shall be registered with the executive director in Austin using Form PI-7 along with supporting documentation that all requirements of this subsection will be met. For facilities constructed under §106.353 of this title (relating to Temporary Oil and Gas Facilities), the registration is required before operation under this subsection can begin. If the facilities cannot meet this subsection, a permit under Chapter 116 of this title (relating to Control of Air Pollution by Permits for New Construction or Modification) is required prior to continuing operation of the facilities.

(m) The following tables shall be used as required in this section.

APPENDIX E AIR QUALITY ANALYSIS

In accordance with 106.512(6), LINN conducted an air quality analysis to demonstrate compliance with the 1-hour and Annual NO_2 National Ambient Air Quality Standards. EPA's SCREEN3 model was used for this demonstration. The maximum hourly NO_X emission rate was used in this evaluation. The summarized results and the SCREEN3 output file is included in this appendix.

Air Quality Analysis Results Summary

1-hour NO_2 Summary

EPN	Modeled Unit Impact Factor $\mu g/m^3$ per lb/hr	Estimated Emission Rate lb/hr	NO_2/NO_X Ratio[1]	Adjusted Concentration $\mu g/m^3$	Screening Background Concentration[2] $\mu g/m^3$	Total Predicted Concentration $\mu g/m^3$	NAAQS NO_2 1-hr $\mu g/m^3$	Predicted Concentration Less than NAAQS
ENG-05	7.684	4.78	0.4	14.70	90	111.80	188	TRUE
ENG-07	5.485	1.52	0.85	7.09				

Annual NO_2 Summary

EPN	Modeled Unit Impact Factor $\mu g/m^3$ per lb/hr	Estimated Emission Rate lb/hr	NO_2/NO_X Ratio[1]	Adjusted Concentration[3] $\mu g/m^3$	Screening Background Concentration[3] $\mu g/m^3$	Total Predicted Concentration $\mu g/m^3$	NAAQS NO_2 Annual $\mu g/m^3$	Predicted Concentration Less than NAAQS
ENG-05	7.684	4.78	0.4	1.18	20	21.74	100	TRUE
ENG-07	5.485	1.52	0.85	0.57				

Notes:

1. In accordance with 30 TAC 106.512(6)(A), the NO_2/NO_X ratio is for an IC Engine with a NO_X emission rate of less of equal to 2.0 g/hp-hr is 0.4, and the NO_2/NO_X ratio for an engine with oxidizing catalyst is 0.85.
2. The 1-hour Screening Background concentration obtained from the TCEQ Document "Interim 1-Hour NO2 Screening Background Concentrations" for TCEQ Region 9.
3. The 1-hr to Annual Multiplying Factor is 0.08, obtained from the TCEQ Document "Oil and Gas Standard Permit and Permit By Rule Refined-Screening Modeling Guidelines".
4. The annual Screening Background concentration obtained from the September 4, 1998 TCEQ memo "Screening Background Concentrations" for TCEQ Region 9.

Example Calculations

Adjusted Concentration - 1-hr
(5.485 µg/m^3 per lb/hr) * 1.521 lb/hr * 0.85 NO2/NOX Ratio = 7.092 µg/m^3

Adjusted Concentration - Annual
(5.485 µg/m^3) * 1.521 lb/hr * 0.85 NO2/NOX Ratio * 0.08 Multiplying Factor = 0.567 µg/m^3

Total Predicted Concentration - 1-hr
(14.704 µg/m^3) + (7.092 µg/m^3) + (90 µg/m^3) = 111.796 µg/m^3

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

 SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =     0.125998
   STACK HEIGHT (M)       =       7.3152
   STK INSIDE DIAM (M)    =       0.3566
   STK EXIT VELOCITY (M/S)=      30.7848
   STK GAS EXIT TEMP (K)  =     723.1500
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       0.0000
   MIN HORIZ BLDG DIM (M) =       0.0000
   MAX HORIZ BLDG DIM (M) =       0.0000

 THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


 BUOY. FLUX =    5.709 M**4/S**3;  MOM. FLUX =   12.208 M**4/S**2.

 *** FULL METEOROLOGY ***

 **********************************
 *** SCREEN AUTOMATED DISTANCES ***
 **********************************

 *** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES
***

   DIST     CONC             U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)
DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
      1.   0.000        1     1.0    1.0   320.0   86.45    1.90    1.87    NO
    100.   5.737        3    10.0   10.0  3200.0   15.23   12.59    7.65    NO
    200.   7.148        3     8.0    8.0  2560.0   17.21   23.79   14.31    NO
    300.   6.784        4     8.0    8.0  2560.0   17.21   22.79   12.42    NO
    400.   5.905        4     8.0    8.0  2560.0   17.21   29.59   15.53    NO
    500.   5.498        4     5.0    5.0  1600.0   23.14   36.43   18.85    NO
    600.   4.951        4     4.5    4.5  1440.0   24.90   43.01   21.80    NO
    700.   4.505        4     3.5    3.5  1120.0   29.92   49.61   24.89    NO
    800.   4.122        4     3.5    3.5  1120.0   29.92   55.95   27.55    NO
    900.   3.817        4     3.0    3.0   960.0   33.69   62.34   30.41    NO
   1000.   3.536        4     2.5    2.5   800.0   38.97   68.72   33.34    NO
   1100.   3.301        4     2.5    2.5   800.0   38.97   74.86   35.30    NO
   1200.   3.078        4     2.5    2.5   800.0   38.97   80.95   37.21    NO
   1300.   2.881        4     2.0    2.0   640.0   46.88   87.25   39.65    NO
   1400.   2.737        4     2.0    2.0   640.0   46.88   93.24   41.43    NO
   1500.   2.751        5     1.0    1.0 10000.0   60.44   75.24   31.79    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
    145.   7.684        3    10.0   10.0  3200.0   15.23   17.82   10.76    NO

  DWASH=   MEANS NO CALC MADE (CONC = 0.0)
  DWASH=NO MEANS NO BUILDING DOWNWASH USED
  DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
  DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
  DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

      *************************************
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*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	7.684	145.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

 SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =     0.125998
   STACK HEIGHT (M)       =       7.3152
   STK INSIDE DIAM (M)    =       0.4063
   STK EXIT VELOCITY (M/S)=      33.2232
   STK GAS EXIT TEMP (K)  =     806.4833
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =       0.0000
   URBAN/RURAL OPTION     =        RURAL
   BUILDING HEIGHT (M)    =       0.0000
   MIN HORIZ BLDG DIM (M) =       0.0000
   MAX HORIZ BLDG DIM (M) =       0.0000

 THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


 BUOY. FLUX =    8.561 M**4/S**3;  MOM. FLUX =   16.550 M**4/S**2.

 *** FULL METEOROLOGY ***

 **********************************
 *** SCREEN AUTOMATED DISTANCES ***
 **********************************

 *** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES
***

   DIST     CONC              U10M   USTK  MIX HT   PLUME   SIGMA   SIGMA
    (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   Y (M)   Z (M)
DWASH
 -------  ----------  ----  -----  -----  ------  ------  ------  ------
-----
      1.   0.000        1     1.0    1.0   320.0  114.54    2.11    2.07    NO
    100.   2.669        3    10.0   10.0  3200.0   18.04   12.62    7.71    NO
    200.   5.327        3    10.0   10.0  3200.0   18.04   23.82   14.36    NO
    300.   4.954        4    10.0   10.0  3200.0   18.04   22.82   12.48    NO
    400.   4.510        4     8.0    8.0  2560.0   20.72   29.70   15.74    NO
    500.   3.992        4     8.0    8.0  2560.0   20.72   36.35   18.69    NO
    600.   3.604        4     5.0    5.0  1600.0   28.76   43.15   22.08    NO
    700.   3.331        4     5.0    5.0  1600.0   28.76   49.57   24.80    NO
    800.   3.053        4     4.5    4.5  1440.0   31.14   55.99   27.63    NO
    900.   2.818        4     4.0    4.0  1280.0   34.12   62.36   30.44    NO
   1000.   2.616        4     3.5    3.5  1120.0   37.95   68.69   33.27    NO
   1100.   2.433        4     3.5    3.5  1120.0   37.95   74.82   35.23    NO
   1200.   2.274        4     3.0    3.0   960.0   43.06   81.09   37.51    NO
   1300.   2.143        4     3.0    3.0   960.0   43.06   87.12   39.35    NO
   1400.   2.018        4     3.0    3.0   960.0   43.06   93.11   41.15    NO
   1500.   1.907        4     2.5    2.5   800.0   50.21   99.30   43.43    NO

 MAXIMUM 1-HR CONCENTRATION AT OR BEYOND     1. M:
    174.   5.485        3    10.0   10.0  3200.0   18.04   21.09   12.76    NO

  DWASH=   MEANS NO CALC MADE (CONC = 0.0)
  DWASH=NO MEANS NO BUILDING DOWNWASH USED
  DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
  DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
  DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

      **************************************
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*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	5.485	174.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****