NMED AIR QUALITY
TITLE V RENEWAL APPLICATION
TARGA NORTHERN DELAWARE, LLC
RED HILLS GAS PROCESSING PLANT

Prepared By:

Rob Liles – Director, Rocky Mountain Region

Jaimy Karacaoglu – Consultant

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June 2023

Project 233201.0055

Trinity Consultants
9400 Holly Ave NE, Bldg 3, Ste B, Albuquerque, NM 87122 / P 505.266.6611 / **trinityconsultants.com**

June 23, 2023

Permit Programs Manager
NMED Air Quality Bureau
525 Camino de los Marquez Suite 1
Santa Fe, NM 87505-1816

RE: Title V Permit #P278-M1 Renewal Application
Targa Northern Delaware, LLC – Red Hills Gas Processing Plant

Permit Programs Manager:

Targa Northern Delaware, LLC is submitting a Title V renewal application for Red Hills Gas Processing Plant. The facility is located approximately 24 miles WNW of Jal, New Mexico.

The format and content of this application are consistent with the Bureau's current policy regarding Title V renewal applications; it is a complete application package using the most current application form. Enclosed are two hard copies of the application, including the original certification. Please feel free to contact me at (505) 266-6611 or by email at Jaimy.Karacaoglu@trinityconsultants.com if you have any questions regarding this application. Alternatively, you may contact Robert Andries, Senior Environmental Specialist for Targa Northern Delaware, LLC, at (713) 548-1360 or by email at randries@targaresources.com.

Sincerely,

Jaimy Karacaoglu
Consultant

Cc: Rob Liles, rliles@trinityconsultants.com (Trinity Consultants)
Charles Bates, cbates@targaresources.com (Targa Northern Delaware, LLC)
Robert Andries, randries@trinityconsultants.com (Targa Northern Delaware, LLC)

Trinity Project File 233201.00557

Mail Application To:		**For Department use only:**
New Mexico Environment Department Air Quality Bureau Permits Section 525 Camino de los Marquez, Suite 1 Santa Fe, New Mexico, 87505 Phone: (505) 476-4300 Fax: (505) 476-4375 www.env.nm.gov/aqb		

Universal Air Quality Permit Application

Use this application for NOI, NSR, or Title V sources.

Use this application for: the initial application, modifications, technical revisions, and renewals. For technical revisions, complete Sections, 1-A, 1-B, 2-E, 3, 9 and any other sections that are relevant to the requested action; coordination with the Air Quality Bureau permit staff prior to submittal is encouraged to clarify submittal requirements and to determine if more or less than these sections of the application are needed. Use this application for streamline permits as well.

This application is submitted as (check all that apply)**:** ☐ Request for a No Permit Required Determination (no fee)
☐ **Updating** an application currently under NMED review. Include this page and all pages that are being updated (no fee required).
Construction Status: ☐ Not Constructed ☑ Existing Permitted (or NOI) Facility ☐ Existing Non-permitted (or NOI) Facility
Minor Source: ☐ a NOI 20.2.73 NMAC ☐ 20.2.72 NMAC application or revision ☐ 20.2.72.300 NMAC Streamline application
Title V Source: ☐ Title V (new) ☑ Title V renewal ☐ TV minor mod. ☐ TV significant mod. TV Acid Rain: ☐ New ☐ Renewal
PSD Major Source: ☐ PSD major source (new) ☐ minor modification to a PSD source ☐ a PSD major modification

Acknowledgements:
☑ I acknowledge that a pre-application meeting is available to me upon request. ☑ Title V Operating, Title IV Acid Rain, and NPR applications have no fees.
☐ $500 NSR application Filing Fee enclosed OR ☐ The full permit fee associated with 10 fee points (required w/ streamline applications).
☐ Check No.: ____ in the amount of ____
☑ I acknowledge the required submittal format for the hard copy application is printed double sided 'head-to-toe', 2-hole punched (except the Sect. 2 landscape tables is printed 'head-to-head'), numbered tab separators. Incl. a copy of the check on a separate page.
☐ I acknowledge there is an annual fee for permits in addition to the permit review fee: www.env.nm.gov/air-quality/permit-fees-2/.
☐ This facility qualifies for the small business fee reduction per 20.2.75.11.C. NMAC. The full $500.00 filing fee is included with this application and I understand the fee reduction will be calculated in the balance due invoice. The Small Business Certification Form has been previously submitted or is included with this application. (Small Business Environmental Assistance Program Information: www.env.nm.gov/air-quality/small-biz-eap-2/.)

Citation: Please provide the **low level citation** under which this application is being submitted: **20.2.70.300.B(2) NMAC**
(e.g. application for a new minor source would be 20.2.72.200.A NMAC, one example for a Technical Permit Revision is 20.2.72.219.B.1.b NMAC, a Title V acid rain application would be: 20.2.70.200.C NMAC)

Section 1 – Facility Information

Section 1-A: Company Information

		AI # if known (see 1st 3 to 5 #s of permit IDEA ID No.): 29885	Updating Permit/NOI #: P278-M1
1	Facility Name: Red Hills Gas Processing Plant	Plant primary SIC Code (4 digits): 1311	
		Plant NAIC code (6 digits): 211120	
a	Facility Street Address (If no facility street address, provide directions from a prominent landmark): 1934 W NM Highway 128, Jal, NM 88252		
2	Plant Operator Company Name: Targa Northern Delaware, LLC	Phone/Fax: (575) 631-7093 / (575) 396-7702	
a	Plant Operator Address: PO Box 1689, Lovington, NM 88260		
b	Plant Operator's New Mexico Corporate ID or Tax ID: 1948249		

3	Plant Owner(s) name(s): Targa Northern Delaware, LLC	Phone/Fax: (575) 631-7093 / (575) 396-7702
a	Plant Owner(s) Mailing Address(s): PO Box 1689, Lovington, NM 88260	
4	Bill To (Company): Targa Northern Delaware, LLC	Phone/Fax: (575) 631-7093 / (575) 396-7702
a	Mailing Address: PO Box 1689, Lovington, NM 88260	E-mail: Jaylen.fuentes@targaresources.com
5	☑ Preparer: Jaimy Karacaoglu ☑ Consultant: Trinity Consultants Inc.	Phone/Fax: (505) 266-6611
a	Mailing Address: 9400 Holly Ave, Bldg. 3, Ste B, Albuquerque, NM 87122	E-mail: Jaimy.Karacaoglu@trinityconsultants.com
6	Plant Operator Contact: Jaylen Fuentes	Phone/Fax: (575) 915-2201
a	Address: PO Box 1689, Lovington, NM 88260	E-mail: Jaylen.fuentes@targaresources.com
7	Air Permit Contact: Robert Andries	Title: Senior Environmental Specialist
a	E-mail: randries@targarecources.com	Phone/Fax: (713) 548-1360 / N/A
b	Mailing Address: 811 Louisiana Street, Ste 2100, Houston, TX 77002	
c	The designated Air permit Contact will receive all official correspondence (i.e. letters, permits) from the Air Quality Bureau.	

Section 1-B: Current Facility Status

1.a	Has this facility already been constructed? ☑ Yes ☐ No	1.b If yes to question 1.a, is it currently operating in New Mexico? ☑ Yes ☐ No
2	If yes to question 1.a, was the existing facility subject to a Notice of Intent (NOI) (20.2.73 NMAC) before submittal of this application? ☐ Yes ☑ No	If yes to question 1.a, was the existing facility subject to a construction permit (20.2.72 NMAC) before submittal of this application? ☑ Yes ☐ No
3	Is the facility currently shut down? ☐ Yes ☑ No	If yes, give month and year of shut down (MM/YY): N/A
4	Was this facility constructed before 8/31/1972 and continuously operated since 1972? ☐ Yes ☑ No	
5	If Yes to question 3, has this facility been modified (see 20.2.72.7.P NMAC) or the capacity increased since 8/31/1972? ☐Yes ☐No ☑ N/A	
6	Does this facility have a Title V operating permit (20.2.70 NMAC)? ☑ Yes ☐ No	If yes, the permit No. is: P278-M1
7	Has this facility been issued a No Permit Required (NPR)? ☐ Yes ☑ No	If yes, the NPR No. is: N/A
8	Has this facility been issued a Notice of Intent (NOI)? ☐ Yes ☐ No	If yes, the NOI No. is: N/A
9	Does this facility have a construction permit (20.2.72/20.2.74 NMAC)? ☑ Yes ☐ No	If yes, the permit No. is: 4310-M5
10	Is this facility registered under a General permit (GCP-1, GCP-2, etc.)? ☐ Yes ☑ No	If yes, the register No. is: N/A

Section 1-C: Facility Input Capacity & Production Rate

1	What is the facility's maximum input capacity, specify units (reference here and list capacities in Section 20, if more room is required)			
a	Current	Hourly: 50.417 MMscfh	Daily:1210 MMscfd	Annually: 441,650 MMscfy
b	Proposed	Hourly: 50.417 MMscfh	Daily: 1210 MMscfd	Annually: 441,650 MMscfy
2	What is the facility's maximum production rate, specify units (reference here and list capacities in Section 20, if more room is required)			
a	Current	Hourly: 50.417 MMscfh	Daily: 1210 MMscfd	Annually: 441,650 MMscfy
b	Proposed	Hourly: 50.417 MMscfh	Daily: 1210 MMscfd	Annually: 441,650 MMscfy

Section 1-D: Facility Location Information

1	Section: 13	Range: 33E	Township: 24S	County: Lea	Elevation (ft): 3582
2	UTM Zone: ☐ 12 or ☑ 13			Datum: ☐ NAD 27 ☐ NAD 83 ☑ WGS 84	
a	UTM E (in meters, to nearest 10 meters): 639,100 m			UTM N (in meters, to nearest 10 meters): 3,564,550 m	
b	**AND** Latitude (deg., min., sec.): **32° 12' 38"**			Longitude (deg., min., sec.): **103° 31' 26"**	
3	Name and zip code of nearest New Mexico town: Jal, NM 88252				
4	Detailed Driving Instructions from nearest NM town (attach a road map if necessary): East of Carlsbad on Hwy 62/180 to State Road 31 south to Hwy 128. Go east for approximately 27 miles. Plant is on left just before MM 29.				
5	The facility is **24** miles **WNW** of **Jal, NM 88252**.				
6	Status of land at facility (check one): ☑ Private ☐ Indian/Pueblo ☐ Federal BLM ☐ Federal Forest Service ☐ Other (specify)				
7	List all municipalities, Indian tribes, and counties within a ten (10) mile radius (20.2.72.203.B.2 NMAC) of the property on which the facility is proposed to be constructed or operated: **Lea County**				
8	**20.2.72** NMAC applications **only**: Will the property on which the facility is proposed to be constructed or operated be closer than 50 km (31 miles) to other states, Bernalillo County, or a Class I area (see www.env.nm.gov/air-quality/modeling-publications/)? ☑ Yes ☐ No (20.2.72.206.A.7 NMAC) If yes, list all with corresponding distances in kilometers: Texas (43 km)				
9	Name nearest Class I area: Carlsbad Caverns				
10	Shortest distance (in km) from facility boundary to the boundary of the nearest Class I area (to the nearest 10 meters): **53.0 km**				
11	Distance (meters) from the perimeter of the Area of Operations (AO is defined as the plant site inclusive of all disturbed lands, including mining overburden removal areas) to nearest residence, school or occupied structure: **>1600 m**				
12	Method(s) used to delineate the Restricted Area: **Continuous Fencing** "**Restricted Area**" is an area to which public entry is effectively precluded. Effective barriers include continuous fencing, continuous walls, or other continuous barriers approved by the Department, such as rugged physical terrain with steep grade that would require special equipment to traverse. If a large property is completely enclosed by fencing, a restricted area within the property may be identified with signage only. Public roads cannot be part of a Restricted Area.				
13	Does the owner/operator intend to operate this source as a portable stationary source as defined in 20.2.72.7.X NMAC? ☐ Yes ☑ No A portable stationary source is not a mobile source, such as an automobile, but a source that can be installed permanently at one location or that can be re-installed at various locations, such as a hot mix asphalt plant that is moved to different job sites.				
14	Will this facility operate in conjunction with other air regulated parties on the same property? ☒ No ☐ Yes If yes, what is the name and permit number (if known) of the other facility? **N/A**				

Section 1-E: Proposed Operating Schedule (The 1-E.1 & 1-E.2 operating schedules may become conditions in the permit.)

1	Facility **maximum** operating ($\frac{hours}{day}$): 24	($\frac{days}{week}$): 7	($\frac{weeks}{year}$): 52		($\frac{hours}{year}$): 8760	
2	Facility's maximum daily operating schedule (if less than 24 $\frac{hours}{day}$)?	Start: N/A	☐AM ☐PM		End: N/A	☐AM ☐PM
3	Month and year of anticipated start of construction: N/A					
4	Month and year of anticipated construction completion: N/A					
5	Month and year of anticipated startup of new or modified facility: N/A					
6	Will this facility operate at this site for more than one year? ☑ Yes ☐ No					

Section 1-F: Other Facility Information

1	Are there any current Notice of Violations (NOV), compliance orders, or any other compliance or enforcement issues related to this facility? ☐ Yes ☑ No If yes, specify:	
a	If yes, NOV date or description of issue: N/A	NOV Tracking No: N/A

b	Is this application in response to any issue listed in 1-F, 1 or 1a above? ☐ Yes ☑ No If Yes, provide the 1c & 1d info below:		
c	Document Title: N/A	Date: N/A	Requirement # (or page # and paragraph #): N/A
d	Provide the required text to be inserted in this permit: N/A		
2	Is air quality dispersion modeling or modeling waiver being submitted with this application? ☐ Yes ☑ No		
3	Does this facility require an "Air Toxics" permit under 20.2.72.400 NMAC & 20.2.72.502, Tables A and/or B? ☐ Yes ☑ No		
4	Will this facility be a source of federal Hazardous Air Pollutants (HAP)? ☑ Yes ☐ No		
a	If Yes, what type of source? ☑ **Major** (☐ ≥10 tpy of any single HAP **OR** ☑ ≥25 tpy of any combination of HAPS) **OR** ☐ **Minor** (☐ <10 tpy of any single HAP **AND** ☐ <25 tpy of any combination of HAPS)		
5	Is any unit exempt under 20.2.72.202.B.3 NMAC? ☑Yes ☐ No		
a	If yes, include the name of company providing commercial electric power to the facility: **Xcel Energy** Commercial power is purchased from a commercial utility company, which specifically does not include power generated on site for the sole purpose of the user.		

Section 1-G: Streamline Application (This section applies to 20.2.72.300 NMAC Streamline applications only)

1	☐ I have filled out Section 18, "Addendum for Streamline Applications." ☑ N/A (This is not a Streamline application.)

Section 1-H: Current Title V Information - Required for all applications from TV Sources

(Title V-source required information for all applications submitted pursuant to 20.2.72 NMAC (Minor Construction Permits), or 20.2.74/20.2.79 NMAC (Major PSD/NNSR applications), and/or 20.2.70 NMAC (Title V))

1	Responsible Official (R.O.) (20.2.70.300.D.2 NMAC): **Jimmy Oxford**	Phone: (940) 220-2493
a	R.O. Title: Vice President - Operations	R.O. e-mail: JOxford@targaresources.com
b	R. O. Address: 3100 McKinnon Street, Suite 800, Dallas, TX 75201	
2	Alternate Responsible Official (20.2.70.300.D.2 NMAC): N/A	Phone: N/A
a	A. R.O. Title: N/A	A. R.O. e-mail:N/A
b	A. R. O. Address: N/A	
3	Company's Corporate or Partnership Relationship to any other Air Quality Permittee (List the names of any companies that have operating (20.2.70 NMAC) permits and with whom the applicant for this permit has a corporate or partnership relationship): **Targa Resources, Inc.**	
4	Name of Parent Company ("Parent Company" means the primary name of the organization that owns the company to be permitted wholly or in part.): **Targa Resources, Inc.**	
a	Address of Parent Company: **811 Louisiana Suite 2100, Houston, TX 77002-1400**	
5	Names of Subsidiary Companies ("Subsidiary Companies" means organizations, branches, divisions or subsidiaries, which are owned, wholly or in part, by the company to be permitted.): **Targa Northern Delaware, LLC, Targa Midstream Services, LLC, Versado Gas Processors, LLC**	
6	Telephone numbers & names of the owners' agents and site contacts familiar with plant operations: Jaylen Fuentes (575) 915-2201	
7	Affected Programs to include Other States, local air pollution control programs (i.e. Bernalillo) and Indian tribes: Will the property on which the facility is proposed to be constructed or operated be closer than 80 km (50 miles) from other states, local pollution control programs, and Indian tribes and pueblos (20.2.70.402.A.2 and 20.2.70.7.B)? If yes, state which ones and provide the distances in kilometers: **Texas – 43 km; Local Air Pollution Programs: Not Applicable; Tribes and Pueblos: Not Applicable**	

Section 1-I – Submittal Requirements

Each 20.2.73 NMAC (**NOI**), a 20.2.70 NMAC (**Title V**), a 20.2.72 NMAC (**NSR** minor source), or 20.2.74 NMAC (**PSD**) application package shall consist of the following:

Hard Copy Submittal Requirements:

1) One hard copy **original signed and notarized application package printed double sided 'head-to-toe' 2-hole punched** as we bind the document on top, not on the side; except Section 2 (landscape tables), which should be head-to-head. Please use **numbered tab separators** in the hard copy submittal(s) as this facilitates the review process. For NOI submittals only, hard copies of UA1, Tables 2A, 2D & 2F, Section 3 and the signed Certification Page are required. Please include a copy of the check on a separate page.

2) If the application is for a minor NSR, PSD, NNSR, or Title V application, include one working hard **copy** for Department use. This copy should be printed in book form, 3-hole punched, and **must be double sided**. Note that this is in addition to the head-to-to 2-hole punched copy required in 1) above. Minor NSR Technical Permit revisions (20.2.72.219.B NMAC) only need to fill out Sections 1-A, 1-B, 3, and should fill out those portions of other Section(s) relevant to the technical permit revision. TV Minor Modifications need only fill out Sections 1-A, 1-B, 1-H, 3, and those portions of other Section(s) relevant to the minor modification. NMED may require additional portions of the application to be submitted, as needed.

3) The entire NOI or Permit application package, including the full modeling study, should be submitted electronically. Electronic files for applications for NOIs, any type of General Construction Permit (GCP), or technical revisions to NSRs must be submitted with compact disk (CD) or digital versatile disc (DVD). For these permit application submittals, **two** CD copies are required (in sleeves, not crystal cases, please), with additional CD copies as specified below. NOI applications require only a single CD submittal. Electronic files for other New Source Review (construction) permits/permit modifications or Title V permits/permit modifications can be submitted on CD/DVD or sent through AQB's secure file transfer service.

Electronic files sent by (check one):

☐ CD/DVD attached to paper application

☑ secure electronic transfer. Air Permit Contact Name: Jaimy Karacaoglu,

Email: Jaimy.karacaoglu@trinityconsultants.com

Phone number: (505) 266-6611

a. If the file transfer service is chosen by the applicant, after receipt of the application, the Bureau will email the applicant with instructions for submitting the electronic files through a secure file transfer service. Submission of the electronic files through the file transfer service needs to be completed within 3 business days after the invitation is received, so the applicant should ensure that the files are ready when sending the hard copy of the application. The applicant will not need a password to complete the transfer. **Do not use the file transfer service for NOIs, any type of GCP, or technical revisions to NSR permits.**

4) Optionally, the applicant may submit the files with the application on compact disk (CD) or digital versatile disc (DVD) following the instructions above and the instructions in 5 for applications subject to PSD review.

5) If **air dispersion modeling** is required by the application type, include the **NMED Modeling Waiver** and/or electronic air dispersion modeling report, input, and output files. The dispersion modeling ***summary report only*** should be submitted as hard copy(ies) unless otherwise indicated by the Bureau.

6) If the applicant submits the electronic files on CD and the application is subject to PSD review under 20.2.74 NMAC (PSD) or NNSR under 20.2.79 NMC include,
   a. one additional CD copy for US EPA,
   b. one additional CD copy for each federal land manager affected (NPS, USFS, FWS, USDI) and,
   c. one additional CD copy for each affected regulatory agency other than the Air Quality Bureau.

   If the application is submitted electronically through the secure file transfer service, these extra CDs do not need to be submitted.

Electronic Submittal Requirements [in addition to the required hard copy(ies)]:

1) All required electronic documents shall be submitted as 2 separate CDs or submitted through the AQB secure file transfer service. Submit a single PDF document of the entire application as submitted and the individual documents comprising the application.

2) The documents should also be submitted in Microsoft Office compatible file format (Word, Excel, etc.) allowing us to access the text and formulas in the documents (copy & paste). Any documents that cannot be submitted in a Microsoft Office compatible

format shall be saved as a PDF file from within the electronic document that created the file. If you are unable to provide Microsoft office compatible electronic files or internally generated PDF files of files (items that were not created electronically: i.e. brochures, maps, graphics, etc,), submit these items in hard copy format. We must be able to review the formulas and inputs that calculated the emissions.

3) It is preferred that this application form be submitted as 4 electronic files (3 MSWord docs: Universal Application section 1 [UA1], Universal Application section 3-19 [UA3], and Universal Application 4, the modeling report [UA4]) and 1 Excel file of the tables (Universal Application section 2 [UA2]). Please include as many of the 3-19 Sections as practical in a single MS Word electronic document. Create separate electronic file(s) if a single file becomes too large or if portions must be saved in a file format other than MS Word.

4) The electronic file names shall be a maximum of 25 characters long (including spaces, if any). The format of the electronic Universal Application shall be in the format: "A-3423-FacilityName". The "A" distinguishes the file as an application submittal, as opposed to other documents the Department itself puts into the database. Thus, all electronic application submittals should begin with "A-". Modifications to existing facilities should use the core permit number (i.e. '3423') the Department assigned to the facility as the next 4 digits. Use 'XXXX' for new facility applications. The format of any separate electronic submittals (additional submittals such as non-Word attachments, re-submittals, application updates) and Section document shall be in the format: "A-3423-9-description", where "9" stands for the section # (in this case Section 9-Public Notice). Please refrain, as much as possible, from submitting any scanned documents as this file format is extremely large, which uses up too much storage capacity in our database. Please take the time to fill out the header information throughout all submittals as this will identify any loose pages, including the Application Date (date submitted) & Revision number (0 for original, 1, 2, etc.; which will help keep track of subsequent partial update(s) to the original submittal. Do not use special symbols (#, @, etc.) in file names. The footer information should not be modified by the applicant.

Table of Contents

Table 2-A: Regulated Emission Sources

Unit and stack numbering must correspond throughout the application package. If applying for a NOI under 20.2.73 NMAC, equipment exemptions under 2.72.202 NMAC do not apply.

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] Date of Construction/ Reconstruction[2]	Controlled by Unit # Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
1-EP-1	Hot Oil Heater	New Point Thermal	DHV 100/50C	7163	35.3 MMBtu/hr	35.3 MMBtu/hr	2011 2011	N/A 1-EP-1	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
1-EP-2	Flare - Cryo 1 Train SSM	Callidus	RTA-20 Air-Assisted	F-201113 Tag #: 29-1001	75 MMscf/d	75 MMscf/d	2012 2012	N/A 1-EP-2	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
1-EP-3	Glycol Dehydrator Flash Tank & Still Vent – Service 1 Train	Tryer Process Equipment	N/A	Tag #: 29-302 V-101 / V-110	70 MMscf/d	70 MMscf/d	2012 2012	EP-5 EP-5	31000301	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
1-EP-4	Amine Unit Flash Tank & Still Vent – Service 1 Train	Allied Equp. BCCK	N/A	P211097 31-205	70 MMscf/d	70 MMscf/d	2012 2012	EP-5 EP-5	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
1.5-EP-1g	10k Stabilizer Heater	Tulsa Heaters Midstream	N/A	MJ19-426	22.61 MMBtu/hr	22.61 MMBtu/hr	2019 2019	N/A N/A	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1g	HMO Heater	New Point Thermal, LP	DHV 100/50C	7163	4.5 MMBtu/hr	4.5 MMBtu/hr	2011 2011	N/A 4-EP-1g	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-1a	Mol Sieve Heater – Cryo 2 Train	Hectac	HCI-5010-40-G	HI14-266	5.6 MMBtu/hr	5.6 MMBtu/hr	2017 2017	N/A 2-EP-1a	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-1b	HMO Heater – Cryo 2 Train	Hectac	HCI-8010-40-D-G	HI14-267	23.65 MMBtu/hr	23.65 MMBtu/hr	2017 2017	N/A 2-EP-1b	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-1e	Glycol Dehydrator Reboiler	Reset Energy	N/A	F-6	3 MMBtu/hr	3 MMBtu/hr	2017 2017	N/A 2-EP-1e	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-2a	Flare SSM - Cryo 2 Train	Zecco	N/A	24675	200 MMscf/d	200 MMscf/d	2017 2017	N/A 2-EP-2a	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-4	Amine Unit Flash Tank & Still Vent – Service 2 Train	PBP Fabrication Inc	N/A	483	200 MMscf/d	200 MMscf/d	2017 2017	EP-5 EP-5	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-1h	Amine Unit Reboiler	HMI	N/A	1016-5059A-1 1016-5059A-2	55 MMBtu/hr	55 MMBtu/hr	2017 2017	N/A 2-EP-1h	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2a-EP-1d	Amine Unit Reboiler	Devco Process	N/A	H-16025904-A	55 MMBtu/hr	55 MMBtu/hr	2017 2017	N/A 2a-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2a-EP-3	Glycol Dehydrator Flash Tank & Still Vent – Service 2 Train	Reset Energy	N/A	Tah # T-2701	200 MMscf/d	200 MMscf/d	2017 2017	EP-5 EP-5	31000301	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2.5-EP-4	Amine Unit Flash Tank & Still Vent (High H2S Handling #1)	Reset Energy	N/A	226	60 MMscf/d	60 MMscf/d	2018 2018	AGI 1 & 2.5-EP-5 AGI 1 & 2.5-EP-5	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] Date of Construction/ Reconstruction[2]	Controlled by Unit # Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
2.5-EP-1d	Amine Unit Reboiler (High H2S Handling #1)	Sigma	HC2-20.0-HENG	J17133-001	25 MMBtu/hr	25 MMBtu/hr	2018 2018	N/A 2.5-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2.5-EP-5	Flare - AGI System 1 SSM (High H2S Handling #1)	Tulsa Combustion	N/A	PO-170084-07	6.4 MMscf/d	6.4 MMscf/d	2018 2018	N/A 2.5-EP-5	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-1a	Mol Sieve Heater – Cryo 3 Train	Tulsa Heaters Midstream	H-741	MJ17-265	7.29 MMBtu/hr	7.29 MMBtu/hr	2018 2018	N/A 3-EP-1a	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-1b	HMO Heater – Cryo 3 Train	Tulsa Heaters Midstream	H-781	MJ17-266	17.55 MMBtu/hr	17.55 MMBtu/hr	2018 2018	N/A 3-EP-1b	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-1d	Amine Unit Reboiler	Devco	N/A	16025904-A	55 MMBtu/hr	55 MMBtu/hr	2018 2018	N/A 3-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-1e	Glycol Dehydrator Reboiler	Reset Energy	N/A	H-6301	3 MMBtu/hr	3 MMBtu/hr	2019 2019	N/A 3-EP-1e	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-1h	Amine Unit Reboiler	Devco	N/A	16025904-A	55 MMBtu/hr	55 MMBtu/hr	2018 2018	N/A 3-EP-1h	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-2a	Flare SSM - Cryo 3 Train	Zecco	N/A	Tag#: FL-5100	200 MMscf/d	200 MMscf/d	2018 2018	N/A 3-EP-2a	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-3	Glycol Dehydrator Flash Tank & Still Vent – Service 3 Train	ISTI/RAMA	N/A	14469-01	200 MMscf/d	200 MMscf/d	2018 2018	EP-6 EP-6	31000301	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-4	Amine Unit Flash Tank & Still Vent Service - 3 Train	Reset Energy	N/A	V-01-01	200 MMscf/d	200 MMscf/d	2016 2016	EP-6 EP-6	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1a	Mol Sieve Heater - Cryo 4 Train	Tulsa Heaters Midstream	H-741	MJ17-271	7.29 MMBtu/hr	7.29 MMBtu/hr	2017 2017	N/A 4-EP-1a	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1b	HMO Heater - Cryo 4 Train	Tulsa Heaters Midstream	H-781	MJ17-272	17.55 MMBtu/hr	17.55 MMBtu/hr	2017 2017	N/A 4-EP-1b	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-2a	Flare SSM - Cryo 4 Train	Zeeco	FI-45100	10507-128182	200 MMscf/d	200 MMscf/d	2019 2019	N/A 4-EP-2a	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
EP-5	Thermal Oxidizer (TO)	Zecco	N/A	Tag #: TO-5500	28 MMBtu/hr	28 MMBtu/hr	2012 2012	N/A EP-5	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
EP-6	Thermal Oxidizer (TO)	Zeeco	N/A	37954	28 MMBtu/hr	28 MMBtu/hr	2016 2016	N/A EP-6	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] / Date of Construction/ Reconstruction[2]	Controlled by Unit # / Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
EP-7	Enclosed Combustion Device (ECD) – Condensate Tank Control	TBD	TBD	TBD	1.55 MMBtu/hr	1.55 MMBtu/hr	TBD TBD	N/A EP-7	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
EP-9	Flare - Sour Slop Tank Control	Tulsa Combustion	N/A	PO-170084-07	6 MMBtu/hr	6 MMBtu/hr	TBD TBD	N/A EP-9	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
1-T	Condensate Storage Tanks 1-T-1, 1-T- 2,1-T-3, 1-T-4, 1-T-5, 1-T-6	Palmer Palmer Palmer Palmer Palmer Permian Tank	N/A	ST-26092 ST-26093 ST-26094 ST-26095 ST-26091 F52974	500 bbl each	500 bbl each	2012 2012	EP-7 EP-7	40400311	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
1-Load	Condensate Loading Emissions	Palmer	LIC-NO/12F0067	5t-26095	N/A	N/A	2011 2011	EP-7 EP-7	40400250	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-Load	Sour Slop Tank Loading Emissions	API	TK6100	201749	N/A	N/A	2018 2018	N/A EP-9	40400250	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-T	H2S Sour Slop Tank 2-T-1 & 2-T-2	Tank & Vessel Builders, L.P.	N/A	201749 201750	500 bbl each	500 bbl each	TBD TBD	EP-9 EP-9	40400311	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
FUG	Fugitive Emissions from Cryo Trains 1 to 4; Service Trains 1 to 3; Tanks: 1-T-1 to 1-T-6 & 2-T-1 to 2-T-2; Loading: 1-Load, 2-Load	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	31088811	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
HAUL	Fugitive Emissions	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	31088811	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1d	Amine Unit Reboiler	Heterick Manufacturing	2BWU3D/5D-31	1218-5288A-2	55 MMBtu/hr	55 MMBtu/hr	2019 2019	N/A 4-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1e	Glycol Dehydrator Reboiler	Reset Energy	N/A	F-15	3 MMBtu/hr	3 MMBtu/hr	2019 2019	N/A 4-EP-1e	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1h	Amine Unit Reboiler	TBD	TBD	TBD	55 MMBtu/hr	55 MMBtu/hr	TBD TBD	N/A 4-EP-1h	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-3	Glycol Dehydrator Flash Tank & Still Vent – Service Train 4	Reset Energy	V-5101	320	200 MMscf/d	200 MMscf/d	2019 2019	EP-8 EP-8	31000301	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] Date of Construction/ Reconstruction[2]	Controlled by Unit # Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
EP-8	Thermal Oxidizer (TO)	Zeeco	N/A	5500	28 MMBtu/hr	28 MMBtu/hr	2012 2012	N/A EP-8	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-4	Amine Unit Flash Tank & Still Vent – Service Train 4	BPB	V-45520	483	200 MMscf/d	200 MMscf/d	2019 2019	EP-8 EP-8	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1a	Amine Unit & Glycol Dehydrator Reboiler	TBD	TBD	TBD	70 MMBtu/hr	70 MMBtu/hr	TBD TBD	N/A 5-EP-1a	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1b	Amine Unit & Glycol Dehydrator Reboiler	TBD	TBD	TBD	70 MMBtu/hr	70 MMBtu/hr	TBD TBD	N/A 5-EP-1b	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1c	Mole Sieve Heater - Cryo 5 Train	Tulsa Heaters Midstream	SHO500	MJ19-384	7.29 MMBtu/hr	7.29 MMBtu/hr	2019 2019	N/A 5-EP-1c	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1d	HMO Heater - Cryo 5 Train	Tulsa Heaters Midstream	SHO2500	MJ18-370	17.55 MMBtu/hr	17.55 MMBtu/hr	TBD TBD	N/A 5-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1e	Glycol Dehydrator Flash Tank & Still Vent – Service 5 Train	Gemstar	V-55520	4262	230 MMscf/d	230 MMscf/d	2019 2019	EP-10 EP-10	31000301	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1f	Amine Unit Flash Tank & Still Vent – Service 5 Train	Reset Energy	V-53101	348	250 MMscf/d	250 MMscf/d	2020 2020	EP-10 EP-10	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-2	Flare SSM - Cryo 5 & 6 Trains	Zeeco	FI-55100	42009	230 MMscf/d	230 MMscf/d	2020 2020	N/A 5-EP-2	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
6-EP-1a	Amine Unit & Glycol Dehydrator Reboiler	TBD	TBD	TBD	70 MMBtu/hr	70 MMBtu/hr	TBD TBD	N/A 6-EP-1a	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
6-EP-1b	Amine Unit & Glycol Dehydrator Reboiler	TBD	TBD	TBD	70 MMBtu/hr	70 MMBtu/hr	TBD TBD	N/A 6-EP-1b	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
6-EP-1c	Mole Sieve Heater – Cryo 6 Train	TBD	TBD	TBD	7.29 MMBtu/hr	7.29 MMBtu/hr	TBD TBD	N/A 6-EP-1c	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
6-EP-1d	HMO Heater – Cryo 6	TBD	TBD	TBD	17.55 MMBtu/hr	17.55 MMBtu/hr	TBD TBD	N/A 6-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
6-EP-1e	Glycol Dehydrator Flash Tank & Still Vent – Service 6 Train	TBD	TBD	TBD	230 MMscf/d	230 MMscf/d	TBD TBD	EP-10 EP-10	31000301	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] Date of Construction/ Reconstruction[2]	Controlled by Unit # Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
6-EP-1f	Amine Unit Flash Tank & Still Vent – Service 6 Train	TBD	TBD	TBD	250 MMscf/d	250 MMscf/d	TBD TBD	EP-10 EP-10	31000305	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
7-EP-1c	Mole Sieve Heater – Cryo 7 Train	TBD	TBD	TBD	7.29 MMBtu/hr	7.29 MMBtu/hr	TBD TBD	N/A 7-EP-1c	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
7-EP-1d	HMO Heater – Cryo 7 Train	TBD	TBD	TBD	17.55 MMBtu/hr	17.55 MMBtu/hr	TBD TBD	N/A 7-EP-1d	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
7-EP-2	Flare SSM - Cryo 7 Train	TBD	TBD	TBD	230 MMscf/d	230 MMscf/d	TBD TBD	N/A 7-EP-2	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5.5-EP-1a	Amine Unit Reboiler (High H2S Handling #2)	TBD	TBD	TBD	70 MMBtu/hr	70 MMBtu/hr	TBD TBD	N/A 5.5-EP-1a	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5.5-EP-1b	Flare - AGI System 2 SSM (High H2S Handling #2)	TBD	TBD	TBD	8.2 MMscf/d	8.2 MMscf/d	TBD TBD	N/A 5.5-EP-1b	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5.5-EP-1c	Amine Unit Flash Tank & Still Vent (High H2S Handling #2)	TBD	TBD	TBD	60 MMscf/d	60 MMscf/d	TBD TBD	AGI 2 & 5.5-EP-1b AGI 2 & 5.5-EP-1b	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-T	Condensate Storage Tanks 3-T-1, 3-T-2,3-T-3, 3-T-4, 3-T-5, 3-T-6	TBD	TBD	TBD	500 bbl each	500 bbl each	TBD TBD	EP-12 EP-12	40400311	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-T	Sour Water Tanks 4-T-1, 4-T-2	TBD	TBD	TBD	500 bbl each	500 bbl each	TBD TBD	EP-13 EP-13	40400311	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-T	Slop Tanks 5-T-1, 5-T-2, 5-T-3, 5-T-4	TBD	TBD	TBD	400 bbl each	400 bbl each	TBD TBD	N/A N/A	40400311	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-LOAD	Condensate Loading Emissions	N/A	TBD	TBD	TBD	TBD	TBD TBD	EP-12 EP-12	40400250	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-LOAD	Sour Water Tanks Loading Emissions	N/A	TBD	TBD	TBD	TBD	TBD TBD	N/A N/A	40400250	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-LOAD	Slop Tanks Loading Emissions	N/A	TBD	TBD	TBD	TBD	TBD TBD	N/A N/A	40400250	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
EP-10	Thermal Oxidizer (TO)	TBD	TBD	TBD	112 MMbtu/hr	112 MMbtu/hr	TBD TBD	N/A EP-10	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] / Date of Construction/ Reconstruction[2]	Controlled by Unit # / Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
EP-11	SSM Venting during SSM of Thermal Oxidizer	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A EP-11	31000404	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
EP-12	Enclosed Combustion Device (ECD)- Condensate Tank Control	TBD	TBD	TBD	TBD	2 MMBtu/hr	TBD TBD	N/A EP-12	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
EP-13	Flare - Sour Water Tanks Control	TBD	TBD	TBD	TBD	2 MMBtu/hr	TBD TBD	N/A EP-13	31000205	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
2-EP-1t	SSM Venting – Cryo Train 2	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A 2-EP-1t	30600402	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
3-EP-1t	SSM Venting – Cryo Train 3	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A 3-EP-1t	30600402	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
4-EP-1t	SSM Venting – Cryo Train 4	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A 4-EP-1t	30600402	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
5-EP-1t	SSM Venting – Cryo Train 5	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A 5-EP-1t	30600402	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
6-EP-1t	SSM Venting – Cryo Train 6	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A 6-EP-1t	30600402	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
7-EP-1t	SSM Venting – Cryo Train 7	N/A	N/A	N/A	N/A	N/A	TBD TBD	N/A 7-EP-1t	30600402	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
SSM/M	Miscellaneous Venting due to Startup, Shutdown and Maintenance and Malfunction (SSM/M)	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
FUG-1	Fugitive Emissions from Cryo Trains 5 to 7; Service Trains 4 to 6; Tanks 3-T-1 to 3-T-6, 4-T-1 to 4-T-2, 5-T-1 to 5-T-4; Loading 3-Load, 4-Load, 5-Load	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	31088811	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
HAUL-1	Fugitive Emissions	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	31088811	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A

Table 2-B: Insignificant Activities[1] (20.2.70 NMAC)

All 20.2.70 NMAC (Title V) applications must list all Insignificant Activities in this table. All 20.2.72 NMAC applications must list Exempted Equipment in this table. If equipment listed on this table is exempt under 20.2.72.202.B.5, include emissions calculations and emissions totals for 202.B.5 "similar functions" units, operations, and activities in Section 6, Calculations. Equipment and activities exempted under 20.2.72.202 NMAC may not necessarily be Insignificant under 20.2.70 NMAC (and vice versa). Unit & stack numbering must be consistent throughout the application package. Per Exemptions Policy 02-012.00 (see http://www.env.nm.gov/aqb/permit/aqb_pol.html), 20.2.72.202.B NMAC Exemptions do not apply, but 20.2.72.202.A NMAC exemptions do apply to NOI facilities under 20.2.73 NMAC. List 20.2.72.301.D.4 NMAC Auxiliary Equipment for Streamline applications in Table 2-A. The List of Insignificant Activities (for TV) can be found online at http://www.env.nm.gov/aqb/forms/InsignificantListTitleV.pdf . TV sources may elect to enter both TV Insignificant Activities and Part 72 Exemptions on this form.

Unit Number	Source Description	Manufacturer	Model No. / Serial No.	Max Capacity / Capacity Units	List Specific 20.2.72.202 NMAC Exemption (e.g. 20.2.72.202.B.5) / Insignificant Activity citation (e.g. IA List Item #1.a)	Date of Manufacture /Reconstruction2 / Date of Installation /Construction2	For Each Piece of Equipment, Check Onc
SmT-1	Amine Storage Tank	N/A	N/A N/A	120 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-2	Lube Oil Storage Tank	N/A	N/A N/A	120 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-3	Glycol Storage Tank	N/A	N/A N/A	120 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-4	Oily Wastewater Tank	N/A	N/A N/A	210 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-5	Oil Storage	N/A	N/A N/A	120 bbl	20.2.72.202.B.5 IA List Item #1.a		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
1-Gen-1	Emergency Generator	Caterpillar	CG137 WRX00112	TBD TBD	20.2.72.202.B.3 IA List Item #7	24-05-12	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-6	Wastewater Tank	N/A	N/A N/A	500 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-7	Wastewater Tank	N/A	N/A N/A	500 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-8	Wastewater Tank	N/A	N/A N/A	210 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-9	Amine Storage Tank	N/A	N/A N/A	210 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
SmT-10	Glycol Storage Tank	N/A	N/A N/A	210 bbl	20.2.72.202.B.2 IA List Item #5		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
HAUL/ HAUL-1	Haul Road Emission	N/A	N/A N/A	N/A N/A	20.2.72.202.B.5 IA List Item #1.a		☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced

[1] Insignificant activities exempted due to size or production rate are defined in 20.2.70.300.D.6, 20.2.70.7.Q NMAC, and the NMED/AQB List of Insignificant Activities, dated September 15, 2008. Emissions from these insignificant activities do not need to be reported, unless specifically requested.

[2] Specify date(s) required to determine regulatory applicability.

Table 2-C: Emissions Control Equipment

Unit and stack numbering must correspond throughout the application package. Only list control equipment for TAPs if the TAP's maximum uncontrolled emissions rate is over its respective threshold as listed in 20.2.72 NMAC, Subpart V, Tables A and B. In accordance with 20.2.72.203.A(3) and (8) NMAC, 20.2.70.300.D(5)(b) and (e) NMAC, and 20.2.73.200.B(7) NMAC, the permittee shall report all control devices and list each pollutant controlled by the control device regardless if the applicant takes credit for the reduction in emissions.

Control Equipment Unit No.	Control Equipment Description	Date Installed	Controlled Pollutant(s)	Controlling Emissions for Unit Number(s)[1]	Efficiency (% Control by Weight)	Method used to Estimate Efficiency
1-BTEX-1	Condenser	TBD	VOC, HAP	1-EP-3	98%	Condenser Curves
2a-BTEX-1	Condenser	TBD	VOC, HAP	2a-EP-3	98%	Condenser Curves
3-BTEX-1	Condenser	TBD	VOC, HAP	3-EP-3	98%	Condenser Curves
4-BTEX-1	Condenser	TBD	VOC, HAP	4-EP-3	98%	Condenser Curves
5-BTEX-1	Condenser	TBD	VOC, HAP	5-EP-1f	98%	Condenser Curves
6-BTEX-1	Condenser	TBD	VOC, HAP	6-EP-1f	98%	Condenser Curves
EP-5	Thermal Oxidizer (TO)	TBD	VOC, HAP	1-EP-3, 1-EP-4, 2-EP-4, 2a-EP-3	98%	Manufacturer
EP-6	Thermal Oxidizer (TO)	TBD	VOC, HAP	3-EP-3, 3-EP-4	98%	Manufacturer
EP-7	Enclosed Combustion Device (ECD) – Condensate Tank Control	TBD	VOC, HAP	1-T, 1-Load	98%	Manufacturer
EP-8	Thermal Oxidizer (TO)	TBD	VOC, HAP	4-EP-3, 4-EP-4	98%	Manufacturer
1-EP-2	Flare - Cryo 1 Train SSM	TBD	VOC, HAP	Facility Wide SSM	98%	Manufacturer
2-EP-2a	Flare SSM - Cryo 2 Train	TBD	VOC, HAP	Facility Wide SSM	98%	Manufacturer
2.5-EP-5	Flare - AGI System 1 SSM (High H2S Handling #1)	TBD	VOC, HAP	2.5-EP-4	98%	Manufacturer
3-EP-2a	Flare SSM - Cryo 3 Train	TBD	VOC, HAP	Facility Wide SSM	98%	Manufacturer
4-EP-2a	Flare SSM - Cryo 4 Train	TBD	VOC, HAP	Facility Wide SSM	98%	Manufacturer
EP-9	Flare - Sour Slop Tank Control	TBD	VOC, HAP, H2S	2-T, 2-Load	95%	NMED Guidance
5-EP-2	Flare SSM - Cryo 5 & 6 Trains	TBD	VOC, HAP, H2S	Cryo Train 5 & 6 SSM	98%	Manufacturer
7-EP-2	Flare SSM - Cryo 7 Train	TBD	VOC, HAP, H2S	Cryo Train 7 SSM	98%	Manufacturer
5.5-EP-1b	Flare - AGI System 2 SSM (High H2S Handling #2)	TBD	VOC, HAP, H2S	AGI 2 SSM	98%	Manufacturer
EP-12	Enclosed Combustion Device (ECD) - Condensate Tank Control	TBD	VOC, HAP, H2S	3-T-1, 3-T- 2,3-T-3, 3-T-4, 3-T-5, 3-T-6 & 3-LOAD	95%	Manufacturer
EP-10	Thermal Oxidizer (TO)	TBD	VOC, HAP, H2S	5-EP-1e, 6-EP-1e, 5-EP-1f, 6-EP-1f	99% VOC, 98% H2S	Manufacturer
EP-13	Flare - Sour Water Tanks Control	TBD	VOC, HAP, H2S	4-T-1, 4-T-2 & 4-LOAD	95%	Manufacturer

[1] List each control device on a separate line. For each control device, list all emission units controlled by the control device.

Table 2-D: Maximum Emissions (under normal operating conditions)

☐ **This Table was intentionally left blank because it would be identical to Table 2-E.**

Maximum Emissions are the emissions at maximum capacity and prior to (in the absence of) pollution control, emission-reducing process equipment, or any other emission reduction. Calculate the hourly emissions using the worst case hourly emissions for each pollutant. For each pollutant, calculate the annual emissions as if the facility were operating at maximum plant capacity without pollution controls for 8760 hours per year, unless otherwise approved by the Department. List Hazardous Air Pollutants (HAP) & Toxic Air Pollutants (TAPs) in Table 2-I. Unit & stack numbering must be consistent throughout the application package. Fill all cells in this table with the emission numbers or a "-" symbol. A "-" symbol indicates that emissions of this pollutant are not expected. Numbers shall be expressed to at least 2 decimal points (e.g. 0.41, 1.41, or 1.41E-4).

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
1-EP-1	3.46	15.16	2.91	12.73	0.19	0.83	0.02	0.08	0.26	1.15	0.26	1.15	0.26	1.15	-	-	-	-
1-EP-2[2]	0.18	0.78	0.81	3.56	-	-	0.002	0.01	-	-	-	-	-	-	1.8E-05	7.8E-05	-	-
1-EP-3	-	-	-	-	110.07	482.10	-	-	-	-	-	-	-	-	9.8E-06	4.3E-05	-	-
1-EP-4	-	-	-	-	10.12	44.33	-	-	-	-	-	-	-	-	1.77	7.74	-	-
1.5-EP-1g	0.90	3.96	0.93	4.06	0.09	0.40	0.01	0.05	0.14	0.59	0.14	0.59	0.14	0.59	-	-	-	-
4-EP-1g	0.22	0.97	0.37	1.62	0.02	0.11	0.02	0.10	0.03	0.15	0.03	0.15	0.03	0.11	-	-	-	-
2-EP-1a	0.27	1.20	0.46	2.02	0.03	0.13	0.03	0.12	0.04	0.18	0.04	0.18	0.03	0.14	-	-	-	-
2-EP-1b	1.16	5.08	1.31	5.75	0.09	0.38	0.12	0.52	0.12	0.52	0.12	0.52	0.13	0.58	-	-	-	-
2-EP-1e	0.29	1.29	0.25	1.08	0.02	0.07	0.002	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	-	-
2-EP-2a[2]	0.18	0.78	0.81	3.56	-	-	0.002	0.01	-	-	-	-	-	-	1.8E-05	7.8E-05	-	-
2-EP-4	-	-	-	-	66.22	290.07	-	-	-	-	-	-	-	-	5.26	23.03	-	-
2-EP-1h	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
2a-EP-1d	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
2a-EP-3	-	-	-	-	109.47	479.49	-	-	-	-	-	-	-	-	1.1E-05	4.8E-05	-	-
2.5-EP-4	-	-	-	-	10.65	46.66	-	-	-	-	-	-	-	-	612.94	2684.68	-	-
2.5-EP-1d	2.45	10.74	2.06	9.02	0.13	0.59	0.01	0.06	0.19	0.82	0.19	0.82	0.19	0.82	-	-	-	-
2.5-EP-5[3]	16.28	1.22	74.21	5.58	0.21	0.01	1155.37	74.54	-	-	-	-	-	-	0.0016	0.00012	-	-
3-EP-1a	0.36	1.57	0.46	2.02	0.03	0.13	0.04	0.16	0.04	0.18	0.04	0.18	0.04	0.18	-	-	-	-
3-EP-1b	0.86	3.77	1.31	5.75	0.09	0.38	0.09	0.38	0.12	0.52	0.12	0.52	0.10	0.43	-	-	-	-
3-EP-1d	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
3-EP-1e	0.29	1.29	0.25	1.08	0.02	0.07	0.002	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	-	-
3-EP-1h	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
3-EP-2a[2]	0.18	0.78	0.81	3.56	-	-	0.002	0.01	-	-	-	-	-	-	1.8E-05	7.8E-05	-	-
3-EP-3	-	-	-	-	109.41	479.20	-	-	-	-	-	-	-	-	9.5E-06	4.2E-05	-	-
3-EP-4	-	-	-	-	72.35	316.90	-	-	-	-	-	-	-	-	5.03	22.04	-	-
4-EP-1a	0.36	1.57	0.46	2.02	0.03	0.13	0.04	0.16	0.04	0.18	0.04	0.18	0.04	0.18	-	-	-	-
4-EP-1b	0.86	3.77	1.31	5.75	0.09	0.38	0.09	0.38	0.12	0.52	0.12	0.52	0.10	0.43	-	-	-	-
4-EP-2a[2]	0.18	0.78	0.81	3.56	-	-	0.002	0.01	-	-	-	-	-	-	1.8E-05	7.8E-05	-	-
4-EP-3	-	-	-	-	109.16	478.13	-	-	-	-	-	-	-	-	1.0E-05	4.5E-05	-	-
4-EP-4	-	-	-	-	68.61	300.52	-	-	-	-	-	-	-	-	5.29	23.17	-	-

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
EP-5	No emissions from these units in an uncontrolled scenario.																	
EP-6																		
EP-7																		
EP-9																		
1-T	-	-	-	-	*	46.00	-	-	-	-	-	-	-	-	-	-	-	-
2-T	-	-	-	-	*	529.80	-	-	-	-	-	-	-	-	-	0.261	*	
1-Load	-	-	-	-	*	129.20	-	-	-	-	-	-	-	-	-	-	-	-
2-Load	-	-	-	-	*	48.20	-	-	-	-	-	-	-	-	0.012	0.007		
FUG	-	-	-	-	*	103.61	-	-	-	-	-	-	-	-	*	0.004	-	-
HAUL	-	-	-	-	-	-	-	-	3.50	1.36	*	*	*	*	-	-	-	-
4-EP-1d	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
4-EP-1e	0.29	1.29	0.25	1.08	0.02	0.07	0.00	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	-	-
4-EP-1h	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
EP-8	No emissions from this unit in an uncontrolled scenario.																	
5-EP-1a	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
5-EP-1b	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
5-EP-1c	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	-	-
5-EP-1d	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.24	0.13	0.24	0.04	0.43	-	-	-	-
5-EP-1e	-	-	-	-	146.92	643.53	-	-	-	-	-	-	-	-	0.000	0.000	-	-
5-EP-1f	-	-	-	-	35.83	156.92	-	-	-	-	-	-	-	-	1.874	8.209	-	-
5-EP-2[2]	0.34	1.51	0.69	3.01	0.00	0.02	0.01	0.004	-	-	-	-	-	-	0.00	0.00	-	-
6-EP-1a	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
6-EP-1b	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
6-EP-1c	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	-	-
6-EP-1d	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	-	-
6-EP-1e	-	-	-	-	146.92	643.53	-	-	-	-	-	-	-	-	0.000	0.000	-	-
6-EP-1f	-	-	-	-	35.83	156.92	-	-	-	-	-	-	-	-	1.874	8.209		
7-EP-1c	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	-	-
7-EP-1d	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	-	-
7-EP-2[2]	0.34	1.51	0.69	3.01	0.004	0.02	0.01	0.004	-	-	-	-	-	-	0.0001	0.0006	-	-
5.5-EP-1a	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
5.5-EP-1b[2]	0.05	0.23	0.11	0.47	0.002	0.01	0.002	0.01	-	-	-	-	-	-	0.00002	0.00009	-	-
3-T	-	-	-	-	31.50	137.97	-	-	-	-	-	-	-	-	0.00000	0.00000	-	-
4-T	-	-	-	-	5.96	26.09	-	-	-	-	-	-	-	-	0.001	0.006	-	-
5-T	-	-	-	-	0.33	1.45	-	-	-	-	-	-	-	-	0.0000	0.0000	-	-
3-LOAD	-	-	-	-	71.22	105.14	-	-	-	-	-	-	-	-	0.0000	0.0000	-	-
4-LOAD	-	-	-	-	66.70	4.49	-	-	-	-	-	-	-	-	0.010	0.001	-	-
5-LOAD	-	-	-	-	3.52	0.66	-	-	-	-	-	-	-	-	0.0000	0.0000	-	-

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
EP-10	No emissions from these units in an uncontrolled scenario.																	
EP-11																		
EP-12																		
EP-13																		
2-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
3-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
4-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
5-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
6-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
7-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
MSS/M	-	-	-	-	0.17	0.73	-	-	-	-	-	-	-	-	-	-	-	-
FUG-1	-	-	-	-	22.01	96.41	-	-	-	-	-	-	-	-	0.0003	0.0014	-	-
HAUL-1	-	-	-	-	-	-	-	-	2.46	1.60	*	*	*	*	-	-	-	-
Totals	**56.43**	**177.14**	**127.30**	**238.14**	**1,250.82**	**5,769.64**	**1,158.16**	**86.66**	**12.75**	**32.36**	**6.79**	**29.40**	**5.89**	**26.06**	**634.55**	**2,777.35**	**-**	**-**

[1]**Condensable Particulate Matter:** Include condensable particulate matter emissions for PM10 and PM2.5 if the source is a combustion source. Do not include condensable particulate matter for PM unless PM is set equal to PM10 and PM2.5. Particulate matter (PM) is not subject to an ambient air quality standard, but PM is a regulated air pollutant under PSD (20.2.74 NMAC) and Title V (20.2.70 NMAC).

[2]Represents pilot + purge/sweep gas emissions only

[3]Represents pilot + purge + assist gas emissions only

Table 2-E: Requested Allowable Emissions

Unit & stack numbering must be consistent throughout the application package. Fill all cells in this table with the emission numbers or a "-" symbol. A "-" symbol indicates that emissions of this pollutant are not expected. Numbers shall be expressed to at least 2 decimal points (e.g. 0.41, 1.41, or 1.41E-4).

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
1-EP-1	3.46	15.16	2.91	12.73	0.19	0.83	0.02	0.08	0.26	1.15	0.26	1.15	0.26	1.15	-	-	-	-
1-EP-2[2]	0.18	0.78	0.81	3.56	-	-	0.002	0.01	-	-	-	-	-	-	1.79E-05	7.82E-05	-	-
1-EP-3[4]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
1-EP-4[4]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
1.5-EP-1g	0.90	3.96	0.93	4.06	0.09	0.40	0.01	0.05	0.14	0.59	0.14	0.59	0.14	0.59	-	-	-	-
4-EP-1g	0.22	0.97	0.37	1.62	0.02	0.11	0.02	0.10	0.03	0.15	0.03	0.15	0.03	0.11	-	-	-	-
2-EP-1a	0.27	1.20	0.46	2.02	0.03	0.13	0.03	0.12	0.04	0.18	0.04	0.18	0.03	0.14	-	-	-	-
2-EP-1b	1.16	5.08	1.31	5.75	0.09	0.38	0.12	0.52	0.12	0.52	0.12	0.52	0.13	0.58	-	-	-	-
2-EP-1e	0.29	1.29	0.25	1.08	0.02	0.07	0.002	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	-	-
2-EP-2a[2]	0.18	0.78	0.81	3.56	-	-	0.002	0.01	-	-	-	-	-	-	1.79E-05	7.82E-05	-	-
2-EP-4[4]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
2-EP-1h	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
2a-EP-1d	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
2a-EP-3[4]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
2.5-EP-4[5]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
2.5-EP-1d	2.45	10.74	2.06	9.02	0.13	0.59	0.01	0.06	0.19	0.82	0.19	0.82	0.19	0.82	-	-	-	-
2.5-EP-5[2]	0.002	0.01	0.01	0.04	-	-	0.000	0.001	-	-	-	-	-	-	-	-	-	-
3-EP-1a	0.36	1.57	0.46	2.02	0.03	0.13	0.04	0.16	0.04	0.18	0.04	0.18	0.04	0.18	-	-	-	-
3-EP-1b	0.86	3.77	1.31	5.75	0.09	0.38	0.09	0.38	0.12	0.52	0.12	0.52	0.10	0.43	-	-	-	-
3-EP-1d	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
3-EP-1e	0.29	1.29	0.25	1.08	0.02	0.07	0.00	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	-	-
3-EP-1h	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
3-EP-2a[2]	0.18	0.78	0.81	3.56	-	-	0.00	0.01	-	-	-	-	-	-	1.79E-05	7.82E-05	-	-
3-EP-3[6]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
3-EP-4[6]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
4-EP-1a	0.36	1.57	0.46	2.02	0.03	0.13	0.04	0.16	0.04	0.18	0.04	0.18	0.04	0.18	-	-	-	-
4-EP-1b	0.86	3.77	1.31	5.75	0.09	0.38	0.09	0.38	0.12	0.52	0.12	0.52	0.10	0.43	-	-	-	-
4-EP-2a[2]	0.18	0.78	0.81	3.56	-	-	0.00	0.01	-	-	-	-	-	-	1.79E-05	7.82E-05	-	-
4-EP-3[7]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
4-EP-4[7]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
EP-5	5.50	24.09	3.50	15.33	5.92	25.92	13.22	57.91	0.21	0.91	0.21	0.91	0.21	0.91	0.14	0.62	-	-
EP-6	5.50	24.09	3.50	15.33	3.64	15.92	9.47	41.49	0.21	0.91	0.21	0.91	0.21	0.91	0.10	0.44	-	-
EP-7	0.59	2.58	0.49	2.16	0.80	3.50	-	-	0.04	0.20	0.04	0.20	0.04	0.20	-	-	-	-
EP-9	0.36	1.57	1.64	7.17	6.42	28.14	0.12	0.50	-	-	-	-	-	-	-	-	-	-
1-T[8]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-		
2-T[9]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
1-Load[8]	-	-	-	-	*	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
2-Load[9]	-	-	-	-	*	14.46	-	-	-	-	-	-	-	-	-	-	-	-
FUG	-	-	-	-	*	103.61	-	-	-	-	-	-	-	-	*	0.001	-	-
HAUL[4]	-	-	-	-	-	-	-	-	3.50	1.36	*	*	*	*	-	-	-	-
4-EP-1d	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
4-EP-1e	0.29	1.29	0.25	1.08	0.02	0.07	0.00	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	-	-
4-EP-1h	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	-	-
EP-8	5.50	24.09	3.50	15.33	3.56	15.57	9.96	43.61	0.21	0.91	0.21	0.91	0.21	0.91	0.11	0.46	-	-
5-EP-1a	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
5-EP-1b	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
5-EP-1c	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	-	-
5-EP-1d	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	-	-
5-EP-1e[10]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
5-EP-1f[10]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
5-EP-2[2]	0.34	1.51	0.69	3.01	0.004	0.02	0.01	0.00	-	-	-	-	-	-	1.30E-04	5.69E-04		
6-EP-1a	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
6-EP-1b	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
6-EP-1c	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	-	-
6-EP-1d	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	-	-
6-EP-1e[10]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
6-EP-1f[10]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-
7-EP-1c	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	-	-
7-EP-1d	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	-	-
7-EP-2[2]	0.34	1.51	0.69	3.01	0.004	0.02	0.01	0.00	-	-	-	-	-	-	1.30E-04	5.69E-04		
5.5-EP-1a	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	-	-
5.5-EP-1b[2]	0.05	0.23	0.11	0.47	0.002	0.01	0.002	0.01	-	-	-	-	-	-	0.00	0.00		
5.5-EP-1c[11]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
3-T[12]	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
4-T[13]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	-	-
5-T	-	-	-	-	*	1.45	-	-	-	-	-	-	-	-	0.0000	0.0000	-	-
3-LOAD	-	-	-	-	*	31.54	-	-	-	-	-	-	-	-	0.0000	0.0000	-	-
4-LOAD	-	-	-	-	*	1.35	-	-	-	-	-	-	-	-	0.01	0.001	-	-
5-LOAD	-	-	-	-	*	0.66	-	-	-	-	-	-	-	-	0.0000	0.0000	-	-
EP-10	16.40	69.97	9.98	42.49	3.66	15.68	0.74	30.24	9.40	40.33	9.40	40.33	7.05	30.25	0.08	0.32	-	-
EP-12	0.17	0.20	0.33	0.40	4.07	10.58	0.00	0.00	-	-	-	-	-	-	0.00004	0.00001	-	-
EP-13	0.15	1.12	0.90	3.94	3.62	0.89	0.08	0.03	-	-	-	-	-	-	0.002	0.0006	-	-
FUG-1	-	-	-	-	22.01	96.41	-	-	-	-	-	-	-	-	0.0003	0.0014		
HAUL-1[4]	-	-	-	-	-	-	-	-	2.46	1.60	*	*	*	*	-	-		
Totals	74.32	323.62	76.96	334.76	58.60	387.23	36.38	185.90	22.82	75.97	16.86	73.00	13.67	59.25	0.44	1.84	-	-

[1] **Condensable Particulate Matter:** Include condensable particulate matter emissions for PM10 and PM2.5 if the source is a combustion source. Do not include condensable particulate matter for PM unless PM is set equal to PM10 and PM2.5. Particulate matter (PM) is not subject to an ambient air quality standard, but it is a regulated air pollutant under PSD (20.2.74 NMAC) and Title V (20.2.70 NMAC).

[2] Represents pilot + purge/sweep gas emissions only

[3] Represents pilot + purge + assist gas emissions only

[4] Emissions controlled by unit EP-5

[5] Emissions controlled by AGI well 1 and Flare 2.5-EP-5

[6] Emissions controlled by unit EP-6

[7] Emissions controlled by unit EP-8

[8] Emissions controlled by unit EP-7

[9] Emissions controlled by unit EP-9

[10] Emissions controlled by unit EP-10

[11] Emissions controlled by AGI well 2 and Flare 5.5-EP-1b

[12] Emissions controlled by unit EP-12

[13] Emissions controlled by unit EP-13

[14] Haul Road emissions under 0.5 tpy are exempt under 20.2.72.202.B.5

Table 2-F: Additional Emissions during Startup, Shutdown, and Routine Maintenance (SSM)

☐ This table is intentionally left blank since all emissions at this facility due to routine or predictable startup, shutdown, or scehduled maintenance are no higher than those listed in Table 2-E and a malfunction emission limit is not already permitted or requested. If you are required to report GHG emissions as described in Section 6a, include any GHG emissions during Startup, Shutdown, and/or Scheduled Maintenance (SSM) in Table 2-P. Provide an explanations of SSM emissions in Section 6 and 6a.

All applications for facilities that have emissions during routine our predictable startup, shutdown or scheduled maintenance (SSM)[1], including NOI applications, must include in this table the Maximum Emissions during routine or predictable startup, shutdown and scheduled maintenance (20.2.7 NMAC, 20.2.72.203.A.3 NMAC, 20.2.73.200.D.2 NMAC). In Section 6 and 6a, provide emissions calculations for all SSM emissions reported in this table. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (https://www.env.nm.gov/aqb/permit/aqb_pol.html) for more detailed instructions. Numbers shall be expressed to at least 2 decimal points (e.g. 0.41, 1.41, or 1.41E-4).

Unit No.	NOx		CO		VOC		SOx		PM[2]		PM10[2]		PM2.5[2]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
1-EP-2	256.05	1.54	1167.30	7.00	859.82	5.16	6.21	0.04	-	-	-	-	-	-	0.067	0.001	-	-
2-EP-2a	682.81	4.10	3112.79	18.68	2292.86	13.76	16.57	0.10	-	-	-	-	-	-	0.180	0.001	-	-
3-EP-2a	682.81	4.10	3112.79	18.68	2292.86	13.76	16.57	0.10	-	-	-	-	-	-	0.180	0.001	-	-
4-EP-2a	682.81	4.10	3112.80	18.68	2292.86	13.76	16.57	0.11	-	-	-	-	-	-	0.180	0.001	-	-
2.5-EP-5	16.28	1.21	74.20	5.54	0.21	0.01	1155.40	74.50	-	-	-	-	-	-	12.300	0.790		
5-EP-2	1658.43	9.95	3310.85	19.87	2430.99	14.58	0.00	0.00	-	-	-	-	-	-	0.000	0.001	-	-
7-EP-2	1658.43	9.95	3310.85	19.87	2430.99	14.58	0.00	0.00	-	-	-	-	-	-	0.000	0.001	-	-
5.5-EP-1b	12.40	0.40	28.76	1.04	9.08	0.53	2684.66	162.10	-	-	-	-	-	-	28.580	1.720	-	-
EP-11	0.00	0.00	0.00	0.00	365.50	32.02	0.00	0.00	-	-	-	-	-	-	3.748	0.328	-	-
SSM/M	-	-	-	-	0.17	0.73	-	-	-	-	-	-	-	-	-	-	-	-
2-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
3-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
4-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
5-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
6-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
7-EP-1t	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.0819	0.0003	-	-
Totals	**5,650.02**	**35.35**	**17,230.34**	**109.36**	**12,988.06**	**108.94**	**3,895.98**	**236.95**	**-**	**-**	**-**	**-**	**-**	**-**	**45.73**	**2.85**	**-**	**-**

[1] **For instance**, if the short term steady-state Table 2-E emissions are 5 lb/hr and the SSM rate is 12 lb/hr, enter 7 lb/hr in this table. If the annual steady-state Table 2-E emissions are 21.9 TPY, and the number of scheduled SSM events result in annual emissions of 31.9 TPY, enter 10.0 TPY in the table below.

[2] **Condensable Particulate Matter:** Include condensable particulate matter emissions for PM10 and PM2.5 if the source is a combustion source. Do not include condensable particulate matter for PM unless PM is set equal to PM10 and PM2.5. Particulate matter (PM) is not subject to an ambient air quality standard, but it is a regulated air pollutant under PSD (20.2.74 NMAC) and Title V (20.2.70 NMAC).

Table 2-G: Stack Exit and Fugitive Emission Rates for Special Stacks

☑ I have elected to leave this table blank because this facility does not have any stacks/vents that split emissions from a single source or combine emissions from more than one source listed in table 2-A. Additionally, the emission rates of all stacks match the Requested allowable emission rates stated in Table 2-E.

Use this table to list stack emissions (requested allowable) from split and combined stacks. List Toxic Air Pollutants (TAPs) and Hazardous Air Pollutants (HAPs) in Table 2-I. List all fugitives that are associated with the normal, routine, and non-emergency operation of the facility. Unit and stack numbering must correspond throughout the application package. Refer to Table 2-E for instructions on use of the "-" symbol and on significant figures.

Stack No.	Serving Unit Number(s) from Table 2-A	NOx		CO		VOC		SOx		PM		PM10		PM2.5		☐ H_2S or ☐ Lead	
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
Totals:																	

Table 2-H: Stack Exit Conditions

Unit and stack numbering must correspond throughout the application package. Include the stack exit conditions for each unit that emits from a stack, including blowdown venting parameters and tank emissions. If the facility has multiple operating scenarios, complete a separate Table 2-H for each scenario and, for each, type scenario name here:

Stack Number	Serving Unit Number(s) from Table 2-A	Orientation (H-Horizontal V=Vertical)	Rain Caps (Yes or No)	Height Above Ground (ft)	Temp. (F)	Flow Rate		Moisture by Volume (%)	Velocity (ft/sec)	Inside Diameter (ft)
						(acfs)	(dscfs)			
1-EP-1	1-EP-1	V	N	50.00	624.00	247.87	N/A	N/A	18.18	4.17
1-EP-2	1-EP-2	V	N	75.00	1831.73	106283.64	N/A	N/A	65.62	45.41
1.5-EP-1g	1.5-EP-1g	V	N	37.00	624.00	126.41	N/A	N/A	29.64	2.33
4-EP-1g	4-EP-1g	V	N	13.25	120.00	18.54	N/A	N/A	5.90	2.00
2-EP-1a	2-EP-1a	V	N	15.88	624.00	39.22	N/A	N/A	22.19	1.50
2-EP-1b	2-EP-1b	V	N	22.44	110.00	84.71	N/A	N/A	7.34	3.83
2-EP-1e	2-EP-1e	V	N	22.75	624.00	21.01	N/A	N/A	6.69	2.00
2-EP-2a	2-EP-2a	V	N	75.00	1831.73	275310.95	N/A	N/A	65.62	72.09
2-EP-1h	2-EP-1h	V	N	24.79	424.99	71.97	N/A	N/A	7.48	3.50
2a-EP-1d	2a-EP-1d	V	N	24.79	424.99	71.97	N/A	N/A	7.48	3.50
2.5-EP-1d	2.5-EP-1d	V	N	22.88	624.00	140.44	N/A	N/A	25.14	2.67
2.5-EP-5	2.5-EP-5	V	N	149.00	1831.73	7334.90	N/A	N/A	65.62	11.93
3-EP-1a	3-EP-1a	V	N	22.00	550.00	32.56	N/A	N/A	23.33	1.33
3-EP-1b	3-EP-1b	V	N	25.83	429.00	82.91	N/A	N/A	19.39	2.33
3-EP-1d	3-EP-1d	V	N	14.99	424.99	71.97	N/A	N/A	40.72	1.50
3-EP-1e	3-EP-1e	V	N	20.01	624.00	21.00	N/A	N/A	54.56	0.70
3-EP-1h	3-EP-1h	V	N	14.99	424.99	71.97	N/A	N/A	40.72	1.50
3-EP-2a	3-EP-2a	V	N	75.00	1831.73	275310.95	N/A	N/A	65.62	73.09
4-EP-1a	4-EP-1a	V	N	22.00	377.00	39.22	N/A	N/A	28.09	1.33
4-EP-1b	4-EP-1b	V	N	25.83	429.00	111.65	N/A	N/A	26.11	2.33
4-EP-1d	4-EP-1d	V	N	32.67	425.00	94.00	N/A	N/A	7.48	4.00
4-EP-1e	4-EP-1e	V	N	22.75	624.00	21.00	N/A	N/A	6.68	2.00
4-EP-1h	4-EP-1h	V	N	32.67	424.99	94.00	N/A	N/A	7.48	4.00
4-EP-2a	4-EP-2a	V	N	75.00	1831.73	275310.95	N/A	N/A	65.62	73.09
EP-5	EP-5	V	N	76.00	1500.01	354.93	N/A	N/A	4.52	10.00

Stack Number	Serving Unit Number(s) from Table 2-A	Orientation (H-Horizontal V=Vertical)	Rain Caps (Yes or No)	Height Above Ground (ft)	Temp. (F)	Flow Rate (acfs)	Flow Rate (dscfs)	Moisture by Volume (%)	Velocity (ft/sec)	Inside Diameter (ft)
EP-6	EP-6	V	N	50.00	1500.01	354.93	N/A	N/A	9.22	7.00
EP-7	EP-7	V	N	36.00	1400.00	72.53	N/A	N/A	3.25	5.33
EP-8	EP-8	V	N	76.00	1500.01	354.93	N/A	N/A	5.41	9.14
EP-9	EP-9	V	N	20.00	1831.73	146.73	N/A	N/A	65.62	1.69
5-EP-1a	5-EP-1a	V	N	36.00	501.01	701.20	N/A	N/A	55.80	4.00
5-EP-1b	5-EP-1b	V	N	36.00	501.01	701.20	N/A	N/A	55.80	4.00
5-EP-1c	5-EP-1c	V	N	22.00	447.00	68.80	N/A	N/A	49.30	1.33
5-EP-1d	5-EP-1d	V	N	25.83	468.00	168.00	N/A	N/A	39.30	2.33
5-EP-2	5-EP-2	V	N	199.00	1831.73	352130.56	N/A	N/A	65.62	82.66
6-EP-1a	6-EP-1a	V	N	36.00	501.01	701.20	N/A	N/A	55.80	4.00
6-EP-1b	6-EP-1b	V	N	36.00	501.01	701.20	N/A	N/A	55.80	4.00
6-EP-1c	6-EP-1c	V	N	22.00	447.00	68.80	N/A	N/A	49.30	1.33
6-EP-1d	6-EP-1d	V	N	25.83	468.00	168.00	N/A	N/A	39.30	2.33
7-EP-1c	7-EP-1c	V	N	22.00	447.00	68.80	N/A	N/A	49.30	1.33
7-EP-1d	7-EP-1d	V	N	25.83	468.00	168.00	N/A	N/A	39.30	2.33
7-EP-2	7-EP-2	V	N	199.00	1831.73	352130.56	N/A	N/A	65.62	82.66
EP-12	EP-12	V	N	40.00	1400.00	2898.86	N/A	N/A	65.62	7.50
5.5-EP-1a	5.5-EP-1a	V	N	36.00	479.00	679.84	N/A	N/A	54.10	4.00
5.5-EP-1b	5.5-EP-1b	V	N	300.00	1831.73	56232.49	N/A	N/A	65.62	37.42
5-T-1	5-T-1	V	N	20.00	80.01	0.00	N/A	N/A	0.03	0.25
5-T-2	5-T-2	V	N	20.00	80.01	0.00	N/A	N/A	0.03	0.25
5-T-3	5-T-3	V	N	20.00	80.01	0.00	N/A	N/A	0.03	0.25
5-T-4	5-T-4	V	N	20.00	80.01	0.00	N/A	N/A	0.03	0.25
EP-10	EP-10	V	N	70.00	1800.00	341.99	N/A	N/A	385.71	1.06
EP-11	EP-11	V	N	60.00	1600.00	224.56	N/A	N/A	102.93	1.67
EP-13	EP-13	V	N	20.00	1831.73	0.12	N/A	N/A	65.62	0.05
4-T-1	4-T-2	V	N	40.00	110.89	0.00	N/A	N/A	0.03	0.25
4-T-2	LOAD-4	V	N	40.00	110.89	0.00	N/A	N/A	0.03	0.25

Stack Number	Serving Unit Number(s) from Table 2-A	Orientation (H-Horizontal V=Vertical)	Rain Caps (Yes or No)	Height Above Ground (ft)	Temp. (F)	Flow Rate		Moisture by Volume (%)	Velocity (ft/sec)	Inside Diameter (ft)
						(acfs)	(dscfs)			
LOAD-4	LOAD-4	V	N	10.00	110.89	0.21	N/A	N/A	4.37	0.25
LOAD-2	LOAD-2	V	N	10.00	110.89	0.21	N/A	N/A	4.37	0.25
7EP1TA	7EP1TA	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
6EP1TA	6EP1TA	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
4EP1TA	4EP1TA	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
5EP1TA	5EP1TA	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
3EP1TA	3EP1TA	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
2EP1TA	2EP1TA	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
7EP1TB	7EP1TB	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
6EP1TB	6EP1TB	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
4EP1TB	4EP1TB	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
5EP1TB	5EP1TB	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
3EP1TB	3EP1TB	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
2EP1TB	2EP1TB	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
7EP1TC	7EP1TC	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
6EP1TC	6EP1TC	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
4EP1TC	4EP1TC	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
5EP1TC	5EP1TC	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
3EP1TC	3EP1TC	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
2EP1TC	2EP1TC	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
7EP1TD	7EP1TD	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
6EP1TD	6EP1TD	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
4EP1TD	4EP1TD	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
5EP1TD	5EP1TD	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
3EP1TD	3EP1TD	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25
2EP1TD	2EP1TD	V	N	30.00	100.00	0.78	N/A	N/A	15.96	0.25

Table 2-I: Stack Exit and Fugitive Emission Rates for HAPs and TAPs

In the table below, report the Potential to Emit for each HAP from each regulated emission unit listed in Table 2-A, only if the entire facility emits the HAP at a rate greater than or equal to one (1) ton per year For each such emission unit, HAPs shall be reported to the nearest 0.1 tpy. Each facility-wide Individual HAP total and the facility-wide Total HAPs shall be the sum of all HAP sources calculated to the nearest 0.1 ton per year. Per 20.2.72.403.A.1 NMAC, facilities not exempt [see 20.2.72.402.C NMAC] from TAP permitting shall report each TAP that has an uncontrolled emission rate in excess of its pounds per hour screening level specified in 20.2.72.502 NMAC. TAPs shall be reported using one more significant figure than the number of significant figures shown in the pound per hour threshold corresponding to the substance. Use the HAP nomenclature as it appears in Section 112 (b) of the 1990 CAAA and the TAP nomenclature as it listed in 20.2.72.502 NMAC. Include tank-flashing emissions estimates of HAPs in this table. For each HAP or TAP listed, fill all cells in this table with the emission numbers or a "-" symbol. A "-" symbol indicates that emissions of this pollutant are not expected or the pollutant is emitted in a quantity less than the threshold amounts described above.

Stack No.	Unit No.(s)	Total HAPs		Benzene ☑ HAP or ☐ TAP		Toluene ☑ HAP or ☐ TAP		Ethylbenzene ☑ HAP or ☐ TAP		n-Hexane ☑ HAP or ☐ TAP		2,2,4-Trimethylpentane ☑ HAP or ☐ TAP		Styrene ☑ HAP or ☐ TAP		Xylene ☑ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP	
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
1-EP-1	1-EP-1	0.51	2.23	0.026	0.12	0.036	0.16	0.075	0.33	0.050	0.22	0.10	0.44	0.073	0.32	0.047	0.20		
1-EP-2	1-EP-2	46.23	0.28	3.09	0.02	1.60	0.01	0.16	0.0009	40.61	0.24	-	-	-	-	0.77	0.005		
1-EP-3	1-EP-3	Emissions from 1-EP-3 are controlled by the thermal oxidizer, unit EP-5. Controlled emissions are represented under unit EP-5.																	
1-EP-4	1-EP-4	Emissions from 1-EP-4 are controlled by the thermal oxidizer, unit EP-5. Controlled emissions are represented under unit EP-5.																	
1.5-EP-1g	1.5-EP-1g	0.26	1.14	0.0135	0.059	0.018	0.080	0.038	0.17	0.025	0.1109	0.051	0.22	0.037	0.16	0.024	0.104		
4-EP-1g	4-EP-1g	0.01	0.04	0.0000	0.000	0.000	0.000	-	-	0.009	0.0385	-	-	-	-	-	-		
2-EP-1a	2-EP-1a	0.08	0.35	0.0042	0.018	0.0057	0.025	0.012	0.052	0.0079	0.035	0.016	0.070	0.012	0.051	0.007397	0.032		
2-EP-1b	2-EP-1b	0.23	1.01	0.012	0.052	0.016	0.071	0.034	0.15	0.022	0.098	0.045	0.20	0.033	0.15	0.021	0.092		
2-EP-1e	2-EP-1e	0.043	0.19	0.0022	0.0098	0.0031	0.013	0.0063	0.028	0.0042	0.019	0.0085	0.037	0.0062	0.027	0.0040	0.017		
2-EP-2a	2-EP-2a	123.27	0.74	8.2	0.049	4.3	0.026	0.42	0.0025	108.3	0.65	-	-	-	-	2.1	0.012		
2-EP-4	2-EP-4	Emissions from 2-EP-4 are controlled by unit EP-5. Controlled emissions are represented under unit EP-5.																	
2-EP-1h	2-EP-1h	0.79	3.47	0.041	0.18	0.056	0.24	0.12	0.51	0.077	0.34	0.16	0.68	0.11	0.50	0.073	0.32		
2a-EP-1d	2a-EP-1d	0.79	3.47	0.041	0.18	0.056	0.24	0.12	0.51	0.077	0.34	0.16	0.68	0.11	0.50	0.073	0.32		
2a-EP-3	2a-EP-3	Emissions from 2a-EP-3 are controlled by unit EP-5. Controlled emissions are represented under unit EP-5.																	
2.5-E-4	2.5-EP-4	Emissions from unit 2.5-EP-4 are controlled by the Acid Gas Injection Well (AGI). During AGI compressor downtime the controlled emissions are represented under the Emergency AGI Flare, unit 2.5-EP-5.																	
2.5-EP-1d	2.5-EP-1d	0.29	1.26	0.015	0.066	0.020	0.089	0.042	0.19	0.028	0.12	0.057	0.25	0.042	0.18	0.026	0.12		
2.5-EP-5	2.5-EP-5	0.005	0.0003	-	-	-	-	-	-	0.0053	0.00034	-	-	-	-	-	-		
3-EP-1a	3-EP-1a	0.08	0.35	0.0042	0.018	0.0057	0.025	0.012	0.052	0.0079	0.035	0.016	0.070	0.012	0.051	0.007397	0.032		
3-EP-1b	3-EP-1b	0.23	1.01	0.012	0.052	0.016	0.071	0.034	0.15	0.022	0.098	0.045	0.20	0.033	0.15	0.021	0.092		
3-EP-1d	3-EP-1d	0.79	3.47	0.041	0.18	0.056	0.24	0.12	0.51	0.077	0.34	0.16	0.68	0.11	0.50	0.073	0.32		
3-EP-1e	3-EP-1e	0.04	0.19	0.0022	0.0098	0.0031	0.013	0.0063	0.028	0.0042	0.019	0.0085	0.037	0.0062	0.027	0.0040	0.017		
3-EP-1h	3-EP-1h	0.79	3.47	0.041	0.18	0.056	0.24	0.12	0.51	0.077	0.34	0.16	0.68	0.11	0.50	0.073	0.32		
3-EP-2a	3-EP-2a	123.27	0.74	8.2	0.049	4.3	0.026	0.42	0.0025	108.3	0.65	-	-	-	-	2.1	0.012		
3-EP-3	3-EP-3	Emissions from unit 3-EP-3 are routed to the thermal oxidizer unit EP-6. Controlled emissions are represented under unit EP-6.																	
3-EP-4	3-EP-4	Emissions from unit 3-EP-4 are routed to the thermal oxidizer unit EP-6. Controlled emissions are represented under unit EP-6.																	
4-EP-1a	4-EP-1a	0.08	0.35	0.0042	0.018	0.0057	0.025	0.012	0.052	0.0079	0.035	0.016	0.070	0.012	0.051	0.007397	0.032		
4-EP-1b	4-EP-1b	0.23	1.01	0.012	0.052	0.016	0.071	0.034	0.15	0.022	0.098	0.045	0.20	0.033	0.15	0.021	0.092		
4-EP-1d	4-EP-1d	0.79	3.47	0.041	0.18	0.056	0.24	0.12	0.51	0.077	0.34	0.16	0.68	0.11	0.50	0.073	0.32		
4-EP-1e	4-EP-1e	0.043	0.19	0.0022	0.0098	0.0031	0.013	0.0063	0.028	0.0042	0.019	0.0085	0.037	0.0062	0.027	0.0040	0.017		
4-EP-1h	4-EP-1h	0.79	3.47	0.041	0.18	0.056	0.24	0.12	0.51	0.077	0.34	0.16	0.68	0.11	0.50	0.073	0.32		

Stack No.	Unit No.(s)	Total HAPs		Benzene ☑ HAP or ☐ TAP		Toluene ☑ HAP or ☐ TAP		Ethylbenzene ☑ HAP or ☐ TAP		n-Hexane ☑ HAP or ☐ TAP		2,2,4-Trimethylpentane ☑ HAP or ☐ TAP		Styrene ☑ HAP or ☐ TAP		Xylene ☑ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP	
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
4-EP-2a	4-EP-2a	123.3	0.74	8.2	0.049	4.3	0.026	0.42	0.0025	108.3	0.65	-	-	-	-	2.1	0.012		
4-EP-3	4-EP-3	Emissions from unit 4-EP-3 are routed to the thermal oxidizer unit EP-8. Controlled emissions are represented under unit EP-8.																	
4-EP-4	4-EP-4	Emissions from unit 4-EP-4 are routed to the thermal oxidizer unit EP-8. Controlled emissions are represented under unit EP-8.																	
EP-5	EP-5	2.64	11.58	1.43	6.26	0.56	2.46	0.03	0.11	0.34	1.48	-	-	-	-	0.14	0.61		
EP-6	EP-6	1.82	7.95	1.04	4.55	0.41	1.79	0.02	0.08	0.24	1.06	-	-	-	-	0.11	0.48		
EP-7	EP-7	0.01	0.03	0.005	0.02	0.001	0.004	0.00003	0.0001	-	-	0.0011	0.0046	-	-	0.0001	0.0006		
EP-8	EP-8	1.77	7.74	1.01	4.43	0.39	1.73	0.02	0.08	0.24	1.05	-	-	-	-	0.10	0.46		
EP-9	EP-9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	0.00	0.00	-	-	0.00	0.00		
1-T	1-T	Emissions from units 1-T-1 to 1-T-6 are routed to the enclosed combustion device, unit EP-7. Controlled emissions are represented under unit EP-7.																	
2-T	2-T	Emissions from units 2-T are routed to the sour slop tank control flare unit EP-9. Controlled emissions are represented under unit EP-9.																	
1-Load	1-Load	Emissions from unit 1-Load are routed to the enclosed combustion device, unit EP-7. Controlled emissions are represented under unit EP-7.																	
FUG	FUG	-	7.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5-EP-1a	5-EP-1a	0.13	0.58	0.00	0.0007	0.0003	0.0011	-	-	0.13	0.58	-	-	-	-	-	-		
5-EP-1b	5-EP-1b	0.12	0.54	0.00	0.0006	0.0002	0.0010	-	-	0.12	0.54	-	-	-	-	-	-		
5-EP-1c	5-EP-1c	0.01	0.06	0.00	0.0001	0.0000	0.0001	-	-	0.01	0.06	-	-	-	-	-	-		
5-EP-1d	5-EP-1d	0.03	0.14	0.00	0.0002	0.0001	0.0003	-	-	0.03	0.14	-	-	-	-	-	-		
5-EP-1e	5-EP-1e	Emissions from unit 5-EP-1e are routed to the thermal oxidizer unit EP-10. Controlled emissions are represented under unit EP-10.																	
5-EP-1f	5-EP-1f	Emissions from unit 5-EP-1f are routed to the thermal oxidizer unit EP-10. Controlled emissions are represented under unit EP-10.																	
5-EP-2	5-EP-2	144.28	0.87	3.60	0.02	0.89	0.01	0.04	0.00	139.59	0.84	0.86	0.01	-	-	0.16	0.00		
6-EP-1a	6-EP-1a	0.12	0.54	0.0001	0.0006	0.0002	0.0010	-	-	0.12	0.54	-	-	-	-	-	-		
6-EP-1b	6-EP-1b	0.12	0.54	0.0001	0.0006	0.0002	0.0010	-	-	0.12	0.54	-	-	-	-	-	-		
6-EP-1c	6-EP-1c	0.01	0.06	0.0000	0.0001	0.0000	0.0001	-	-	0.01	0.06	-	-	-	-	-	-		
6-EP-1d	6-EP-1d	0.03	0.14	0.0000	0.0002	0.0001	0.0003	-	-	0.03	0.14	-	-	-	-	-	-		
6-EP-1e	6-EP-1e	Emissions from unit 6-EP-1e are routed to the thermal oxidizer unit EP-10. Controlled emissions are represented under unit EP-10.																	
6-EP-1f	6-EP-1f	Emissions from unit 6-EP-1f are routed to the thermal oxidizer unit EP-10. Controlled emissions are represented under unit EP-10.																	
7-EP-1c	7-EP-1c	0.01	0.06	0.00002	0.0001	0.0000	0.0001	-	-	0.01	0.06	-	-	-	-	-	-		
7-EP-1d	7-EP-1d	0.03	0.14	0.00004	0.0002	0.0001	0.0003	-	-	0.03	0.14	-	-	-	-	-	-		
7-EP-2	7-EP-2	144.28	0.87	3.60	0.02	0.89	0.01	0.04	0.0002	139.59	0.84	0.86	0.01	-	-	0.16	0.001		
5.5-EP-1a	5.5-EP-1a	0.12	0.54	0.0001	0.0006	0.0002	0.0010	-	-	0.12	0.54	-	-	-	-	-	-		
5.5-EP-1b	5.5-EP-1b	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-	-	0.0000	0.0000		
3-T	3-T	Emissions from tanks 3-T-1 to 3-T-6 are routed to the enclosed combustor unit EP-12. Controlled emissions are represented under unit EP-12.																	
4-T	4-T	Emissions from tanks 4-T-1 to 4-T-2 are routed to the flare unit EP-13. Controlled emissions are represented under unit EP-13.																	
5-T	5-T	0.03	0.14	0.03	0.14	-	-	-	-	-	-	-	-	-	-	-	-		
3-LOAD	3-LOAD	0.32	0.47	0.32	0.47	-	-	-	-	-	-	-	-	-	-	-	-		
4-LOAD	4-LOAD	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-		
5-LOAD	5-LOAD	0.26	0.05	0.26	0.05	-	-	-	-	-	-	-	-	-	-	-	-		
EP-10	EP-10	1.66	7.13	0.75	3.22	0.24	1.05	0.01	0.04	0.60	2.58	0.01	0.03	-	-	0.05	0.21		
EP-11	EP-11	165.47	14.41	75.07	6.54	24.40	2.12	0.99	0.09	60.17	5.24	0.00	0.00	-	-	4.83	0.42		
EP-12	EP-12	0.03	0.11	0.02	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-	-	0.00	0.01		

Stack No.	Unit No.(s)	Total HAPs		Benzene ☑ HAP or □ TAP		Toluene ☑ HAP or □ TAP		Ethylbenzene ☑ HAP or □ TAP		n-Hexane ☑ HAP or □ TAP		2,2,4-Trimethylpentane ☑ HAP or □ TAP		Styrene ☑ HAP or □ TAP		Xylene ☑ HAP or □ TAP		Provide Pollutant Name Here □ HAP or □ TAP	
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
EP-13	EP-13	0.02	0.002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.02	0.002	0.0000	0.0000			0.0000	0.0000		
2-EP-1t	2-EP-1t	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-	-	-		
3-EP-1t	3-EP-1t	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-	-	-		
4-EP-1t	4-EP-1t	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-	-	-		
5-EP-1t	5-EP-1t	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-	-	-		
6-EP-1t	6-EP-1t	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-	-	-		
7-EP-1t	7-EP-1t	0.0000	0.0000	0.0000	0.0000	-	-	-	-	-	-	-	-	-	-	-	-		
FUG-1	FUG-1	0.83	3.62	0.83	3.62	-	-	-	-	-	-	-	-	-	-	-	-		
Totals:		887.12	98.07	116.11	31.17	42.68	11.36	3.57	4.82	707.73	21.58	3.09	5.98	0.98	4.34	13.18	4.99		

Table 2-J: Fuel

Specify fuel characteristics and usage. Unit and stack numbering must correspond throughout the application package.

Unit No.	Fuel Type (low sulfur Diesel, ultra low sulfur diesel, Natural Gas, Coal, …)	Fuel Source: purchased commercial, pipeline quality natural gas, residue gas, raw/field natural gas, process gas (e.g. SRU tail gas) or other	Specify Units				
			Lower Heating Value	Hourly Usage	Annual Usage	% Sulfur	% Ash
1-EP-1	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	33,619 scf/hr	294.5 MMscf/yr	N/A	N/A
1-EP-2	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,500 scf/hr	21.9 MMscf/yr	N/A	N/A
1.5-EP-1g	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	11,428.6 scf/hr	100.1 MMscf/yr	N/A	N/A
4-EP-1g	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	11,428.6 scf/hr	100.1 MMscf/yr	N/A	N/A
2-EP-1a	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	5,333.3 scf/hr	46.7 MMscf/yr	N/A	N/A
2-EP-1b	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	15,190.5 scf/hr	133.1 MMscf/yr	N/A	N/A
2-EP-1e	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,381 scf/hr	20.9 MMscf/yr	N/A	N/A
2-EP-1h	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	52,381 scf/hr	458.9 MMscf/yr	N/A	N/A
2-EP-2a	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,500 scf/hr	21.9 MMscf/yr	N/A	N/A
2a-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	52,381 scf/hr	458.9 MMscf/yr	N/A	N/A
2.5-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	19,047.6 scf/hr	166.9 MMscf/yr	N/A	N/A
2.5-EP-5	Natural Gas	Pipeline Quality Natural Gas	925 btu/scf	222,852.4 scf/hr	1952.2 MMscf/yr	N/A	N/A
3-EP-1a	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	5,333.3 scf/hr	46.7 MMscf/yr	N/A	N/A
3-EP-1b	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	15,190.5 scf/hr	133.1 MMscf/yr	N/A	N/A
3-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	52,381 scf/hr	458.9 MMscf/yr	N/A	N/A
3-EP-1e	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,381 scf/hr	20.9 MMscf/yr	N/A	N/A
3-EP-1h	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	52,381 scf/hr	458.9 MMscf/yr	N/A	N/A
3-EP-2a	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,500 scf/hr	21.9 MMscf/yr	N/A	N/A
4-EP-1a	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	5,333.3 scf/hr	46.7 MMscf/yr	N/A	N/A

Unit No.	Fuel Type (low sulfur Diesel, ultra low sulfur diesel, Natural Gas, Coal, …)	Fuel Source: purchased commercial, pipeline quality natural gas, residue gas, raw/field natural gas, process gas (e.g. SRU tail gas) or other	Specify Units				
			Lower Heating Value	Hourly Usage	Annual Usage	% Sulfur	% Ash
4-EP-1b	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	15,190.5 scf/hr	133.1 MMscf/yr	N/A	N/A
4-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	52,381 scf/hr	458.9 MMscf/yr	N/A	N/A
4-EP-1e	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,381 scf/hr	20.9 MMscf/yr	N/A	N/A
4-EP-1h	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	52,381 scf/hr	458.9 MMscf/yr	N/A	N/A
4-EP-2a	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	2,500 scf/hr	21.9 MMscf/yr	N/A	N/A
EP-5	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	26,666.7 scf/hr	233.6 MMscf/yr	N/A	N/A
EP-6	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	26,666.7 scf/hr	233.6 MMscf/yr	N/A	N/A
EP-7	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	462.2 scf/hr	4.0 MMscf/yr	N/A	N/A
EP-8	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	26,666.7 scf/hr	233.6 MMscf/yr	N/A	N/A
EP-9	Natural Gas	Pipeline Quality Natural Gas	1050 btu/scf	12 scf/hr	0.105 MMscf/yr	N/A	N/A
5-EP-1a	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	68,627 scf/hr	601.2 MMscf/yr	N/A	N/A
5-EP-1b	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	68,627 scf/hr	601.2 MMscf/yr	N/A	N/A
6-EP-1a	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	68,627 scf/hr	601.2 MMscf/yr	N/A	N/A
6-EP-1b	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	68,627 scf/hr	601.2 MMscf/yr	N/A	N/A
5-EP-1c	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	7,147 scf/hr	62.6 MMscf/yr	N/A	N/A
5-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	17,206 scf/hr	150.7 MMscf/yr	N/A	N/A
6-EP-1c	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	7,147 scf/hr	62.6 MMscf/yr	N/A	N/A
6-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	17,206 scf/hr	150.7 MMscf/yr	N/A	N/A
7-EP-1c	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	7,147 scf/hr	62.6 MMscf/yr	N/A	N/A
7-EP-1d	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	17,206 scf/hr	150.7 MMscf/yr	N/A	N/A
5.5-EP-1a	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	68,627 scf/hr	601.2 MMscf/yr	N/A	N/A

Unit No.	Fuel Type (low sulfur Diesel, ultra low sulfur diesel, Natural Gas, Coal, …)	Fuel Source: purchased commercial, pipeline quality natural gas, residue gas, raw/field natural gas, process gas (e.g. SRU tail gas) or other	Specify Units				
			Lower Heating Value	Hourly Usage	Annual Usage	% Sulfur	% Ash
EP-10	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	109,804 scf/hr	961.9 MMscf/yr	N/A	N/A
5-EP-2	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	2445 scf/hr	21.4 MMscf/hr	N/A	N/A
7-EP-2	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	2445 scf/hr	21.4 MMscf/hr	N/A	N/A
5.5-EP-1b	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	380 scf/hr	3.3 MMscf/hr	N/A	N/A
EP-12	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	65 scf/hr	0.6 MMscf/hr	N/A	N/A
EP-13	Natural Gas	Pipeline Quality Natural Gas	1020 btu/scf	65 scf/hr	0.6 MMscf/hr	N/A	N/A

Table 2-K: Liquid Data for Tanks Listed in Table 2-L

For each tank, list the liquid(s) to be stored in each tank. If it is expected that a tank may store a variety of hydrocarbon liquids, enter "mixed hydrocarbons" in the Composition column for that tank and enter the corresponding data of the most volatile liquid to be stored in the tank. If tank is to be used for storage of different materials, list all the materials in the "All Calculations" attachment, run the newest version of TANKS on each, and use the material with the highest emission rate to determine maximum uncontrolled and requested allowable emissions rate. The permit will specify the most volatile category of liquids that may be stored in each tank. Include appropriate tank-flashing modeling input data. Use additional sheets if necessary. Unit and stack numbering must correspond throughout the application package.

Tank No.	SCC Code	Material Name	Composition	Liquid Density (lb/gal)	Vapor Molecular Weight (lb/lb*mol)	Average Storage Conditions		Max Storage Conditions	
						Temperature (°F)	True Vapor Pressure (psia)	Temperature (°F)	True Vapor Pressure (psia)
1-T-1	40400311	Condensate	Mixed Hydrocarbons	5.4	85.2	120.4	13.1	120.4	13.1
1-T-2	40400311	Condensate	Mixed Hydrocarbons	5.4	85.2	120.4	13.1	120.4	13.1
1-T-3	40400311	Condensate	Mixed Hydrocarbons	5.4	85.2	120.4	13.1	120.4	13.1
1-T-4	40400311	Condensate	Mixed Hydrocarbons	5.4	85.2	120.4	13.1	120.4	13.1
1-T-5	40400311	Condensate	Mixed Hydrocarbons	5.4	85.2	120.4	13.1	120.4	13.1
1-T-6	40400311	Condensate	Mixed Hydrocarbons	5.4	85.2	120.4	13.1	120.4	13.1
2-T-1	40400311	Condensate	Water	8.25	22.25	119.9	14.6	119.9	14.6
2-T-2	40400311	Condensate	Water	8.25	22.75	119.9	14.6	119.9	14.6
3-T-1	40400311	Condensate	Mixed Hydrocarbons	5.39087	75.03	111.21	9.06	111.21	9.06
3-T-2	40400311	Condensate	Mixed Hydrocarbons	5.39087	75.03	111.21	9.06	111.21	9.06
3-T-3	40400311	Condensate	Mixed Hydrocarbons	5.39087	75.03	111.21	9.06	111.21	9.06
3-T-4	40400311	Condensate	Mixed Hydrocarbons	5.39087	75.03	111.21	9.06	111.21	9.06
3-T-5	40400311	Condensate	Mixed Hydrocarbons	5.39087	75.03	111.21	9.06	111.21	9.06
3-T-6	40400311	Condensate	Mixed Hydrocarbons	5.39087	75.03	111.21	9.06	111.21	9.06
4-T-1	40400311	Sour Water	Water	8.3	40	110.89	16.49	110.89	16.49
4-T-2	40400311	Sour Water	Water	8.3	40	110.89	16.49	110.89	16.49
5-T-1	40400311	Slop	Hydrocarbon Contacted Wastewater	8.3	19.56	111.62	15.39	111.62	15.39
5-T-2	40400311	Slop	Hydrocarbon Contacted Wastewater	8.3	19.56	111.62	15.39	111.62	15.39
5-T-3	40400311	Slop	Hydrocarbon Contacted Wastewater	8.3	19.56	111.62	15.39	111.62	15.39
5-T-4	40400311	Slop	Hydrocarbon Contacted Wastewater	8.3	19.56	111.62	15.39	111.62	15.39

Table 2-L: Tank Data

Include appropriate tank-flashing modeling input data. Use an addendum to this table for unlisted data categories. Unit and stack numbering must correspond throughout the application package. Use additional sheets if necessary. See reference Table 2-L2. Note: 1.00 bbl = 10.159 M3 = 42.0 gal

Tank No.	Date Installed	Materials Stored	Seal Type (refer to Table 2-LR below)	Roof Type (refer to Table 2-LR below)	Capacity		Diameter (M)	Vapor Space (M)	Color (from Table VI-C)		Paint Condition (from Table VI-C)	Annual Throughput (gal/yr)	Turn-overs (per year)
					(bbl)	(M^3)			Roof	Shell			
1-T-1		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	5,110,000	243.3
1-T-2		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	5,110,000	243.3
1-T-3		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	5,110,000	243.3
1-T-4		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	5,110,000	243.3
1-T-5		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	5,110,000	243.3
1-T-6		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	5,110,000	243.3
2-T-1		Sour Water			500	79.5	4.72		OT - Tan	OT - Tan	Good	9,198,000	438.0
2-T-2		Sour Water			500	79.5	4.72		OT - Tan	OT - Tan	Good	9,198,000	438.0
3-T-1		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	8,217,300	364.0
3-T-2		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	8,217,300	364.0
3-T-3		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	8,217,300	364.0
3-T-4		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	8,217,300	364.0
3-T-5		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	8,217,300	364.0
3-T-6		Condensate			500	79.5	4.72		OT - Tan	OT - Tan	Good	8,217,300	364.0
4-T-1		Sour Water			500	79.5	4.72		OT - Tan	OT - Tan	Good	670,950	30.0
4-T-2		Sour Water			500	79.5	4.72		OT - Tan	OT - Tan	Good	670,950	30.0
5-T-1		Slop			400	39.4	3.66		OT - Tan	OT - Tan	Good	933,912	55.0
5-T-2		Slop			400	39.4	3.66		OT - Tan	OT - Tan	Good	933,912	55.0
5-T-3		Slop			400	39.4	3.66		OT - Tan	OT - Tan	Good	933,912	55.0
5-T-4		Slop			400	39.4	3.66		OT - Tan	OT - Tan	Good	933,912	55.0

Table 2-L2: Liquid Storage Tank Data Codes Reference Table

Roof Type	Seal Type, Welded Tank Seal Type		Seal Type, Riveted Tank Seal Type		Roof, Shell Color	Paint Condition
	Mechanical Shoe Seal	Liquid-mounted resilient seal	Vapor-mounted resilient seal	Seal Type		
FX: Fixed Roof					**WH**: White	Good
IF: Internal Floating Roof	**A**: Primary only	**A**: Primary only	**A**: Primary only	**A**: Mechanical shoe, primary only	**AS**: Aluminum (specular)	Poor
EF: External Floating Roof	**B**: Shoe-mounted secondary	**B**: Weather shield	**B**: Weather shield	**B**: Shoe-mounted secondary	**AD**: Aluminum (diffuse)	
P: Pressure	**C**: Rim-mounted secondary	**C**: Rim-mounted secondary	**C**: Rim-mounted secondary	**C**: Rim-mounted secondary	**LG**: Light Gray	
					MG: Medium Gray	
					BL: Black	
					OT: Other (specify)	

Note: 1.00 bbl = 0.159 M^3 = 42.0 gal

Table 2-M: Materials Processed and Produced (Use additional sheets as necessary.)

Material Processed				Material Produced			
Description	Chemical Composition	Phase (Gas, Liquid, or Solid)	Quantity (specify units)	Description	Chemical Composition	Phase	Quantity (specify units)
Natural Gas	Mixed Hydrocarbons	Gas	1210 MMSCFD	Natural Gas	Mixed Hydrocarbons	Gas	1210 MMSCFD
				Condensate	Condensate	Liquid	79,963,800 gal/yr
				Natural Gas Liquids	Natural Gas Liquids	Liquid	60,000 bpd

Table 2-N: CEM Equipment

Enter Continuous Emissions Measurement (CEM) Data in this table. If CEM data will be used as part of a federally enforceable permit condition, or used to satisfy the requirements of a state or federal regulation, include a copy of the CEM's manufacturer specification sheet in the Information Used to Determine Emissions attachment. Unit and stack numbering must correspond throughout the application package. Use additional sheets if necessary.

Stack No.	Pollutant(s)	Manufacturer	Model No.	Serial No.	Sample Frequency	Averaging Time	Range	Sensitivity	Accuracy
Not applicable. There is no CEM equipment used at this facility.									

Table 2-O: Parametric Emissions Measurement Equipment

Unit and stack numbering must correspond throughout the application package. Use additional sheets if necessary.

Unit No.	Parameter/Pollutant Measured	Location of Measurement	Unit of Measure	Acceptable Range	Frequency of Maintenance	Nature of Maintenance	Method of Recording	Averaging Time
Not applicable. There is no PEM equipment used at this facility.								

Table 2-P: Greenhouse Gas Emissions

Applications submitted under 20.2.70, 20.2.72, & 20.2.74 NMAC are required to complete this Table. Power plants, Title V major sources, and PSD major sources must report and calculate all GHG emissions for each unit. Applicants must report potential emission rates in short tons per year (see Section 6.a for assistance). Include GHG emissions during Startup, Shutdown, and Scheduled Maintenance in this table. For minor source facilities that are not power plants, are not Title V, or are not PSD, there are three options for reporting GHGs 1) report GHGs for each individual piece of equipment; 2) report all GHGs from a group of unit types, for example report all combustion source GHGs as a single unit and all venting GHG as a second separate unit; OR 3) check the following box ☐ By checking this box, the applicant acknowledges the total CO2e emissions are less than 75,000 tons per year.

		CO_2 ton/yr	N_2O ton/yr	CH_4 ton/yr	SF_6 ton/yr	PFC/HFC ton/yr[2]					Total GHG Mass Basis ton/yr[4]	Total CO_2e ton/yr[5]
Unit No.	GWPs [1]	1	298	25	22,800	footnote 3						
1-EP-1	mass GHG	18086.10	0.03	0.34							18,086.47	
	CO_2e	18086.10	10.16	8.52								18,104.78
1-EP-2	mass GHG	2770.60	0.00	10.88							2,781.49	
	CO_2e	2770.60	1.48	272.00								3,044.09
1.5-EP-1g	mass GHG	9222.40	0.02	0.17							9,222.59	
	CO2e	9222.40	5.18	4.35								9,231.92
4-EP-1g	mass GHG	9222.40	0.02	0.17							9,222.59	
	CO2e	9222.40	5.18	4.35								9,231.92
2-EP-1a	mass GHG	2869.20	0.01	0.05							2,869.26	
	CO2e	2869.20	1.61	1.35								2,872.16
2-EP-1b	mass GHG	8172.10	0.02	0.15							8,172.27	
	CO2e	8172.10	4.59	3.85								8,180.54
2-EP-1e	mass GHG	1537.10	0.00	0.03							1,537.13	
	CO2e	1537.10	0.86	0.72								1,538.69
2-EP-2a	mass GHG	7388.30	0.01	29.01							7,417.33	
	CO2e	7388.30	3.96	725.34								8,117.60
2-EP-1h	mass GHG	28179.50	0.05	0.53							28,180.08	
	CO2e	28179.50	15.83	13.28								28,208.60
2a-EP-1d	mass GHG	28179.50	0.05	0.53							28,180.08	
	CO2e	28179.50	15.83	13.28								28,208.60
2.5-EP-1d	mass GHG	10247.10	0.02	0.19							10,247.31	
	CO2e	10247.10	5.76	4.83								10,257.68
2.5-EP-5	mass GHG	19331.90	0.00	1.89							19,333.79	
	CO2e	19331.90	0.02	47.18								19,379.10
3-EP-1a	mass GHG	2869.20	0.01	0.05							2,869.26	
	CO2e	2869.20	1.61	1.35								2,872.16
3-EP-1b	mass GHG	8172.10	0.02	0.15							8,172.27	
	CO2e	8172.10	4.59	3.85								8,180.54

3-EP-1d	mass GHG	28179.50	0.05	0.53							28,180.08	
	CO2e	28179.50	15.83	13.28								28,208.60
3-EP-1e	mass GHG	1537.10	0.00	0.03							1,537.13	
	CO2e	1537.10	0.86	0.72								1,538.69
3-EP-1h	mass GHG	28179.50	0.05	0.53							28,180.08	
	CO2e	28179.50	15.83	13.28								28,208.60
3-EP-2a	mass GHG	7388.30	0.01	29.01							7,417.33	
	CO2e	7388.30	3.96	725.34								8,117.60
4-EP-1a	mass GHG	2869.20	0.01	0.05							2,869.26	
	CO2e	2869.20	1.61	1.35								2,872.16
4-EP-1b	mass GHG	8172.10	0.02	0.15							8,172.27	
	CO2e	8172.10	4.59	3.85								8,180.54
4-EP-1d	mass GHG	28179.50	0.05	0.53							28,180.08	
	CO2e	28179.50	15.83	13.28								28,208.60
4-EP-1e	mass GHG	1537.10	0.00	0.03							1,537.13	
	CO2e	1537.10	0.86	0.72								1,538.69
4-EP-1h	mass GHG	28179.50	0.05	0.53							28,180.08	
	CO2e	28179.50	15.83	13.28								28,208.60
4-EP-2a	mass GHG	7388.30	0.01	29.01							7,417.33	
	CO2e	7388.30	3.96	725.34								8,117.60
EP-5	mass GHG	14345.95	0.03	0.27							14,346.24	
	CO_2e	14345.95	8.06	6.76								14,360.76
EP-6	mass GHG	14345.95	0.03	0.27							14,346.24	
	CO_2e	14345.95	8.06	6.76								14,360.76
EP-7	mass GHG	796.69	0.00	0.02							796.70	
	CO_2e	796.69	0.45	0.38								797.51
EP-8	mass GHG	14345.95	0.03	0.27							14,346.24	
	CO_2e	14345.95	8.06	6.76								14,360.76
EP-9	mass GHG	2700.62	0.01	0.05							2,700.67	
	CO_2e	2700.62	1.52	1.27								2,703.40
FUG	mass GHG	7.63	0.00	33.95							41.58	
	CO2e	7.63	0.00	848.75								856.38
5-EP-1a	mass GHG	32727.80	0.06	0.62							32,728.48	
	CO2e	32727.80	18.48	15.50								32,761.78
5-EP-1b	mass GHG	32727.80	0.06	0.62							32,728.48	
	CO2e	32727.80	18.48	15.50								32,761.78

5-EP-1c	mass GHG	3408.40	0.01	0.06							3,408.47	
	CO2e	3408.40	1.79	1.50								3,411.69
5-EP-1d	mass GHG	8205.30	0.02	0.15							8,205.47	
	CO2e	8205.30	4.47	3.75								8,213.52
5-EP-1e	mass GHG	1839.60	0.00	23.77							1,863.37	
	CO2e	1839.60	0.89	594.25								2,434.74
5-EP-1f	mass GHG	5276.29	0.00	0.00							5,276.29	
	CO2e	5276.29	0.00	0.00								5,276.29
5-EP-2	mass GHG	7952.60	0.01	34.64							7,987.25	
	CO_2e	7952.60	4.17	866.00								8,822.77
6-EP-1a	mass GHG	32727.80	0.06	0.62							32,728.48	
	CO_2e	32727.80	18.48	15.50								32,761.78
6-EP-1b	mass GHG	32727.80	0.06	0.62							32,728.48	
	CO_2e	32727.80	18.48	15.50								32,761.78
6-EP-1c	mass GHG	3408.40	0.01	0.06							3,408.47	
	CO_2e	3408.40	1.79	1.50								3,411.69
6-EP-1d	mass GHG	8205.30	0.02	0.15							8,205.47	
	CO_2e	8205.30	4.47	3.75								8,213.52
6-EP-1e	mass GHG	1839.60	0.00	23.77							1,863.37	
	CO2e	1839.60	0.89	594.25								2,434.74
6-EP-1f	mass GHG	5276.29	0.00	0.00							5,276.29	
	CO2e	5276.29	0.00	0.00								5,276.29
7-EP-1c	mass GHG	3408.40	0.01	0.06							3,408.47	
	CO2e	3408.40	1.79	1.50								3,411.69
7-EP-1d	mass GHG	8205.30	0.02	0.15							8,205.47	
	CO2e	8205.30	4.47	3.75								8,213.52
7-EP-2	mass GHG	7952.60	0.01	34.64							7,987.25	
	CO2e	7952.60	4.17	866.00								8,822.77
5.5-EP-1a	mass GHG	32727.80	0.06	0.62							32,728.48	
	CO_2e	32727.80	18.48	15.50								32,761.78
5.5-EP-1b	mass GHG	911.70	0.00	1.21							912.91	
	CO_2e	911.70	0.00	30.25								941.95
EP-10	mass GHG	52058.20	0.10	0.98							52,059.28	
	CO_2e	52058.20	29.20	24.50								52,111.90
EP-11	mass GHG	9158.89	0.00	6.55							9,165.44	
	CO_2e	9158.89	0.00	163.73								9,322.62
EP-12	mass GHG	360.30	0.00	0.51							360.81	
	CO_2e	360.30	0.30	12.75								373.35
EP-13	mass GHG	932.30	0.00	2.92							935.22	
	CO2e	932.30	0.60	73.00								1,005.90

2-EP-1t	**mass GHG**	0.00	0.00	4.37							4.38	
	CO_2e	0.00	0.00	109.36								109.36
3-EP-1t	**mass GHG**	0.00	0.00	4.37							4.38	
	CO2e	0.00	0.00	109.36								109.36
4-EP-1t	**mass GHG**	0.00	0.00	4.37							4.38	
	CO2e	0.00	0.00	109.36								109.36
5-EP-1t	**mass GHG**	0.00	0.00	4.37							4.38	
	CO2e	0.00	0.00	109.36								109.36
6-EP-1t	**mass GHG**	0.00	0.00	4.37							4.38	
	CO2e	0.00	0.00	109.36								109.36
7-EP-1t	**mass GHG**	0.00	0.00	4.37							4.38	
	CO2e	0.00	0.00	109.36								109.36
FUG-1	**mass GHG**	4462.60	0.00	20848.80							25,311.40	
	CO_2e	4462.60	0.00	521220.00								525,682.60
	mass GHG											
	CO_2e											
	mass GHG											
	CO_2e											
Total	**mass GHG**										**662,049.74**	
	CO_2e											**1,169,914.27**

[1] **GWP** (Global Warming Potential): Applicants must use the most current GWPs codified in Table A-1 of 40 CFR part 98. GWPs are subject to change, therefore, applicants need to check 40 CFR 98 to confirm

[2] For **HFCs** or **PFCs** describe the specific HFC or PFC compound and use a separate column for each individual compound.

[3] For each new compound, enter the appropriate GWP for each HFC or PFC compound from Table A-1 in 40 CFR 98.

[4] Green house gas emissions on a **mass basis** is the ton per year green house gas emission before adjustment with its GWP.

[5] **CO_2e** means Carbon Dioxide Equivalent and is calculated by multiplying the TPY mass emissions of the green house gas by its GWP.

Section 3

Application Summary

The **Application** **Summary** shall include a brief description of the facility and its process, the type of permit application, the applicable regulation (i.e. 20.2.72.200.A.X, or 20.2.73 NMAC) under which the application is being submitted, and any air quality permit numbers associated with this site. If this facility is to be collocated with another facility, provide details of the other facility including permit number(s). In case of a revision or modification to a facility, provide the lowest level regulatory citation (i.e. 20.2.72.219.B.1.d NMAC) under which the revision or modification is being requested. Also describe the proposed changes from the original permit, how the proposed modification will affect the facility's operations and emissions, de-bottlenecking impacts, and changes to the facility's major/minor status (both PSD & Title V).

The **Process** **Summary** shall include a brief description of the facility and its processes.

Startup, Shutdown, and Maintenance (SSM) routine or predictable emissions: Provide an overview of how SSM emissions are accounted for in this application. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on SSM emissions.

Targa Northern Delaware, LLC owns and operates the Red Hills Gas Processing Plant (Red Hills) in Lea County, NM. The Red Hills Gas Processing Plant dehydrates and removes CO_2 and natural gas liquids from sweet field gas for transportation via a sales pipeline. With this application, Targa Northern Delaware, LLC is seeking to renew the Red Hills Gas Processing Plant Title V Permit, number P278-M1.

Pursuant 20.2.70.300.B(2) NMAC: It is a timely application that is being submitted at least twelve (12) months prior to the date of permit expiration and is complete pursuant 20.2.70.300.C(1) NMAC.

Pursuant to Condition B101.B under Title V Permit #278-M1 and 20.2.70.302.J(4) NMAC, the permit shield shall remain in effect if the permit terms and conditions are extended past the expiration date of the permit pursuant to Subsection D of 20.2.70.400 NMAC. The permit shield shall extend to terms and conditions that allow emission increases and decreases as part of emissions trading within a facility pursuant to Paragraph (2) of Subsection H of 20.2.70.302 NMAC, and to all terms and conditions under each operating scenario included pursuant to Paragraph (3) of Subsection A of 20.2.70.302 NMAC. Since Targa Northern Delaware, LLC submitted a timely application for Title V Renewal on June 23, 2023, Targa Northern Delaware, LLC is expressly requesting that the NMED grant a permit shield.

Pursuant to 20.2.70.302.J(1), the department shall expressly include in a Part 70 permit a provision stating that compliance with the conditions of the permit shall be deemed compliance with any applicable requirements as of the date of permit issuance, provided that:

a) such applicable requirements are included and are specifically identified in the permit; or
b) the department, in acting on the permit application or significant permit modification, determines in writing that other requirements specifically identified are not applicable to the source, and the permit includes the determination or a concise summary thereof.

Process Description

The facility processes gas from several trains (Train 1 through Train 7, including Train 1.5 and Train 2.5). The inlet gas will be treated to remove acid gases, dehydrated to remove water, and processed to remove C2+ hydrocarbons from the gas stream.

A slug catcher, acting as a three-phase separator, will separate any free hydrocarbon liquids and water present in the inlet pipeline gas stream (Train 1). Additional separator and slug catcher series will separate hydrocarbons and water from Train 2 and Train 3, 4, 5, & 6.

Heavier hydrocarbons will be removed initially by the propane refrigeration system. The overhead stabilization system increases the plant efficiency of Natural Gas Liquid (NGL) production through chilling and compressing the gas from inlet. Separated condensate will be combined with slug catcher condensate and trucked out or sent to pipeline sales.

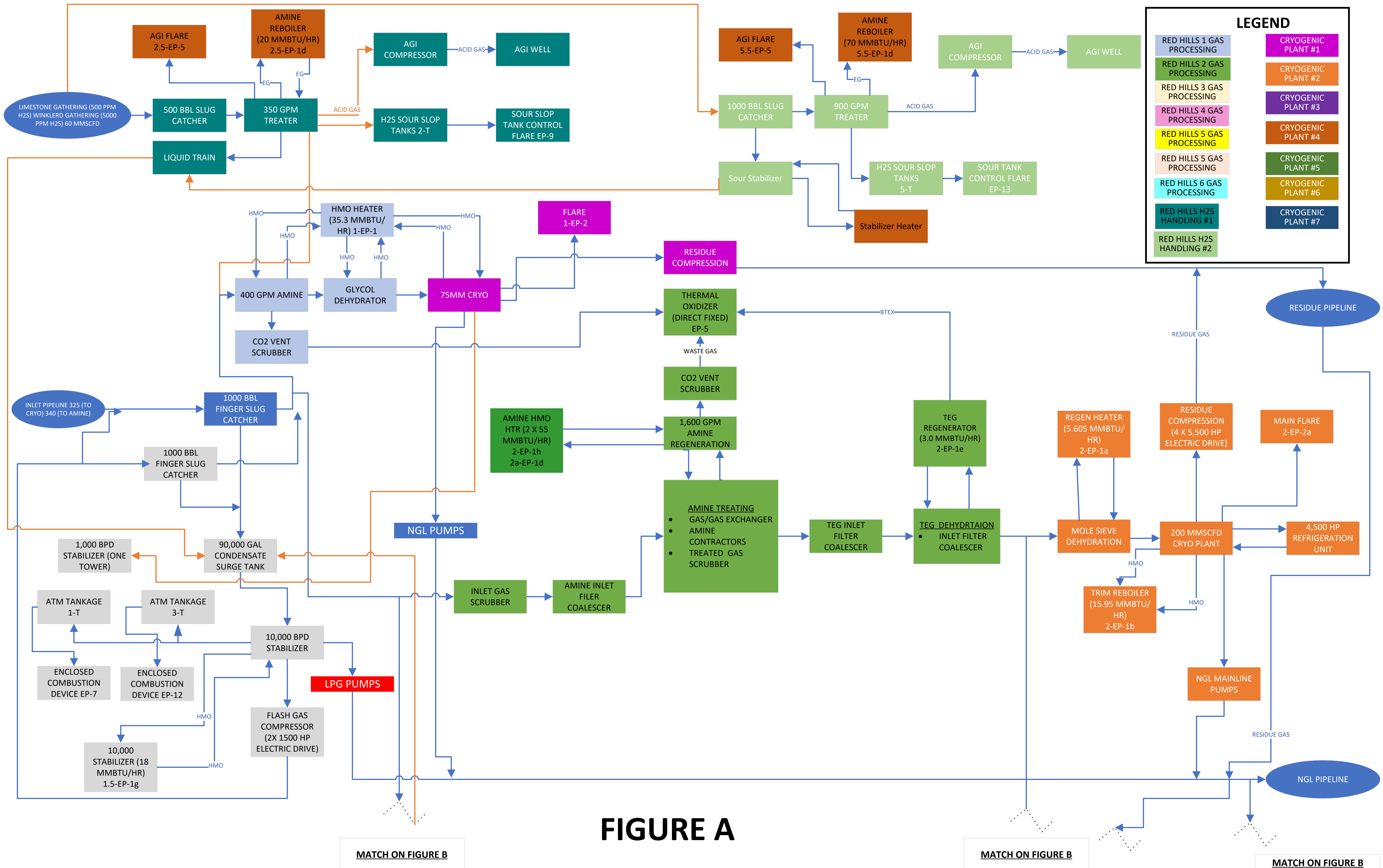
Inlet stream is further treated to remove acid gas and water by amine treating and dehydrator respectively. Treated gas is routed to a cryogenic unit to initiate secondary removal of hydrocarbon liquid that will be stored in up to five pressurized tanks before sending it to the pipeline sales. Plant startup, shutdown, maintenance, and upset conditions are controlled by flares.

Section 4

Process Flow Sheet

A **process flow sheet** and/or block diagram indicating the individual equipment, all emission points and types of control applied to those points. The unit numbering system should be consistent throughout this application.

A process flow diagram is attached to this application.



LEGEND
RED HILLS 1 GAS PROCESSING
RED HILLS 2 GAS PROCESSING
RED HILLS 3 GAS PROCESSING
RED HILLS 4 GAS PROCESSING
RED HILLS 5 GAS PROCESSING
RED HILLS 5 GAS PROCESSING
RED HILLS 6 GAS PROCESSING
RED HILLS H2S HANDLING #1
RED HILLS H2S HANDLING #2
CRYOGENIC PLANT #1
CRYOGENIC PLANT #2
CRYOGENIC PLANT #3
CRYOGENIC PLANT #4
CRYOGENIC PLANT #5
CRYOGENIC PLANT #6
CRYOGENIC PLANT #7
LIMESTONE GATHERING (500 PPM H2S) WINKLERD GATHERING (5000 PPM H2S) 60 MMSCFD
500 BBL SLUG CATCHER
350 GPM TREATER
AGI FLARE 2.5-EP-5
AMINE REBOILER (20 MMBTU/HR) 2.5-EP-1d
EG
EG
ACID GAS
AGI COMPRESSOR
ACID GAS
AGI WELL
H2S SOUR SLOP TANKS 2-T
SOUR SLOP TANK CONTROL FLARE EP-9
LIQUID TRAIN
1000 BBL SLUG CATCHER
900 GPM TREATER
AGI FLARE 5.5-EP-5
AMINE REBOILER (70 MMBTU/HR) 5.5-EP-1d
EG
ACID GAS
AGI COMPRESSOR
ACID GAS
AGI WELL
Sour Stabilizer
H2S SOUR SLOP TANKS 5-T
SOUR TANK CONTROL FLARE EP-13
Stabilizer Heater
HMO HEATER (35.3 MMBTU/HR) 1-EP-1
HMO
HMO
HMO
HMO
HMO
HMO
400 GPM AMINE
GLYCOL DEHYDRATOR
75MM CRYO
FLARE 1-EP-2
RESIDUE COMPRESSION
RESIDUE PIPELINE
CO2 VENT SCRUBBER
THERMAL OXIDIZER (DIRECT FIXED) EP-5
BTEX
WASTE GAS
CO2 VENT SCRUBBER
1,600 GPM AMINE REGENERATION
AMINE HMO HTR (2 X 55 MMBTU/HR) 2-EP-1h 2a-EP-1d
INLET PIPELINE 325 (TO CRYO) 340 (TO AMINE)
1000 BBL FINGER SLUG CATCHER
1000 BBL FINGER SLUG CATCHER
NGL PUMPS
1,000 BPD STABILIZER (ONE TOWER)
90,000 GAL CONDENSATE SURGE TANK
ATM TANKAGE 1-T
ATM TANKAGE 3-T
10,000 BPD STABILIZER
ENCLOSED COMBUSTION DEVICE EP-7
ENCLOSED COMBUSTION DEVICE EP-12
LPG PUMPS
HMO
HMO
10,000 STABILIZER (18 MMBTU/HR) 1.5-EP-1g
FLASH GAS COMPRESSOR (2X 1500 HP ELECTRIC DRIVE)
INLET GAS SCRUBBER
AMINE INLET FILER COALESCER
AMINE TREATING
GAS/GAS EXCHANGER
AMINE CONTRACTORS
TREATED GAS SCRUBBER
TEG INLET FILTER COALESCER
TEG REGENERATOR (3.0 MMBTU/HR) 2-EP-1e
TEG DEHYDRTAION
INLET FILTER COALESCER
REGEN HEATER (5.605 MMBTU/HR) 2-EP-1a
RESIDUE GAS
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
MAIN FLARE 2-EP-2a
MOLE SIEVE DEHYDRATION
200 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
HMO
TRIM REBOILER (15.95 MMBTU/HR) 2-EP-1b
HMO
NGL MAINLINE PUMPS
RESIDUE GAS
NGL PIPELINE
MATCH ON FIGURE B
MATCH ON FIGURE B
MATCH ON FIGURE B

FIGURE A

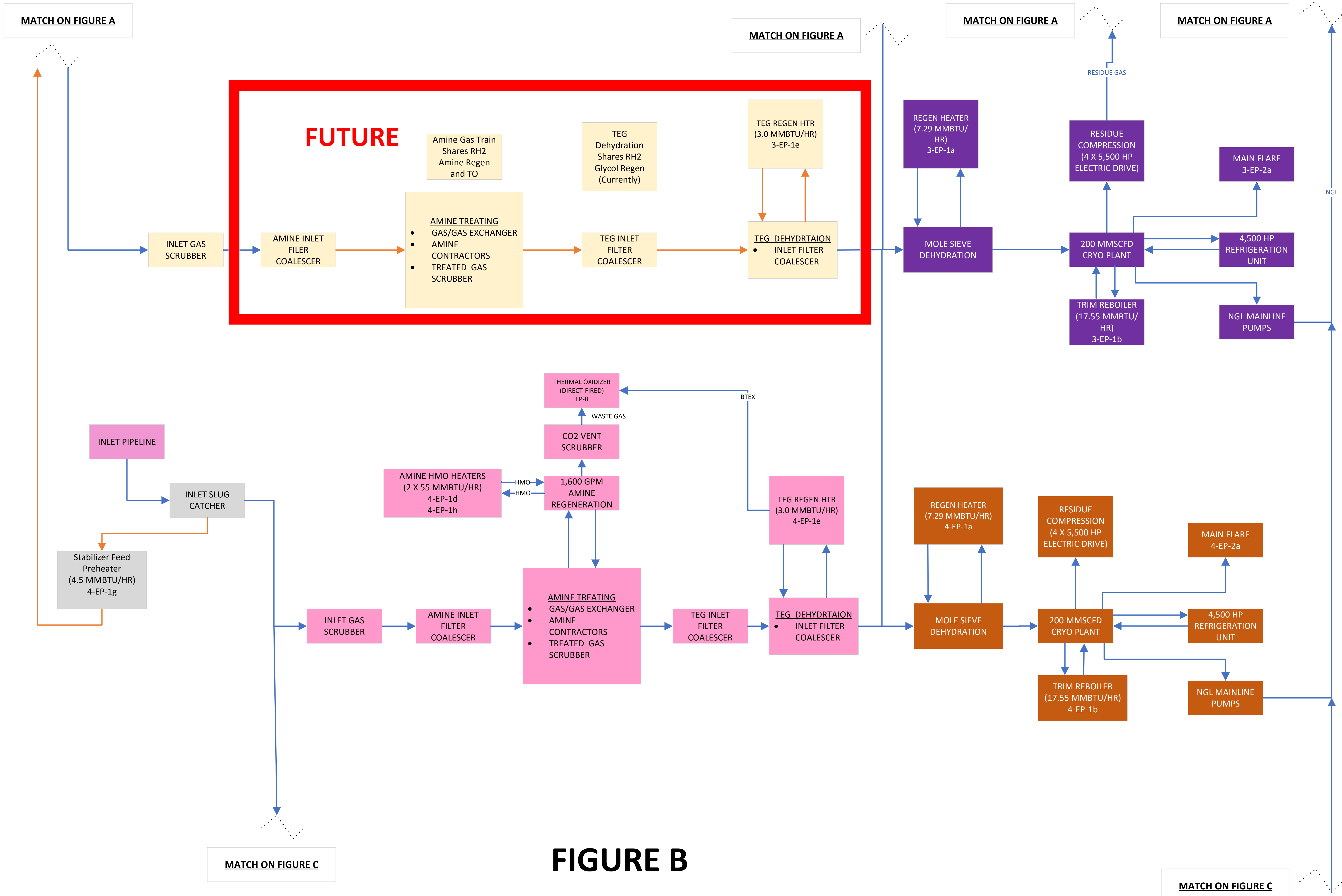

MATCH ON FIGURE A
MATCH ON FIGURE A
MATCH ON FIGURE A
MATCH ON FIGURE A
FUTURE
Amine Gas Train Shares RH2 Amine Regen and TO
TEG Dehydration Shares RH2 Glycol Regen (Currently)
TEG REGEN HTR (3.0 MMBTU/HR) 3-EP-1e
INLET GAS SCRUBBER
AMINE INLET FILER COALESCER
AMINE TREATING
GAS/GAS EXCHANGER
AMINE CONTRACTORS
TREATED GAS SCRUBBER
TEG INLET FILTER COALESCER
TEG DEHYDRTAION
INLET FILTER COALESCER
REGEN HEATER (7.29 MMBTU/ HR) 3-EP-1a
MOLE SIEVE DEHYDRATION
RESIDUE GAS
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
200 MMSCFD CRYO PLANT
TRIM REBOILER (17.55 MMBTU/ HR) 3-EP-1b
MAIN FLARE 3-EP-2a
4,500 HP REFRIGERATION UNIT
NGL MAINLINE PUMPS
NGL
THERMAL OXIDIZER (DIRECT-FIRED) EP-8
BTEX
WASTE GAS
CO2 VENT SCRUBBER
INLET PIPELINE
INLET SLUG CATCHER
AMINE HMO HEATERS (2 X 55 MMBTU/HR) 4-EP-1d 4-EP-1h
HMO
HMO
1,600 GPM AMINE REGENERATION
TEG REGEN HTR (3.0 MMBTU/HR) 4-EP-1e
Stabilizer Feed Preheater (4.5 MMBTU/HR) 4-EP-1g
INLET GAS SCRUBBER
AMINE INLET FILTER COALESCER
AMINE TREATING
GAS/GAS EXCHANGER
AMINE CONTRACTORS
TREATED GAS SCRUBBER
TEG INLET FILTER COALESCER
TEG DEHYDRTAION
INLET FILTER COALESCER
REGEN HEATER (7.29 MMBTU/HR) 4-EP-1a
MOLE SIEVE DEHYDRATION
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
200 MMSCFD CRYO PLANT
TRIM REBOILER (17.55 MMBTU/HR) 4-EP-1b
MAIN FLARE 4-EP-2a
4,500 HP REFRIGERATION UNIT
NGL MAINLINE PUMPS
MATCH ON FIGURE C
MATCH ON FIGURE C

FIGURE B

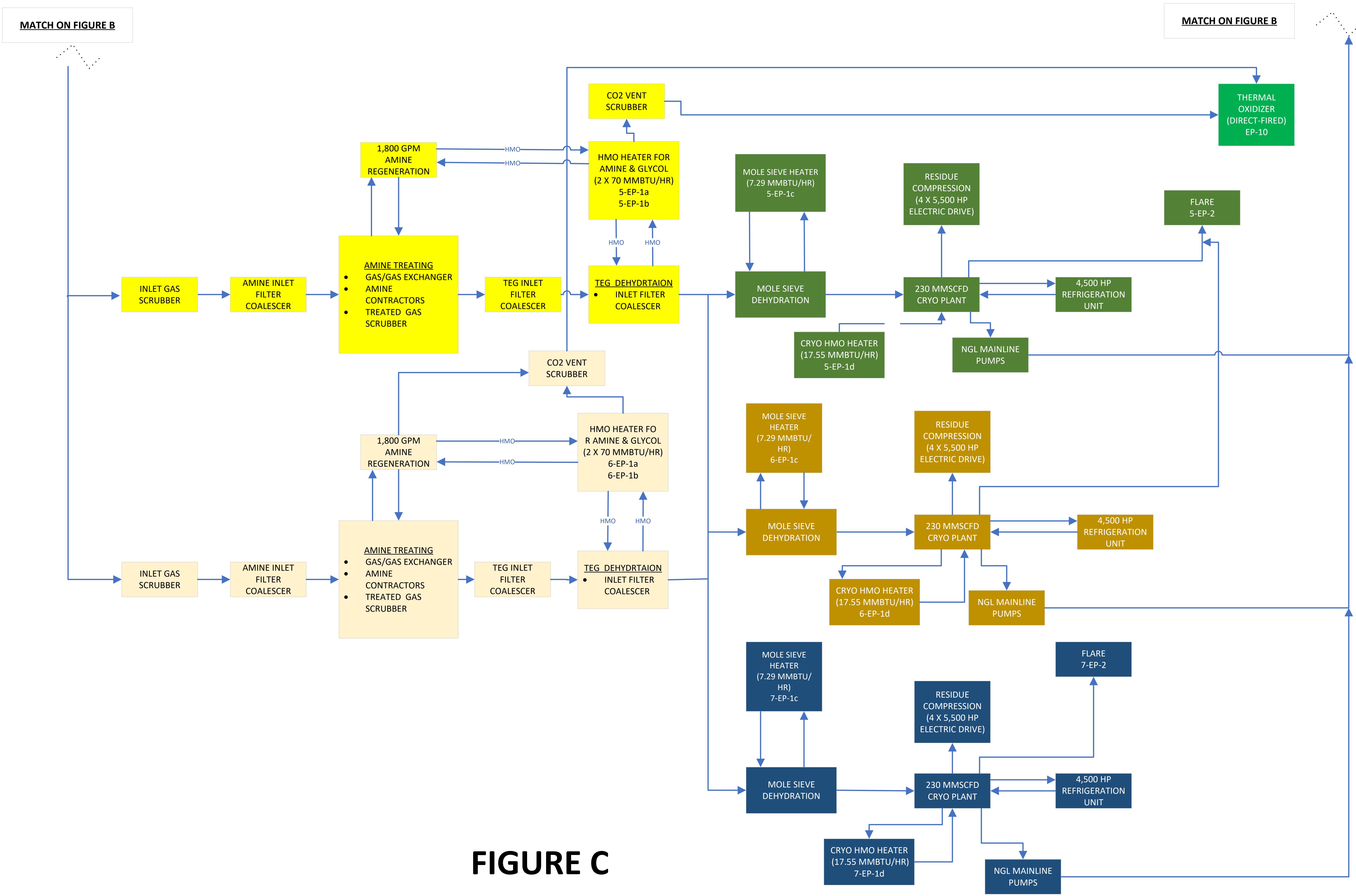

MATCH ON FIGURE B
MATCH ON FIGURE B
CO2 VENT SCRUBBER
THERMAL OXIDIZER (DIRECT-FIRED) EP-10
1,800 GPM AMINE REGENERATION
HMO
HMO
HMO HEATER FOR AMINE & GLYCOL (2 X 70 MMBTU/HR) 5-EP-1a 5-EP-1b
MOLE SIEVE HEATER (7.29 MMBTU/HR) 5-EP-1c
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
FLARE 5-EP-2
INLET GAS SCRUBBER
AMINE INLET FILTER COALESCER
AMINE TREATING
GAS/GAS EXCHANGER
AMINE CONTRACTORS
TREATED GAS SCRUBBER
TEG INLET FILTER COALESCER
TEG DEHYDRTAION
INLET FILTER COALESCER
MOLE SIEVE DEHYDRATION
230 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
CRYO HMO HEATER (17.55 MMBTU/HR) 5-EP-1d
NGL MAINLINE PUMPS
CO2 VENT SCRUBBER
1,800 GPM AMINE REGENERATION
HMO HEATER FO R AMINE & GLYCOL (2 X 70 MMBTU/HR) 6-EP-1a 6-EP-1b
MOLE SIEVE HEATER (7.29 MMBTU/ HR) 6-EP-1c
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
INLET GAS SCRUBBER
AMINE INLET FILTER COALESCER
AMINE TREATING
GAS/GAS EXCHANGER
AMINE CONTRACTORS
TREATED GAS SCRUBBER
TEG INLET FILTER COALESCER
TEG DEHYDRTAION
INLET FILTER COALESCER
MOLE SIEVE DEHYDRATION
230 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
CRYO HMO HEATER (17.55 MMBTU/HR) 6-EP-1d
NGL MAINLINE PUMPS
MOLE SIEVE HEATER (7.29 MMBTU/ HR) 7-EP-1c
FLARE 7-EP-2
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
MOLE SIEVE DEHYDRATION
230 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
CRYO HMO HEATER (17.55 MMBTU/HR) 7-EP-1d
NGL MAINLINE PUMPS

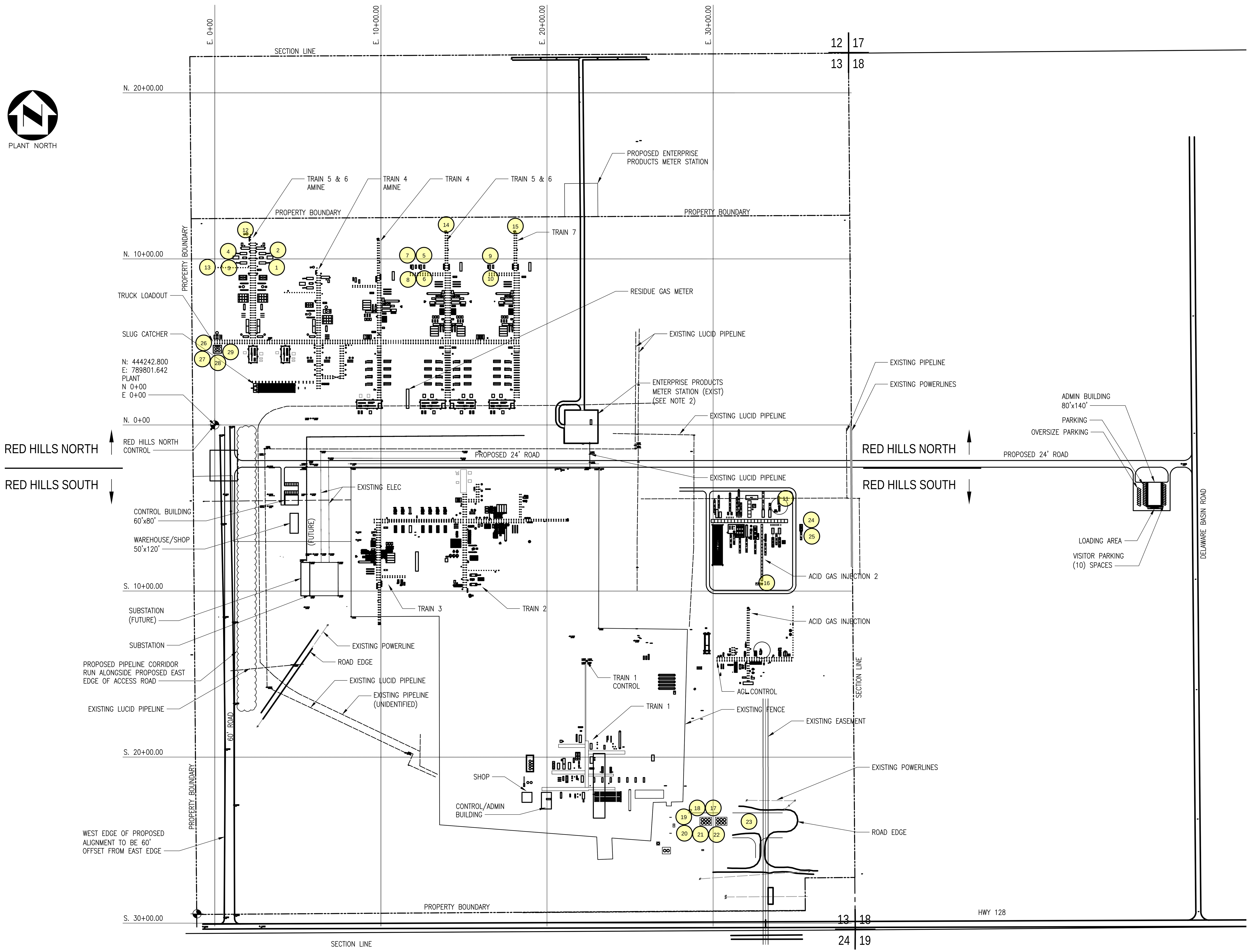
FIGURE C

Section 5

Plot Plan Drawn To Scale

A **plot plan drawn to scale** showing emissions points, roads, structures, tanks, and fences of property owned, leased, or under direct control of the applicant. This plot plan must clearly designate the restricted area as defined in UA1, Section 1-D.12. The unit numbering system should be consistent throughout this application.

A plot plan of the facility is attached to this application.



LEGEND

- ROAD EDGE
- FENCE
- -E—E—E- ELEC EXISTTRICAL LINES
- -P—P—P- PIPELINE
- SECTION LINE
- PROPERTY BOUNDARY
- SECTION CORNER

NOTES

1. NOT USE.
2. ENTERPRISE PRODUCTS METER STATION EXISTS CURRENTLY ON SOUTH BORDER OF RED HILLS NORTH. THIS STATION WILL BE RELOCATED TO THE NORTH BORDER.
3. EQUIPMENT LOCATED ACCORDING TO THE FOLLOWING:
   TRAIN 1 – CENTER OF FLARE
   N 442820.80
   E 792041.20
   TRAIN 2 –
   N XXX
   E XXX
   TRAIN 3 –
   N XXX
   E XXX
   TRAIN 4 –
   N XXX
   E XXX
   ACID GAS INJECTION (AGI)
   N XXX
   E XXX
   COORDINATES DEVELOPED BY PROSPECT SURVEY

GRAPHIC SCALE
150 0 150 300
(IN FEET)
1 inch = 300 ft.

PRELIMINARY
NOT FOR CONSTRUCTION

REV	DATE	BY	APP'D	DESCRIPTION
C	05/09/19			ISSUED FOR CLIENT REVIEW
B	05/08/19			ISSUED FOR CLIENT REVIEW
A	04/22/19			ISSUED FOR INTERNAL REVIEW
				PRELIMINARY ISSUE

LUCID energy group

SCALE	AS SHOWN	MO DAY YR
DRAWN	STS	04/18/19
CHK'D		
APP'D		
APP'D		
APPROVED		
DATE		
PROJECT	61526.00	

Harris Group

CIVIL
SITE PLAN

RED HILLS PLANT
JAL, NEW MEXICO

DRAWING NUMBER C550001
REV C

P:\0061526.00\st\Drawings\C550001.dwg 5/9/2019 ssamson

Section 6

All Calculations

Show all calculations used to determine both the hourly and annual controlled and uncontrolled emission rates. All calculations shall be performed keeping a minimum of three significant figures. Document the source of each emission factor used (if an emission rate is carried forward and not revised, then a statement to that effect is required). If identical units are being permitted and will be subject to the same operating conditions, submit calculations for only one unit and a note specifying what other units to which the calculations apply. All formulas and calculations used to calculate emissions must be submitted. The "Calculations" tab in the UA2 has been provided to allow calculations to be linked to the emissions tables. Add additional "Calc" tabs as needed. If the UA2 or other spread sheets are used, all calculation spread sheet(s) shall be submitted electronically in Microsoft Excel compatible format so that formulas and input values can be checked. Format all spread sheets and calculations such that the reviewer can follow the logic and verify the input values. Define all variables. If calculation spread sheets are not used, provide the original formulas with defined variables. Additionally, provide subsequent formulas showing the input values for each variable in the formula. All calculations, including those calculations are imbedded in the Calc tab of the UA2 portion of the application, the printed Calc tab(s), should be submitted under this section.

Tank Flashing Calculations: The information provided to the AQB shall include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., NOI, permit, or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis. If Hysis is used, all relevant input parameters shall be reported, including separator pressure, gas throughput, and all other relevant parameters necessary for flashing calculation.

SSM Calculations: It is the applicant's responsibility to provide an estimate of SSM emissions or to provide justification for not doing so. In this Section, provide emissions calculations for Startup, Shutdown, and Routine Maintenance (SSM) emissions listed in the Section 2 SSM and/or Section 22 GHG Tables and the rational for why the others are reported as zero (or left blank in the SSM/GHG Tables). Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on calculating SSM emissions. If SSM emissions are greater than those reported in the Section 2, Requested Allowables Table, modeling may be required to ensure compliance with the standards whether the application is NSR or Title V. Refer to the Modeling Section of this application for more guidance on modeling requirements.

Glycol Dehydrator Calculations: The information provided to the AQB shall include the manufacturer's maximum design recirculation rate for the glycol pump. If GRI-Glycalc is used, the full input summary report shall be included as well as a copy of the gas analysis that was used.

Road Calculations: Calculate fugitive particulate emissions and enter haul road fugitives in Tables 2-A, 2-D and 2-E for:

1. If you transport raw material, process material and/or product into or out of or within the facility and have PER emissions greater than 0.5 tpy.
2. If you transport raw material, process material and/or product into or out of the facility more frequently than one round trip per day.

Significant Figures:
A. All emissions standards are deemed to have at least two significant figures, but not more than three significant figures.
B. At least 5 significant figures shall be retained in all intermediate calculations.
C. In calculating emissions to determine compliance with an emission standard, the following rounding off procedures shall be used:

- **(1)** If the first digit to be discarded is less than the number 5, the last digit retained shall not be changed;
- **(2)** If the first digit discarded is greater than the number 5, or if it is the number 5 followed by at least one digit other than the number zero, the last figure retained shall be increased by one unit; **and**
- **(3)** If the first digit discarded is exactly the number 5, followed only by zeros, the last digit retained shall be rounded upward if it is an odd number, but no adjustment shall be made if it is an even number.
- **(4)** The final result of the calculation shall be expressed in the units of the standard.

Control Devices: In accordance with 20.2.72.203.A(3) and (8) NMAC, 20.2.70.300.D(5)(b) and (e) NMAC, and 20.2.73.200.B(7) NMAC, the permittee shall report all control devices and list each pollutant controlled by the control device regardless if the applicant takes credit for the reduction in emissions. The applicant can indicate in this section of the application if they chose to not take credit for the reduction in emission rates. For notices of intent submitted under 20.2.73 NMAC, only uncontrolled emission rates can be considered to determine applicability unless the state or federal Acts require the control. This information is necessary to determine if federally enforceable conditions are necessary for the control device, and/or if the control device produces its own regulated pollutants or increases emission rates of other pollutants.

Heaters (Units 1-EP-1, 1-EP-5, 1.5-EP-1f, 1.5-EP-1g, 2-EP-1a, 2-EP-1b, 3-EP-1a, and 3-EP-1b)
NO_x, CO, VOC, PM, and SO_2 emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1 and 1.4-2. As a conservative measure, it was assumed that TSP = PM_{10} = $PM_{2.5}$. Hazardous air pollutant emissions were calculated using GRI-HAPCalc 3.01. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Heaters (Units 5-EP-1c, 5-EP-1d, 6-EP-1c, 6-EP-1d, 7-EP-1c, 7-EP-1d)
NO_x, CO, VOC, PM, and SO_2 and hazardous emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1, 1.4-2 and 1.4-3. As a conservative measure, it was assumed that PM(Total) = PM_{10} and PM (condensable) = $PM_{2.5}$. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Reboilers (Units 1.5-EP-1e, 2-EP-1e, 2-EP-1h, 2a-EP-1d, 2.5-EP 1d, 3-EP-1d, 3-EP-1e, and 3-EP-1h)
NO_x, CO, VOC, PM, and SO_2 emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1 and 1.4-2. As a conservative measure, it was assumed that TSP = PM_{10} = $PM_{2.5}$. Hazardous air pollutant emissions were calculated using GRI-HAPCalc 3.01. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Reboilers (Units 5-EP-1a, 5-EP-1b, 6-EP-1a, 6-EP-1b and 5.5-EP-1a)
NO_x, CO, VOC, PM, and SO_2 and hazardous emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1, 1.4-2 and 1.4-3. The CO emissions were calculated based on the manufacturer's spec sheet with a safety factor of 50%. As a conservative measure, it was assumed that PM(Total) = PM_{10} and PM (condensable) = $PM_{2.5}$. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Reboilers (Units 4-EP-1d, 4-EP-1e, and 4-EP-1h)
NO_x, CO, VOC, PM, and SO_2 and hazardous emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1, 1.4-2 and 1.4-3. As a conservative measure, it was assumed that PM(Total) = PM_{10} and PM (condensable) = $PM_{2.5}$. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Flares (Units 1-EP-2, 1.5-EP-2, 2-EP-2a, 2.5-EP-5, 3-EP-2a, 5-EP-2, and 7-EP-2)

Flare Pilot and Purge Gas
Pilot and purge gas emission rates for NO_x and CO are based on emission factors from AP-42 Table 13.5-1 (9/91) (Reformatted 1/95). It is assumed that there is no VOC content in the pilot and purge gas as the purchased fuel is methane. Emissions of H_2S and SO_2 from the pilot and purge gas are based respectively on the specification of sweet natural gas fuel, 0.25 gr H_2S/100scf and 5 gr S/100scf.

Flare SSM
The plant flares are used for flaring during startup, shutdown, maintenance and upset conditions. The only steady state conditions associated with this flare are from the pilot and purge gas streams, described above. SSM from the plant flare is due to various maintenance activities throughout the facility per manufacturer's recommended maintenance schedules. These maintenance activities include but are not limited to compressor catalyst changes, blowdowns for associated maintenance throughout the facility, instrumental calibrations, and process safety device maintenance.

The basis of the flaring calculations are the expected composition and maximum expected volumes of the gas. The SO_2 composition is based on a 98% molar conversion of H_2S to SO_2. NO_x and CO emissions for both scenarios are calculated using AP-42 Table 13.5-1 emission factors. VOC emissions are calculated from the VOC volume fraction of the inlet gas to the flare, the specific volume of the VOC fraction of the inlet gas, and a 98% destruction efficiency. The ProMax inlet gas analysis can be found in Section 7. Emissions of greenhouse gases are calculated using methodology from 40 CFR Subpart 98.233(n).

AGI Flare SSM (Unit 2.5-EP-5, and 5.5-EP-1b)
When the AGI well is inoperable due to maintenance or upset conditions, acid gas will be flared for limited periods at the acid gas flare. Under startup, shutdown, maintenance, and upset conditions the AGI well could be offline. During times when the AGI well is down, the sour gas will be sent to the acid gas flare. The expected composition and maximum expected volumes of the acid gas are used as the basis of the flaring calculations. The acid gas is expected to be relatively low heat content, so assist gas sufficient to raise the heat content of the flared gas may be added. The targeted heat content of the gas is 925 Btu/scf. The SO_2 composition is based on a 98% molar conversion of H_2S to SO_2. NO_x and CO emissions for both scenarios are calculated using AP-42 Table 13.5-1 emission factors. The ProMax gas analysis for the facility is attached in Section 7. Emissions of greenhouse gases are calculated using methodology from 40 CFR Subpart 98.233(n).

Amine Vents (Units 1-EP-4, 1.5-EP-4, 2-EP-4, 2.5-EP-4, and 3-EP-4)
All emissions from these units are calculated using ProMax. Emissions from 1-EP-4 are controlled by the regen heater, unit 1-EP-5. Controlled emissions are represented under unit 1-EP-5. Emissions from 1.5-EP-4 and 2-EP-4 are controlled by unit EP-5. Controlled emissions are represented under unit EP-5. Emissions from unit 2.5-EP-4 are controlled by the Acid Gas Injection Well (AGI). During AGI compressor downtime the controlled emissions are represented under the Emergency AGI Flare, unit 2.5-EP-5. Emissions from unit 3-EP-4 are routed to the thermal oxidizer unit EP-6. Controlled emissions are represented under unit EP-6.

Amine Vents (Units 4-EP-4, 5-EP-1f, and 6-EP-1f)
All emissions from these units are calculated using ProMax. The amine flash is routed back to the process. The regenerator emissions from the amine units are routed to a thermal oxidizer. Controlled emissions are represented under unit the thermal oxidizer used for control. Emissions during maintenance and malfunction are accounted for in thermal oxidizer SSM. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Glycol Dehydrators (Units 1-EP-3, 1.5-EP-3, 2a-EP-3, and 3-EP-3)
All emissions from these units are calculated using ProMax. Emissions from the glycol dehydrator unit 1-EP-3 will be routed to the facility fuel system. This is a closed-loop system, therefore, there are no emissions associated with these units.
The AGI Flare (Unit 1.5-EP-2) will control incondensable and flash tank emission from the glycol dehydrator unit 1.5-EP-3. Emissions from units 2a-EP-3 and 3-EP-3 are controlled by thermal oxidizer units EP-5 and EP-6, respectively. Emissions from these units will be represented under their controls. Flash Tank emissions will be routed to the facility fuel system.

Glycol Dehydrators (Units 4-EP-3, 5-EP-1e, and 6-EP-1e)
All emissions from these units are calculated using ProMax. The glycol flash will be routed back to the process. The regenerator emissions will be routed to a thermal oxidizer. Controlled emissions from these units will be represented under the thermal oxidizer used for control. Emissions during maintenance and malfunction are accounted for in thermal oxidizer SSM. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Thermal Oxidizers (Units EP-5, EP-6, EP-8, and EP-10)
NO_x, CO, emissions were updated using the manufacture's spec sheet. PM, and SO_2 emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1 and 1.4-2. HAP and VOC emissions were calculated using streams from ProMax. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Thermal Oxidizers SSM (Unit EP-11)
This accounts for emissions during startup shutdown and maintenance and upset conditions from the thermal oxidizer. VOC and HAPs emissions were calculated from ProMax run 1.4-1 and 1.4-2. HAP and VOC emissions were calculated using streams from ProMax. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Enclosed Combustion Device (Unit EP-7)
NO_x, CO, VOC, PM, and SO_2 emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1 and 1.4-2. As a conservative measure, it was assumed that TSP = PM_{10} = $PM_{2.5}$. HAP and VOC emissions were calculated using streams from ProMax. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Enclosed Combustion Device (Unit EP-12)
NO_x, CO, and SO_2 emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1 and 1.4-2. HAP and VOC emissions were calculated using streams from ProMax. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Sour Water Tank Flare (Unit EP-13)
NO_x, CO, and SO_2emissions were calculated using AP-42 factors for external natural gas combustion sources in Tables 1.4-1 and 1.4-2. HAP and VOC emissions were calculated using streams from ProMax and vapor head gas analysis. Greenhouse gas emissions were estimated using methodology from 40 CFR Part 98 and emission factors from Tables C-1 and C-2 of Part 98.

Condensate Storage Tank (Unit 1-T)
Unit 1-T represents six connected 500 bbl condensate storage tanks. Uncontrolled emissions are calculated using ProMax and an annual throughput of 2,000 bbl/day. Controlled emissions will be routed to the enclosed combustion device, unit EP-7.

Condensate Storage Tanks (Unit 3-T)
Unit 3-T represents six connected 500 bbl condensate storage tanks. Uncontrolled emissions are calculated using ProMax. Controlled emissions will be routed to the enclosed combustion device, unit EP-10.

Sour Water Tank (Unit 4-T)
Unit 4-T represents two connected 500 bbl sour slop tanks. Uncontrolled emissions are calculated using ProMax. Controlled emissions will be routed to the sour slop tank control flare, unit EP-9.

Slop Tank (Unit 5-T)
Unit 5-T represents two connected 500 bbl slop tanks. Uncontrolled emissions are calculated using ProMax.

Loading Emissions (Unit 1-Load)
Emissions from loading of condensate out of the facility by truck were estimated using Equation 1 in AP-42 Section 5.2-4. The requested loading of condensate out of the facility is 2,000 bbl/day.

Loading Emissions (Unit 3-Load, 4-Load, and 5-Load)
Emissions from loading of condensate out of the facility by truck were estimated using Equation 1 in AP-42 Section 5.2-4. The requested loading of condensate out of the facility is 3129.6 bbl/day. The flash from loading is captured and routed back to the tanks and the enclosed combustor. Emissions from 4-Load are routed to the sour water tanks. 5-Load trucking operations are vented to the atmosphere. The requested loading of sour slop and slop out of the facility are 87 bbl/day and 242 bbl/day respectively.

MSS Blowdowns (Units 2-EP-1t, 3-EP-1t, 4-EP-1t, 5-EP-1t, 6-EP-1t, 7-EP-1t)
Emissions from blowdown of the residue compressor from train 2, 3, 4, 5, 6 and 7 during maintenance activities are vented to the atmosphere. Each train has 4 electric compressors, each with 470 acf of blowdown volume. To be conservative, these events are assumed to vent for an hour and occur for 8 times/year. For the purpose of simplicity, one blowdown emission point consists of the total volume from the 4 compressors at each train.

Miscellaneous Startup, shutdown, and Maintenance (SSM/M)
This accounts for miscellaneous startup, shutdown, and maintenance activities at the facility.

Fugitive Emissions (Unit FUG and FUG-1)
Fugitive emissions were estimated using emission factors from Table 2-4 of EPA Protocol for Equipment Leak Emission Estimates, November 1995, EPA-453/R-95-017. Component counts were estimated as previously permitted. The percent VOC and HAPs are from the inlet gas analysis dated 8/22/2012. The percent VOC in liquids conservatively assumed to be 100%. The percent H_2S in liquids is zero. The percent of HAPs in the liquids is estimated based on the ratio of VOC and HAP in the previous gas analysis. Total HAPs is the sum of n-Hexane, Benzene, Toluene, Ethylbenzene, and Xylene.

Haul Road Emissions (Unit HAUL-1)
Unpaved haul road emissions were estimated based on Equations 1a and 2 of AP-42 Section 13.2.1 (1/11). Particle size multipliers and constants for these equations are found in AP-42 Table 13.2.2-2, Industrial Roads. Silt content is taken from AP-42 Table 13.2.2-1 and annual wet days is from AP-42 Figure 13.2.2-1. The control efficiency from base course is from the NMED guidance document entitled Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions. The length of the haul road is estimated from Google Earth.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Facility-wide Emissions Summary

Uncontrolled Emissions

Unit	Equipment Description	NO_x		CO		VOC		SO_2		TSP		PM_{10}		$PM_{2.5}$		H_2S		Total HAP		Benzene		Toluene		Ethylbenzene		n-Hexane		2,2,4-Trimethylpentane		Styrene		Xylene		CO_2e	CH4	N2O
Unit	Equipment Description	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr	CO_2e ton/yr	CO_2e ton/yr
1-EP-1	Hot Oil Heater	3.46	15.16	2.91	12.73	0.19	0.83	0.02	0.08	0.26	1.15	0.26	1.15	0.26	1.15	-	-	0.51	2.23	0.03	0.12	0.04	0.16	0.07	0.33	0.05	0.22	0.10	0.44	0.07	0.32	0.05	0.20	18086.14	0.34	0.03
1-EP-2	Flare (SSM)	0.18	0.78	0.81	3.56	-	-	0.00	0.01	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1206.54	8.99	0.00
1-EP-3	Glycol Dehydrator	-	-	-	-	110.07	482.10	-	-	-	-	-	-	-	-	0.00	0.00	38.84	170.11	17.12	75.00	7.35	32.20	0.34	1.48	12.45	54.51	-	-	-	-	1.58	6.92	0.14	17.16	-
1-EP-4	Amine Vent	-	-	-	-	10.12	44.33	-	-	-	-	-	-	-	-	1.77	7.74	7.25	31.77	5.10	22.33	1.62	7.08	0.07	0.30	0.02	0.10	-	-	-	-	0.45	1.96	73505.69	36.21	-
1.5-EP-1g	10k Stabilizer Heater	0.90	3.96	0.93	4.06	0.09	0.40	0.012	0.054	0.14	0.59	0.14	0.59	0.14	0.59	-	-	0.26	1.14	0.01	0.06	0.02	0.08	0.04	0.17	0.03	0.11	0.05	0.22	0.04	0.16	0.02	0.10	9222.39	0.17	0.02
4-EP-1g	10k Stabilizer Heater	0.22	0.97	0.37	1.62	0.02	0.11	0.02	0.10	0.03	0.15	0.03	0.15	0.03	0.11	-	-	0.01	0.04	0.00	0.00	0.00	0.00	-	-	0.01	0.04	-	-	-	-	-	-	-	-	-
2-EP-1a	Mol Sieve Heater	0.27	1.20	0.46	2.02	0.03	0.13	0.03	0.12	0.04	0.18	0.04	0.18	0.03	0.14	-	-	0.08	0.35	0.00	0.02	0.01	0.02	0.01	0.05	0.01	0.03	0.02	0.07	0.01	0.05	0.01	0.03	2869.19	0.05	0.01
2-EP-1b	Cryo HMO Heater	1.16	5.08	1.31	5.75	0.09	0.38	0.12	0.52	0.12	0.52	0.12	0.52	0.13	0.58	-	-	0.23	1.01	0.01	0.05	0.02	0.07	0.03	0.15	0.02	0.10	0.05	0.20	0.03	0.15	0.02	0.09	8172.07	0.15	0.02
2-EP-1e	Glycol Reboiler	0.29	1.29	0.25	1.08	0.02	0.07	0.00	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	0.04	0.19	0.00	0.01	0.00	0.01	0.01	0.03	0.00	0.02	0.01	0.04	0.01	0.03	0.00	0.02	1537.07	0.03	0.00
2-EP-2a	Emergency Flare A (inlet)	0.18	0.78	0.81	3.56	-	-	0.00	0.01	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1206.54	8.99	0.00
2-EP-4	Amine Vent	-	-	-	-	66.22	290.07	-	-	-	-	-	-	-	-	5.26	23.03	46.29	202.75	31.23	136.79	11.07	48.49	0.49	2.13	0.22	0.96	-	-	-	-	3.28	14.38	220136.43	193.32	-
2-EP-1h	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
2a-EP-1d	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
2a-EP-3	Glycol Dehydrator	-	-	-	-	109.47	479.49	-	-	-	-	-	-	-	-	0.00	0.00	39.79	174.28	17.98	78.74	8.01	35.10	0.37	1.61	4.19	18.37	-	-	-	-	1.66	7.25	0.29	18.37	-
2.5-EP-4	Amine Vent	-	-	-	-	10.65	46.66	-	-	-	-	-	-	-	-	612.94	2684.68	0.26	1.16	-	-	-	-	-	-	0.26	1.16	-	-	-	-	-	-	13027.29	66.01	-
2.5-EP-1d	Amine Reboiler	2.45	10.74	2.06	9.02	0.13	0.59	0.01	0.06	0.19	0.82	0.19	0.82	0.19	0.82	-	-	0.29	1.26	0.01	0.07	0.02	0.09	0.04	0.19	0.03	0.12	0.06	0.25	0.04	0.18	0.03	0.12	10247.10	0.19	0.02
2.5-EP-5	Emergency AGI Flare	15.91	1.20	72.54	5.48	-	-	1.59	0.12	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1846.52	13.65	0.00
3-EP-1a	Mol Sieve Heater	0.36	1.57	0.46	2.02	0.03	0.13	0.04	0.16	0.04	0.18	0.04	0.18	0.04	0.18	-	-	0.08	0.35	0.00	0.02	0.01	0.02	0.01	0.05	0.01	0.03	0.02	0.07	0.01	0.05	0.01	0.03	2869.19	0.05	0.01
3-EP-1b	Cryo HMO Heater	0.86	3.77	1.31	5.75	0.09	0.38	0.09	0.38	0.12	0.52	0.12	0.52	0.10	0.43	-	-	0.23	1.01	0.01	0.05	0.02	0.07	0.03	0.15	0.02	0.10	0.05	0.20	0.03	0.15	0.02	0.09	8172.07	0.15	0.02
3-EP-1d	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
3-EP-1e	Glycol Reboiler	0.29	1.29	0.25	1.08	0.02	0.07	0.00	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	0.04	0.19	0.00	0.01	0.00	0.01	0.01	0.03	0.00	0.02	0.01	0.04	0.01	0.03	0.00	0.02	1537.07	0.03	0.00
3-EP-1h	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
3-EP-2a	Flare (SSM)	0.18	0.78	0.81	3.56	-	-	0.00	0.01	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1206.54	8.99	0.00
3-EP-3	Glycol Dehydrator	-	-	-	-	109.41	479.20	-	-	-	-	-	-	-	-	0.00	0.00	39.50	173.03	17.69	77.49	7.94	34.78	0.37	1.62	11.85	51.89	-	-	-	-	1.65	7.23	0.00	18.31	-
3-EP-4	Amine Vent	-	-	-	-	72.35	316.90	-	-	-	-	-	-	-	-	5.03	22.04	51.28	224.63	34.23	149.91	12.44	54.49	0.55	2.40	0.24	1.05	-	-	-	-	3.83	16.77	210715.39	199.46	-
4-EP-1a	Mol Sieve Heater	0.36	1.57	0.46	2.02	0.03	0.13	0.04	0.16	0.04	0.18	0.04	0.18	0.04	0.18	-	-	0.08	0.35	0.00	0.02	0.01	0.02	0.01	0.05	0.01	0.03	0.02	0.07	0.01	0.05	0.01	0.03	2869.19	0.05	0.01
4-EP-1b	Cryo HMO Heater	0.86	3.77	1.31	5.75	0.09	0.38	0.09	0.38	0.12	0.52	0.12	0.52	0.10	0.43	-	-	0.23	1.01	0.01	0.05	0.02	0.07	0.03	0.15	0.02	0.10	0.05	0.20	0.03	0.15	0.02	0.09	8172.07	0.15	0.02
4-EP-2a	Flare (SSM)	0.18	0.78	0.81	3.56	-	-	0.00	0.01	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1206.54	8.99	0.00
EP-5	Thermal Oxidizer																																			
EP-6	Thermal Oxidizer																																			
EP-7	Enclosed Combustion Device																																			
EP-8	Thermal Oxidizer																																			
EP-9	Sour Slop Tank Control Flare															No emissions from these units in an uncontrolled scenario.																				
1-T	Condensate Storage Tank	-	-	-	-	*	46.00	-	-	-	-	-	-	-	-	-	-	*	0.38	*	0.26	*	0.05	*	0.00	-	-	*	0.06	-	-	*	0.01	-	-	-
2-T	H2S Sour Slop Tank	-	-	-	-	*	529.80	-	-	-	-	-	-	-	-	-	0.26	*	0.00	*	0.00	*	0.00	*	0.00	-	-	*	0.00	-	-	*	0.00	0.09	-	-
1-Load	Loading Emissions	-	-	-	-	*	129.20	-	-	-	-	-	-	-	-	-	-	*	0.90	*	0.73	*	0.14	*	0.01	-	-	*	0.17	-	-	*	0.02	-	-	-
2-Load	Loading Emissions	-	-	-	-	*	48.20	-	-	-	-	-	-	-	-	0.01	0.01	*	0.00	*	0.00	*	0.00	*	0.00	-	-	*	0.00	-	-	*	0.00	0.01	0.53	-
FUG	Fugitive Emissions	-	-	-	-	*	103.61	-	-	-	-	-	-	-	-	*	0.004	*	7.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29.42	130.65	-
HAUL	Haul Road Emissions	-	-	-	-	-	-	-	-	17.49	6.80	4.46	1.73	0.45	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Facility-wide Uncontrolled Emissions		**0.00**	**74.13**	**96.29**	**109.47**	**668.06**	**3804.03**	**2.18**	**2.68**	**20.24**	**18.83**	**7.20**	**13.76**	**3.14**	**11.98**	**630.30**	**2760.93**	**316.82**	**1396.09**	**174.17**	**763.88**	**68.52**	**300.32**	**3.83**	**16.78**	**41.73**	**182.77**	**1.03**	**4.76**	**0.76**	**3.31**	**18.14**	**79.48**	**931017.65**	**944.61**	**0.37**
4-EP-1d	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
4-EP-1e	Glycol Reboiler	0.29	1.29	0.25	1.08	0.02	0.07	0.00	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	0.04	0.19	0.00	0.01	0.00	0.01	0.01	0.03	0.00	0.02	0.01	0.04	0.01	0.03	0.00	0.02	1537.07	0.03	0.00
4-EP-1h	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
4-EP-3	Glycol Dehydrator	-	-	-	-	109.16	478.13	-	-	-	-	-	-	-	-	0.00	0.00	39.61	173.48	17.85	78.18	7.98	34.96	0.37	1.61	11.76	51.49	-	-	-	-	1.65	7.24	0.00	18.37	-
4-EP-4	Amine Vent	-	-	-	-	68.61	300.52	-	-	-	-	-	-	-	-	5.29	23.17	48.73	213.45	32.71	143.25	11.74	51.41	0.51	2.25	0.22	0.96	-	-	-	-	3.56	15.59	220458.53	193.10	-
5-EP-1a	Train 5 - Amine/Glycol Reboiler 1	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.13	0.58	0.00	0.00	0.00	0.00	-	-	0.13	0.58	-	-	-	-	-	-	32727.80	15.42	18.38
5-EP-1b	Train 5 - Amine/Glycol Reboiler 2	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.12	0.54	0.00	0.00	0.00	0.00	-	-	0.12	0.54	-	-	-	-	-	-	32727.80	15.42	18.38
5-EP-1c	Cryo Train 5 - Mole Sieve Heater	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	0.01	0.06	0.00	0.00	0.00	0.00	-	-	0.01	0.06	-	-	-	-	-	-	3408.40	1.61	1.91
5-EP-1d	Cryo Train 5 - HMO Heater	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.24	0.13	0.24	0.04	0.43	-	-	0.03	0.14	0.00	0.00	0.00	0.00	-	-	0.03	0.14	-	-	-	-	-	-	8205.30	3.87	4.61
5-EP-1e	Train 5 - Glycol Dehy	-	-	-	-	146.92	643.53	-	-	-	-	-	-	-	-	0.00	0.00	21.08	92.34	21.08	92.34	-	-	-	-	-	-	-	-	-	-	-	-	1841.50	594.25	0.89
5-EP-1f	Train 5 - Amine	-	-	-	-	35.83	156.92	-	-	-	-	-	-	-	-	1.87	8.21	16.46	72.07	16.46	72.07	-	-	-	-	-	-	-	-	-	-	-	-	5266.53	0.00	0.00
5-EP-2	Cryo 5 & 6 Flare SSM	0.34	1.51	0.69	3.01	0.00	0.02	0.01	0.00	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6-EP-1a	Train 6 - Amine/Glycol Reboiler 1	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.12	0.54	0.00	0.00	0.00	0.00	-	-	0.12	0.54	-	-	-	-	-	-	32727.80	15.42	18.38
6-EP-1b	Train 6 - Amine/Glycol Reboiler 2	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.12	0.54	0.00	0.00	0.00	0.00	-	-	0.12	0.54	-	-	-	-	-	-	32727.80	15.42	18.38
6-EP-1c	Cryo Train 6 - Mole Sieve Heater	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	0.01	0.06	0.00	0.00	0.00	0.00	-	-	0.01	0.06	-	-	-	-	-	-	3408.40	1.61	1.91
6-EP-1d	Cryo Train 6 - HMO Heater	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	0.03	0.14	0.00	0.00	0.00	0.00	-	-	0.03	0.14	-	-	-	-	-	-	8205.30	3.87	4.61
6-EP-1e	Train 6 - Glycol Dehy	-	-	-	-	146.92	643.53	-	-	-	-	-	-	-	-	0.00	0.00	21.08	92.34	21.08	92.34	-	-	-	-	-	-	-	-	-	-	-	-	1841.50	594.25	0.89
6-EP-1f	Train 6 - Amine	-	-	-	-	35.83	156.92	-	-	-	-	-	-	-	-	1.87	8.21	16.46	72.07	16.46	72.07	-	-	-	-	-	-	-	-	-	-	-	-	5266.53	0.00	0.00
7-EP-1c	Cryo Train 7 - Mole Sieve Heater	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	0.01	0.06	0.00	0.00	0.00	0.00	-	-	0.01	0.06	-	-	-	-	-	-	3408.40	1.61	1.91
7-EP-1d	Cryo Train 7 - HMO Heater	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	0.03	0.14	0.00	0.00	0.00	0.00	-	-	0.03	0.14	-	-	-	-	-	-	8205.30	3.87	4.61
7-EP-2	Cryo 7 Flare SSM	0.34	1.51	0.69	3.01	0.00	0.02	0.01	0.00	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.5-EP-1a	AGI 2 HMO Heater	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.12	0.54	0.00	0.00	0.00	0.00	-	-	0.12	0.54	-	-	-	-	-	-	32727.80	15.42	18.38
5.5-EP-1b	AGI 2 Flare SSM	0.05	0.23	0.11	0.47	0.00	0.01	0.00	0.01	-	-	-	-	-	-	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-T	Condensate Storage Tanks	-	-	-	-	31.50	137.97	-	-	-	-	-	-	-	-	0.00	0.00	0.48	2.10	0.48	2.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-T	Sour Water Tanks	-	-	-	-	5.96	26.09	-	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	0.00	0.00	-	-	-
5-T	Slop Tanks	-	-	-	-	0.33	1.45	-	-	-	-	-	-	-	-	0.00	0.00	0.02	0.11	0.02	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-LOAD	Condensate Tanks Truck Loading	-	-	-	-	71.22	105.14	-	-	-	-	-	-	-	-	0.00	0.00	0.32	0.47	0.32	0.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-LOAD	Sour Water Tanks Truck Loading	-	-	-	-	66.70	4.49	-	-	-	-	-	-	-	-	0.01	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5-LOAD	Slop Tanks Truck Loading	-	-	-	-	3.52	0.66	-	-	-	-	-	-	-	-	0.00	0.00	0.26	0.05	0.26	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP-10	Thermal Oxidizer																																			
EP-11	Thermal Oxidizer SSM																																			
EP-12	Condensate Tanks Combustor																																			
EP-13	Sour Water Tanks Flare															No emissions from these units in an uncontrolled scenario.																				
2-EP-1t	Train 2 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.01	109.36	0.00
3-EP-1t	Train 3 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.01	109.36	0.00
4-EP-1t	Train 4 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.01	109.36	0.00
5-EP-1t	Train 5 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.01	109.36	0.00
6-EP-1t	Train 6 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.01	109.36	0.00
7-EP-1t	Train 7 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.01	109.36	0.00
FUG-1	Fugitive Emissions	-	-	-	-	22.01	96.41	-	-	-	-	-	-	-	-	0.00032	0.00140	0.83	3.62	0.83	3.62	-	-	-	-	-	-	-	-	-	-	-	-	4462.60	521220.00	0.00
SSM/M	Miscellaneous Startup, Shutdown and Maintenance	-	-	-	-	0.17	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-1	Haul emissions	-	-	-	-	-	-	-	-	2.46	1.60	0.63	0.41	0.06	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Addition of Facility-wide Uncontrolled Emissions		**23.88**	**104.60**	**29.50**	**129.19**	**760.31**	**2765.27**	**2.20**	**9.54**	**6.46**	**18.81**	**4.63**	**17.62**	**3.22**	**14.12**	**9.54**	**39.59**	**167.72**	**732.57**	**127.63**	**556.97**	**19.83**	**86.87**	**1.12**	**4.91**	**12.89**	**56.47**	**0.32**	**1.41**	**0.23**	**1.03**	**5.36**	**23.48**	**495513.49**	**523370.77**	**113.37**
TOTAL FACILITY-WIDE UNCONTROLLED		**54.11**	**168.52**	**132.73**	**269.08**	**1233.94**	**5717.72**	**4.32**	**11.95**	**25.86**	**33.95**	**10.99**	**27.69**	**5.52**	**22.41**	**634.55**	**2777.35**	**393.95**	**1731.90**	**250.56**	**1096.40**	**68.53**	**300.33**	**3.83**	**16.78**	**42.48**	**186.05**	**1.03**	**4.76**	**0.76**	**3.31**	**18.14**	**79.48**	**1148176.47**	**23731.42**	**113.62**

Controlled Emissions

Unit	Equipment Description	NO_x		CO		VOC		SO_2		TSP		PM_{10}		$PM_{2.5}$		H_2S		Total HAP		Benzene		Toluene		Ethylbenzene		n-Hexane		2,2,4-Trimethylpentane		Styrene		Xylene		CO_2e	CH4	N2O
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	ton/yr	ton/yr	ton/yr
1-EP-1	Hot Oil Heater	3.46	15.16	2.91	12.73	0.19	0.83	0.02	0.08	0.26	1.15	0.26	1.15	0.26	1.15	-	-	0.51	2.23	0.03	0.12	0.04	0.16	0.07	0.33	0.05	0.22	0.10	0.44	0.07	0.32	0.05	0.20	18086.14	0.34	0.03
1-EP-2	Flare (SSM)	256.23	2.32	1168.11	10.57	859.82	5.16	6.21	0.04	-	-	-	-	-	-	0.07	0.0005	46.23	0.28	3.09	0.02	1.60	0.01	0.16	0.00	40.61	0.24	-	-	-	-	0.77	0.00	2770.62	10.88	0.00
1-EP-3	Glycol Dehydrator	Emissions from 1-EP-3 are controlled by the thermal oxidizer, unit EP-5. Controlled emissions are represented under unit EP-5.																																		
1-EP-4	Amine Vent	Emissions from 1-EP-4 are controlled by the thermal oxidizer, unit EP-5. Controlled emissions are represented under unit EP-5.																																		
1.5-EP-1g	10k Stabilizer Heater	0.90	3.96	0.93	4.06	0.09	0.40	0.012	0.054	0.136	0.59	0.136	0.59	0.136	0.59	-	-	0.26	1.14	0.01	0.06	0.02	0.08	0.04	0.17	0.03	0.11	0.05	0.22	0.04	0.16	0.02	0.10	9222.39	0.17	0.02
4-EP-1g	10k Stabilizer Heater	0.22	0.97	0.37	1.62	0.02	0.11	0.022	0.098	0.03	0.15	0.034	0.15	0.03	0.11	-	-	0.0088	0.039	0.0000	0.0000	0.0000	0.0001	-	-	0.0088	0.0385	-	-	-	-	-	-			
2-EP-1a	Mol Sieve Heater	0.27	1.20	0.46	2.02	0.03	0.13	0.03	0.12	0.04	0.18	0.042	0.18	0.031	0.14	-	-	0.08	0.35	0.00	0.02	0.01	0.02	0.01	0.05	0.01	0.03	0.02	0.07	0.01	0.05	0.01	0.03	2869.19	0.05	0.01
2-EP-1b	Cryo HMO Heater	1.16	5.08	1.31	5.75	0.09	0.38	0.12	0.52	0.12	0.52	0.176	0.77	0.13	0.58	-	-	0.23	1.01	0.01	0.05	0.02	0.07	0.03	0.15	0.02	0.10	0.05	0.20	0.03	0.15	0.02	0.09	8172.07	0.15	0.02
2-EP-1e	Glycol Reboiler	0.29	1.29	0.25	1.08	0.02	0.07	0.002	0.01	0.02	0.10	0.022	0.10	0.02	0.10	-	-	0.04	0.19	0.00	0.01	0.00	0.01	0.01	0.03	0.00	0.02	0.01	0.04	0.01	0.03	0.00	0.02	1537.07	0.03	0.00
2-EP-2a	Flare (SSM)	682.98	4.88	3113.60	22.24	2292.86	13.76	16.57	0.11	-	-	-	-	-	-	0.18	0.00	123.27	0.74	8.25	0.05	4.26	0.03	0.42	0.00	108.29	0.65	-	-	-	-	2.06	0.01	7388.33	29.01	0.01
2-EP-4	Amine Vent	Emissions from 2-EP-4 are controlled by unit EP-5. Controlled emissions are represented under unit EP-5.																																		
2-EP-1h	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
2a-EP-1d	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
2a-EP-3	Glycol Dehydrator	Emissions from 2a-EP-3 are controlled by unit EP-5. Controlled emissions are represented under unit EP-5.																																		
2.5-EP-4	Amine Vent	Emissions from unit 2.5-EP-4 are controlled by the Acid Gas Injection Well (AGI). During AGI compressor downtime the controlled emissions are represented under the Emergency AGI Flare, unit 2.5-EP-5.																																		
2.5-EP-1d	Amine Reboiler	2.45	10.74	2.06	9.02	0.13	0.59	0.01	0.06	0.19	0.82	0.19	0.82	0.19	0.82	-	-	0.29	1.26	0.01	0.07	0.02	0.09	0.04	0.19	0.03	0.12	0.06	0.25	0.04	0.18	0.03	0.12	10247.10	0.19	0.02
2.5-EP-5	Emergency AGI Flare	16.28	1.22	74.21	5.58	0.21	0.01	1155.37	74.52	-	-	-	-	-	-	12.26	0.79	0.01	0.0003	-	-	-	-	-	-	0.01	0.00	-	-	-	-	-	-	19331.88	1.89	0.00
3-EP-1a	Mol Sieve Heater	0.36	1.57	0.46	2.02	0.03	0.13	0.036	0.16	0.04	0.18	0.05	0.24	0.04	0.18	-	-	0.08	0.35	0.00	0.02	0.01	0.02	0.01	0.05	0.01	0.03	0.02	0.07	0.01	0.05	0.01	0.03	2869.19	0.05	0.01
3-EP-1b	Cryo HMO Heater	0.86	3.77	1.31	5.75	0.09	0.38	0.087	0.38	0.12	0.52	0.13	0.57	0.098	0.43	-	-	0.23	1.01	0.01	0.05	0.02	0.07	0.03	0.15	0.02	0.10	0.05	0.20	0.03	0.15	0.02	0.09	8172.07	0.15	0.02
3-EP-1d	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
3-EP-1e	Glycol Reboiler	0.29	1.29	0.25	1.08	0.02	0.07	0.002	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	0.04	0.19	0.00	0.01	0.00	0.01	0.01	0.03	0.00	0.02	0.01	0.04	0.01	0.03	0.00	0.02	1537.07	0.03	0.00
3-EP-1h	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
3-EP-2a	Flare (SSM)	682.98	4.88	3113.60	22.24	2292.86	13.76	16.57	0.11	-	-	-	-	-	-	0.18	0.00	123.27	0.74	8.25	0.05	4.26	0.03	0.42	0.00	108.29	0.65	-	-	-	-	2.06	0.01	7388.33	29.01	0.01
3-EP-3	Glycol Dehydrator																																			
3-EP-4	Amine Vent	Emissions from units 3-EP-3 and 3-EP-4 are routed to the thermal oxidizer unit EP-6. Controlled emissions are represented under unit EP-6.																																		
4-EP-1a	Mol Sieve Heater	0.36	1.57	0.46	2.02	0.03	0.13	0.036	0.16	0.04	0.18	0.05	0.24	0.04	0.18	-	-	0.08	0.35	0.00	0.02	0.01	0.02	0.01	0.05	0.01	0.03	0.02	0.07	0.01	0.05	0.01	0.03	2869.19	0.05	0.01
4-EP-1b	Cryo HMO Heater	0.86	3.77	1.31	5.75	0.09	0.38	0.087	0.38	0.12	0.52	0.13	0.57	0.10	0.43	-	-	0.23	1.01	0.01	0.05	0.02	0.07	0.03	0.15	0.02	0.10	0.05	0.20	0.03	0.15	0.02	0.09	8172.07	0.15	0.02
4-EP-2a	Flare (SSM)	682.98	4.88	3113.60	22.24	2292.86	13.76	16.57	0.11	-	-	-	-	-	-	0.18	0.00	123.27	0.74	8.25	0.05	4.26	0.03	0.42	0.00	108.29	0.65	-	-	-	-	2.06	0.01	7388.33	29.01	0.01
EP-5	Thermal Oxidizer	5.50	24.09	3.50	15.33	5.92	25.92	13.22	57.91	0.21	0.91	0.21	0.91	0.21	0.91	0.14	0.62	2.64	11.58	1.43	6.26	0.56	2.46	0.03	0.11	0.34	1.48	-	-	-	-	0.14	0.61	14345.95	0.27	0.03
EP-6	Thermal Oxidizer	5.50	24.09	3.50	15.33	3.64	15.92	9.47	41.49	0.21	0.91	0.21	0.91	0.21	0.91	0.10	0.44	1.82	7.95	1.04	4.55	0.41	1.79	0.02	0.08	0.24	1.06	-	-	-	-	0.11	0.48	14345.95	0.27	0.03
EP-7	Enclosed Combustion Device	0.59	2.58	0.49	2.16	0.80	3.50	-	-	0.04	0.20	0.04	0.20	0.04	0.20	-	-	0.01	0.03	0.00	0.02	0.00	0.00	0.00	0.00	-	-	0.00	0.00	-	-	0.00	0.00	796.69	0.02	0.00
EP-9	Sour Slop Tank Control Flare	0.36	1.57	1.64	7.17	6.42	28.14	0.12	0.50	-	-	-	-	-	-	0.003	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	-	0.00	0.00	-	-	0.00	0.00	2700.62	0.05	0.01
1-T	Condensate Storage Tank	Emissions from units 1-T-1 to 1-T-6 are routed to the enclosed combustion device, unit EP-7. Controlled emissions are represented under unit EP-7.																																		
2-T	H2S Sour Slop Tank	Emissions from units 2-T-1 are routed to the sour slop tank control flare , unit EP-9. Controlled emissions are represented under unit EP-9.																																		
1-Load	Loading Emissions	Emissions from unit 1-Load are routed to the enclosed combustion device, unit EP-7. Controlled emissions are represented under unit EP-7.																																		
2-Load	Loading Emissions					23.68	14.46	-	-	-	-	-	-	-	-	0.01	0.01																			
FUG	Fugitive Emissions	-	-	-	-	*	103.61	-	-	-	-	-	-	-	-	*	0.004	*	7.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.63	33.95	-
HAUL	Haul Road Emissions	-	-	-	-	-	-	-	-	3.50	1.36	0.89	0.35	0.09	0.03																					
Current Facility-wide Controlled Emissions		**2348.97**	**138.69**	**10612.60**	**211.98**	**7781.09**	**246.79**	**1234.68**	**177.34**	**6.75**	**15.58**	**4.24**	**14.68**	**3.29**	**14.04**	**13.12**	**1.88**	**425.77**	**52.21**	**30.58**	**12.18**	**15.70**	**5.95**	**2.23**	**3.57**	**366.60**	**7.01**	**1.04**	**4.53**	**0.76**	**3.31**	**7.67**	**3.24**	**262935.99**	**137.88**	**0.46**
4-EP-1d	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
4-EP-1e	Glycol Reboiler	0.29	1.29	0.25	1.08	0.02	0.07	0.002	0.01	0.02	0.10	0.02	0.10	0.02	0.10	-	-	0.04	0.19	0.00	0.01	0.00	0.01	0.01	0.03	0.00	0.02	0.01	0.04	0.01	0.03	0.00	0.02	1537.07	0.03	0.00
4-EP-1h	Amine Reboiler	1.02	4.46	2.07	9.05	0.30	1.30	0.03	0.13	0.41	1.79	0.41	1.79	0.41	1.79	-	-	0.79	3.47	0.04	0.18	0.06	0.24	0.12	0.51	0.08	0.34	0.16	0.68	0.11	0.50	0.07	0.32	28179.54	0.53	0.05
4-EP-3	Glycol Dehydrator																																			
4-EP-4	Amine Vent	Emissions from units 4-EP-3 and 4-EP-4 are routed to the thermal oxidizer unit EP-8. Controlled emissions are represented under unit EP-8.																																		
5-EP-1a	Train 5 - Amine/Glycol Reboiler 1	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.13	0.5815	0.0002	0.0007	0.0003	0.0011	-	-	0.1324	0.5797	-	-	-	-	-	-	32727.80	15.50	18.48
5-EP-1b	Train 5 - Amine/Glycol Reboiler 2	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.12	0.54	0.0001	0.0006	0.0002	0.0010	-	-	0.1235	0.5411	-	-	-	-	-	-	32727.80	15.50	18.48
5-EP-1c	Cryo Train 5 - Mole Sieve Heater	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	0.01	0.06	0.0000	0.0001	0.0000	0.0001	-	-	0.0129	0.0563	-	-	-	-	-	-	3408.40	1.50	1.79
5-EP-1d	Cryo Train 5 - HMO Heater	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	0.03	0.14	0.0000	0.0002	0.0001	0.0003	-	-	0.0310	0.1357	-	-	-	-	-	-	8205.30	3.75	4.47
5-EP-1e	Train 5 - Glycol Dehy	Emissions from 5-EP-1e are controlled by the thermal oxidizer, unit EP-10. Controlled emissions are represented under unit EP-10.																															1839.60	594.25	0.89
5-EP-1f	Train 5 - Amine	Emissions from 5-EP-1f are controlled by the thermal oxidizer, unit EP-10. Controlled emissions are represented under unit EP-10.																															5276.29	0.00	0.00
5-EP-2	Cryo 5 & 6 Flare SSM	1658.77	11.46	3311.54	22.87	2431.00	14.60	0.01	0.00	-	-	-	-	-	-	0.00	0.00	144.28	0.87	3.60	0.02	0.89	0.01	0.04	0.00	139.59	0.84	0.86	0.01	-	-	0.16	0.00	7952.60	866.00	4.17
6-EP-1a	Train 6 - Amine/Glycol Reboiler 1	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.1239	0.543	0.0001	0.0006	0.0002	0.0010	-	-	0.1235	0.5411	-	-	-	-	-	-	32727.80	15.50	18.48
6-EP-1b	Train 6 - Amine/Glycol Reboiler 2	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.1239	0.543	0.0001	0.0006	0.0002	0.0010	-	-	0.1235	0.5411	-	-	-	-	-	-	32727.80	15.50	18.48
6-EP-1c	Cryo Train 6 - Mole Sieve Heater	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	0.0129	0.057	0.0000	0.0001	0.0000	0.0001	-	-	0.0129	0.0563	-	-	-	-	-	-	3408.40	1.50	1.79
6-EP-1d	Cryo Train 6 - HMO Heater	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.098	0.43	-	-	0.0311	0.136	0.0000	0.0002	0.0001	0.0003	-	-	0.0310	0.1357	-	-	-	-	-	-	8205.30	3.75	4.47
6-EP-1e	Train 6 - Glycol Dehy	Emissions from 6-EP-1e are controlled by the thermal oxidizer, unit EP-10. Controlled emissions are represented under unit EP-10.																															1839.60	594.25	0.89
6-EP-1f	Train 6 - Amine	Emissions from 6-EP-1f are controlled by the thermal oxidizer, unit EP-10. Controlled emissions are represented under unit EP-10.																															5276.29	0.00	0.00
7-EP-1c	Cryo Train 7 - Mole Sieve Heater	0.36	1.57	0.60	2.63	0.04	0.17	0.04	0.16	0.05	0.24	0.05	0.24	0.04	0.18	-	-	0.0129	0.057	0.0000	0.0001	0.0000	0.0001	-	-	0.0129	0.0563	-	-	-	-	-	-	3408.40	1.50	1.79
7-EP-1d	Cryo Train 7 - HMO Heater	0.86	3.77	1.45	6.33	0.09	0.41	0.09	0.38	0.13	0.57	0.13	0.57	0.10	0.43	-	-	0.0311	0.136	0.0000	0.0002	0.0001	0.0003	-	-	0.0310	0.1357	-	-	-	-	-	-	8205.30	3.75	4.47
7-EP-2	Cryo 7 Flare SSM	1658.77	11.46	3311.54	22.87	2431.00	14.60	0.01	0.00	-	-	-	-	-	-	0.00	0.00	144.2763	0.866	3.5963	0.0216	0.8908	0.0053	0.0354	0.0002	139.5908	0.8375	0.8589	0.0052	-	-	0.16	0.00	7952.60	866.00	4.17
5.5-EP-1a	AGI 2 HMO Heater	3.43	15.03	3.50	15.33	0.38	1.65	0.35	1.53	0.52	2.28	0.52	2.28	0.39	1.71	-	-	0.1239	0.543	0.0001	0.0006	0.0002	0.0010	-	-	0.1235	0.5411	-	-	-	-	-	-	32727.80	15.50	18.48
5.5-EP-1b	AGI 2 Flare SSM	12.41	0.63	28.87	1.51	9.08	0.54	2684.66	162.10	-	-	-	-	-	-	28.58	1.73	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-	-	0.00	0.00	911.70	30.25	0.00
5.5-EP-1c	Amine Unit Flash Tank & Still Vent (High H2S Handling #2)	Emissions from unit 5.5-EP-1c are controlled by the Acid Gas Injection Well 2 (AGI). During AGI compressor downtime the controlled emissions are represented under the Emergency AGI Flare, unit 5.5-EP-1b.																																		
3-T	Condensate Storage Tanks	Emissions from units 3-T-1 to 3-T-6 are routed to the enclosed combustion device, unit EP-12. Controlled emissions are represented under unit EP-12.																															-	-	-
4-T	Sour Water Tanks	Emissions from units 4-T-1 to 4-T-2 are routed to the flare, unit EP-13. Controlled emissions are represented under unit EP-13.																															-	-	-
5-T	Slop Tanks	-	-	-	-	0.33	1.45	-	-	-	-	-	-	-	-	0.00	0.00	0.02	0.11	0.02	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-LOAD	Condensate Tanks Truck Loading	-	-	-	-	21.37	31.54	-	-	-	-	-	-	-	-	0.00	0.00	0.32	0.47	0.32	0.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-LOAD	Sour Water Tanks Truck Loading	-	-	-	-	20.01	1.35	-	-	-	-	-	-	-	-	0.01	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5-LOAD	Slop Tanks Truck Loading	-	-	-	-	3.52	0.66	-	-	-	-	-	-	-	-	0.00	0.00	0.26	0.05	0.26	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EP-8	Thermal Oxidizer	5.50	24.09	3.50	15.33	3.56	15.57	9.96	43.61	0.21	0.91	0.21	0.91	0.21	0.91	0.11	0.46	1.77	7.74	1.01	4.43	0.39	1.73	0.02	0.08	0.24	1.05	-	-	-	-	0.10	0.46	14345.95	0.27	0.03
EP-10	Thermal Oxidizer	16.40	69.97	9.98	42.49	3.66	15.69	0.74	30.24	9.40	40.33	9.40	40.33	7.05	30.25	0.08	0.32	1.66	7.13	0.75	3.22	0.24	1.05	0.01	0.04	0.60	2.58	0.01	0.03	-	-	0.05	0.21	52058.20	24.50	29.20
EP-11	Thermal Oxidizer SSM	0.00	0.00	0.00	0.00	365.50	32.02	0.00	0.00	-	-	0.00	0.00	0.00	0.00	3.75	0.33	165.47	14.41	75.07	6.54	24.40	2.12	0.99	0.09	60.17	5.24	0.00	0.00	-	-	4.83	0.42	9158.89	163.73	0.00
EP-12	Condensate Tanks Combustor	0.17	0.20	0.33	0.40	4.07	10.58	0.00002	0.00007	-	-	-	-	-	-	0.00004	0.00001	0.03	0.11	0.02	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	-	-	0.00	0.01	360.30	12.75	0.30
EP-13	Sour Water Tanks Flare	0.15	1.12	0.90	3.94	3.62	0.89	0.080	0.026	-	-	-	-	-	-	0.0021	0.0006	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00			0.00	0.00	932.30	73.00	0.60
2-EP-1t	Train 2 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.0003	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.00	109.36	0.00
3-EP-1t	Train 3 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.0003	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.00	109.36	0.00
4-EP-1t	Train 4 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.0003	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.00	109.36	0.00
5-EP-1t	Train 5 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.0003	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.00	109.36	0.00
6-EP-1t	Train 6 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.0003	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.00	109.36	0.00
7-EP-1t	Train 7 - Blowdown SSM	-	-	-	-	2.12	0.01	-	-	-	-	-	-	-	-	0.08	0.0003	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	0.00	109.36	0.00
FUG-1	Fugitive Emissions	-	-	-	-	22.01	96.41	-	-	-	-	-	-	-	-	0.00	0.00	0.83	3.62	0.83	3.62	-	-	-	-	-	-	-	-	-	-	-	-	4462.60	521220.00	0.00
HAUL-1	Haul emissions	-	-	-	-	-	-	-	-	2.46	1.60	0.63	0.41	0.06	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SSM/M	Miscellaneous Startup, Shutdown and Maintenance	-	-	-	-	0.17	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Addition of Facility-wide Controlled Emissions		**3375.31**	**220.27**	**6694.67**	**232.12**	**5334.51**	**249.40**	**2697.64**	**245.50**	**16.08**	**60.39**	**13.62**	**58.79**	**10.48**	**45.24**	**33.01**	**2.84**	**461.32**	**45.83**	**85.57**	**18.95**	**26.93**	**5.42**	**1.33**	**1.25**	**341.13**	**14.56**	**2.05**	**1.45**	**0.23**	**1.03**	**5.46**	**1.75**	**368743.16**	**525195.51**	**151.52**
Total Facitity-wide Controlled Emissions		**5724.28**	**358.96**	**17307.27**	**444.10**	**13115.59**	**496.18**	**3932.32**	**422.85**	**22.82**	**75.97**	**17.86**	**73.47**	**13.76**	**59.28**	**46.14**	**4.72**	**887.09**	**98.03**	**116.15**	**31.14**	**42.63**	**11.37**	**3.56**	**4.82**	**707.73**	**21.58**	**3.08**	**5.99**	**0.99**	**4.34**	**13.13**	**4.99**	**631,679.15**	**525,333.38**	**151.98**

Notes:

1,157,164.51

Train 1 Hot Oil Heater

Emission Unit: 1-EP-1
Source Description: Natural gas-fired hot oil heater
Manufacturer:

Fuel Consumption

Input heat rate	35.30	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	33619.0	scf/hr	Input heat rate / Fuel heat value

Emission Rates

Potential Emission Rate

NOx	CO	VOC	SO_2	PM	Total HAP[1]	Benzene[1]	Toluene[1]	Units	
100	84	5.5		7.6				lb/MMscf	AP-42 Table 1.4-1 & 2
0.0980	0.082	0.0053922		0.007451				lb/MMBtu	lb/MMScf /1020 BTU/scf
			0.002					gr S/scf	Pipeline specification
3.46	2.91	0.19	0.019	0.263	0.51	0.026	0.036	lb/hr	lb/MMscf *scf/hr/1e6
15.16	12.73	0.83	0.084	1.15	2.23	0.12	0.16	tpy	lb/hr * 8760 hrs/yr / 2000lb/ton

2,24-Trimethylpentane[1]	Ethylbenzene[1]	Styrene[1]	n-Hexane[1]	Xylenes[1]	CO_2	CH_4	N_2O	Units	
					53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
0.10	0.075	0.073	0.050	0.047				lb/hr	
0.44	0.33	0.32	0.22	0.20				tpy	GRI-HAPCalc
					16,408	0.31	0.031	metric tons	1x10-3 x Fuel x HHV x EF
					18,086	0.34	0.034	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using GRI-HAPCalc

Exhaust Parameters

Exhaust temp (Tstk):	624	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	6242.2167	scfm	Calculated from F factor and heat rate
Exhaust flow:	14852.657	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	1	ft	Estimated - typical
Stack height:	15	ft	Estimated - typical
Exhaust velocity:	315.2	ft/sec	Exhaust flow ÷ stack area

Train 1 Flare SSM

Emission Unit:	1-EP-2	
Source Description:	Flare SSM	
Manufacturer:		
Destruction Efficiency:	98%	Manufacturer guaranteed DRE for C3+ & H_2S

Fuel Data

Flare Pilot

Flow Rate	500.0	scf/hr	Design
Flow Rate	0.00050	MMscf/hr	
Fuel heat value	1,050.00	Btu/scf	Estimated pipeline gas, HHV
Fuel usage	0.53	MMBtu/hr	
Flow Rate	4.38	MMscf/yr	

Purge Gas

Flow Rate	2,000.00	scf/hr	Eng Estimate
Flow Rate	0.0020	MMscf/hr	scf/hr / 10^6
Fuel heat value	1050.00	Btu/scf	Estimated pipeline gas, HHV
Fuel usage	2.1	MMBtu/hr	MMscf/hr * Btu/scf
Flow Rate	17.5	MMscf/yr	

Flare SSM

Flow Rate	75.00	MMscf/d	Engineering estimate
Flow Rate	3,125.00	Mscf/hr	
Flow Rate	3,125,000.00	scf/hr	Input flow rate (MMscf/day) * (1 day/24 hr) * (10^6 scf/MMscf)
Flow Rate	37,500.00	Mscf/yr	
Fuel heat value	1,204.95	Btu/scf	ProMax, Inlet Gas
Fuel usage	3,765.47	MMBtu/hr	(scf/hr) * (Btu/scf) * (MMBtu/10^6 Btu)

Flare SSM Events

Flaring Time	6.0	hours/event
Events Per Year	2.0	

Inlet Gas Analysis[4]

Composition[1]	Mol%	MW[1]	MW*Mol%	Spec. Volume (scf/lb)[1]	Heating Value (Btu/scf)[1]	Mass Flow (lb/hr)[2]	Mass Flow (lb/yr)[3]
Carbon Dioxide	6.009%	44.01	2.645	8.623	0.0	21777.1	261324.9
Nitrogen	2.305%	28.013	0.646	13.547	0.0	5316.3	63796.1
Hydrogen Sulfide	0.0012%	34.076	0.000	11.136	637.0	3.4	40.4
Methane	70.694%	16.043	11.341	23.65	1009.7	93411.9	1120942.5
Ethane	11.117%	30.07	3.343	12.62	1768.7	27527.8	330333.1
Propane	5.881%	44.097	2.593	8.606	2517.2	21356.0	256271.5
i-Butane	0.744%	58.123	0.432	6.529	3252.6	3560.8	42729.0
n-Butane	1.818%	58.123	1.057	6.529	3262	8701.3	104415.9
i-Pentane	0.450%	72.15	0.325	5.26	3999.7	2675.5	32105.8
n-Pentane	0.464%	72.15	0.335	5.26	4008.7	2758.3	33099.2
Hexanes	0.286%	86.178	0.246	4.4	4756.1	2030.5	24366.1
Heptanes	0.143%	100.205	0.143	3.787	5502.8	1180.0	14160.0
Benzene	0.024%	78.114	0.019	4.858	3741.9	154.6	1855.6
Toluene	0.011%	92.141	0.010	4.119	4474.8	79.8	957.5
Xylene	0.004%	106.16	0.005	3.574	4957	38.5	462.4
Ethylbenzene	0.001%	106.17	0.001	3.574	4970.6	7.9	94.6
Octane	0.048%	114.23	0.054	3.322	5796.1	448.1	5377.0
VOC Total	**9.9%**		**5.22**			**42,991.2**	**515,894.5**
Total	**100%**		**23.20**			**191,027.6**	**2,292,331.5**

Emission Rates

Pilot+ Purge Gas

NOx	CO	VOC	H_2S	SO_2	Units	
0.0680	0.31				lb/MMBtu	Table 13.5-1; AP-42 Section 13
			3.57E-04		lb H_2S/Mscf	Purchased sweet natural gas fuel, 0.25 gr H_2S/100scf
			8.93E-04		lb H_2S/hr	H_2S rate * fuel usage
				7.14E-03	lb S/Mscf	Purchased sweet natural gas fuel, 5 gr S/100scf
				1.79E-02	lb SO_2/hr	SO_2 rate * fuel usage
		0.00%			mol%	Assume no VOC content in purchased fuel (methane)
		23.7			ft^3/lb	Specific volume
		0.00			lb/hr	vol. Gas * mole fraction / specific volume
				98%	%	Estimated conversion of combusted H_2S to SO_2
0.18	0.81	0.00	1.79E-05	0.0016	lb/hr	
0.78	3.56	0.0	7.82E-05	0.0072	tpy	

Train 1 Flare SSM

Emission Unit: 1-EP-2
Source Description: Flare SSM
Manufacturer:

Potential SSM Emission Rate

NOx	CO	VOC	H_2S	SO_2	Units	
0.068	0.31				lb/MMBtu	AP-42 Table 13.5 Emission Factors
				98%	%	Estimated conversion of combusted H_2S to SO_2
256.1	**1,167.3**	**859.8**	**0.067**	**6.2**	lb/hr	lb/MMBtu * MMBtu/hr
1.5	**7.0**	**5.2**	**0.00040**	**0.037**	tpy	lb/hr * hrs/event * events/yr * 1 ton/2000 lb

n-Hexane	Benzene	Toluene	Xylene	Ethylbenzene	Total HAPs	
40.6	**3.1**	**1.6**	**0.77**	**0.16**	**46.2**	**lb/hr**
0.24	**0.019**	**0.010**	**0.0046**	**0.00095**	**0.28**	**tons/yr**

Notes

[1] From "Physical Properties of Hydrocarbons"
[2] Flow (lb/hr) = Volume (Mscf/event) / Duration (hr/event) * 1000cf/Mscf / Sp. Vol. (scf/lb) * Mol%
[3] Flow (tons/yr) = Volume (Mscf/yr) * 1000scf/Mscf / Sp. Vol. (scf/lb) * Mol%
[4] Inlet analysis form ProMax

Fuel gas molecular weight:	23.2	g/mol	Mol. wt. of the gas being burned - Assumed to be methane
Heat release (q):	2.64E+08	cal/sec	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
q_n:	2.03E+08		$q_n = q(1-0.048(MW)^{1/2})$
Effective stack diameter (D):	14.240	m	$D = (10^{-6}q_n)^{1/2}$

Train 1 Flare (SSM)

§98.233(n) Flare stack GHG emissions.

Pilot & Purge Gas & SSM

Step 1. Calculate contribution of un-combusted CH_4 emissions

$E_{a,CH4}$ (un-combusted) = V_a * (1- η)* X_{CH4} *(Equation W-39B)*

where:

$E_{a,CH4}$ = contribution of annual un-combusted CH_4 emissions from regenerator in cubic feet under actual conditions.

V_a = volume of gas sent to combustion unit during the year (cf)

η = Fraction of gas combusted by a burning flare (or regenerator), default value from Subpart W = 0.98

For gas sent to an unlit flare, η is zero.

X_{CH4} = Mole fraction of CH_4 in gas to the flare = 0.7069 Inlet Gas Analysis 1.0 pilot +Purge gas[1]

Step 2. Calculate contribution of un-combusted CO_2 emissions

$E_{a,CO2}$ = V_a * X_{CO2} *(Equation W-20)*

where:

$E_{a,CO2}$ = contribution of annual un-combusted CO_2 emissions from regenerator in cubic feet under actual conditions.

V_a = volume of gas sent to combustion unit during the year (cf)

X_{CO2} = Mole fraction of CO_2 in gas to the flare = 0.060 Inlet Gas Analysis 0.0 pilot +Purge gas[1]

Step 3. Calculate contribution of combusted CO_2 emissions

$E_{a,CO2}$ (combusted) = ∑ (η * V_a * Y_j * R_j) *(Equation W-21)*

where:

η = Fraction of gas combusted by a burning flare (or regenerator) = 0.98

For gas sent to an unlit flare, η is zero.

V_a = volume of gas sent to combustion unit during the year (cf)

Y_j = mole fraction of gas hydrocarbon constituents j:

Constituent j, Methane =	0.7069	Gas Analysis
Constituent j, Ethane =	0.1112	
Constituent j, Propane =	0.0588	
Constituent j, Butane =	0.02562	
Constituent j, Pentanes Plus =	0.0143	

R_j = number of carbon atoms in the gas hydrocarbon constituent j:

Constituent j, Methane =	1
Constituent j, Ethane =	2
Constituent j, Propane =	3
Constituent j, Butane =	4
Constituent j, Pentanes Plus =	5

Step 4. Calculate GHG volumetric emissions at standard conditions (scf).

$$E_{s,n} = \frac{E_{a,n} * (459.67 + T_s) * P_a}{(459.67 + T_a) * P_s}$$ *(Equation W-33)*

where:

$E_{s,n}$ = GHG i volumetric emissions at standard temperature and pressure (STP) in cubic feet

$E_{a,n}$ = GHG i volumetric emissions at actual conditions (cf)

T_s = Temperature at standard conditions (F) = 60 F

T_a = Temperature at actual conditions (F) = 76 F (Based on Annual Avg Max Temperature for Hobbs, NM from

P_s = Absolute pressure at standard conditions (psia) = 14.7 psia

P_a = Absolute pressure at actual conditions (psia) = 14.7 psia (Assumption)

Constant = 459.67 (temperature conversion from F to R)

Step 5. Calculate annual CH_4 and CO_2 mass emissions (ton).

$Mass_{s,i}$ = $E_{s,i}$ * ρ_i * 0.0011023 *(Equation W-36)*

where:

$Mass_{s,i}$ = GHG i (CO_2, CH_4, or N_2O) mass emissions at standard conditions in tons (tpy)

$E_{s,i}$ = GHG i (CO_2, CH_4, or N_2O) volumetric emissions at standard conditions (cf)

ρ_i = Density of GHG i. Use:

CH_4: 0.0192 kg/ft^3 (at 60F and 14.7 psia)

CO_2: 0.0526 kg/ft^3 (at 60F and 14.7 psia)

Step 6. Calculate annual N_2O emissions from portable or stationary fuel combustion sources under actual conditions (cf) using Equation W-40 .

$Mass_{N2O}$ = 0.0011023 * Fuel * HHV * EF *(Equation W-40)*

where:

$Mass_{N2O}$ = annual N_2O emissions from combustion of a particular type of fuel (tons).

Fuel = mass or volume of the fuel combusted

HHV = high heat value of the fuel

Pilot & Purge gas HHV = 0.0011 MMBtu/scf

Inlet Gas HHV = 0.0012 MMBtu/scf

EF = 1.00E-04 kg N_2O/MMBtu

10^{-3} = conversion factor from kg to metric tons.

Step 7. Calculate total annual emission from flare by summing Equations W-40, W-19, W-20, and W-21.

Gas Sent to Flare	Gas Sent to Flare (cf/yr)	CH_4 Un-Combusted, $E_{a,CH4}$ (cf)	CO_2 Un-Combusted, $E_{a,CO2}$ (cf)	CO_2 Combusted, $E_{a,CO2}$ (cf)	CH_4 Un-Combusted, $E_{a,CH4}$ (scf)	CO_2 Un-Combusted, $E_{a,CO2}$ (scf)	CO_2 Combusted, $E_{a,CO2}$ (scf)	CH_4 Un-Combusted, $E_{a,CH4}$ (tpy)	CO_2 Un-Combusted, $E_{a,CO2}$ (tpy)	CO_2 Combusted, $E_{a,CO2}$ (tpy)	N_2O Mass Emissions (tpy)	CO2e (tpy)
Pilot & Purge[1]	21,900,000	438000	0	21,462,000	424,679	0	20,809,294	8.99	0.00	1,206.54	0.00253	1432.0
SSM	37,500,000	530206	2,253,404	47,030,468	514,081	2,184,873	45,600,170	10.88	126.68	2,643.94	0.00498	3044.1

	CO_2	CH_4	N_2O
GWP	1	25	298

Note: [1] Pilot+purge fuel is pipeline quality and assumed to be methane.

Red Hills Gas Processing Plant
Facility-Wide Fugitive Emissions

Analysis[1]

Stream	% VOC	% HAP	% CO_2	% CH_4	% H2S
Vapor	27%	1%	11%	49%	0.0017%
Light liquid	100%	10%	0%	13%	0%
Heavy liquid	100%	10%	0%	13%	0%

Totals

Uncontrolled Rate					Controlled Rate					
VOC	Total HAP	CO_2	CH_4	H2S	VOC	Total HAP	CO_2	CH_4	H2S	
28.48	**1.63**	**6.72**	**29.83**	**1.02E-03**	**23.65**	**1.63**	**6.72**	**29.83**	**1.02E-03**	**lb/hr**
103.61	**7.14**	**29.42**	**130.65**	**4.49E-03**	**103.61**	**7.14**	**29.42**	**130.65**	**4.49E-03**	**tpy**

Train 1.0

Equip Cat	Type	Monitor Frequency	# of Components	Emission Factor[2] (kg/hr/source)	Control (%)[4]	Uncontrolled Rate TOC (lb/hr)	VOC (lb/hr)	Total HAP (lb/hr)	CO_2 (lb/hr)	CH_4 (lb/hr)	H2S (lb/hr)	Controlled Rate VOC (lb/hr)	Total HAP (lb/hr)	CO_2 (lb/hr)	CH_4 (lb/hr)	H2S (lb/hr)
Connector	Light Liquid	Yearly (SS)	2077	2.10E-04		0.96	0.96	0.10	0.00	0.13	0.00	0.96	0.10	0.00	0.13	0.00
Connector	Vapor	Yearly (SS)	2290	2.00E-04		1.01	0.271072328	0.014563745	0.114431168	0.490742768	1.74545E-05	0.27	0.01	0.11	0.49	1.75E-05
Press Relief Device	Light Liquid	Yearly (SS)	4	7.50E-03		0.066	0.066138	0.0066138	0	0.008730216	0.00	0.07	0.01	0.00	0.01	0.00
Press Relief Device	Vapor	Yearly (SS)	1	8.80E-03		0.019	0.005208377	0.000279827	0.002198677	0.009429119	3.35371E-07	0.01	0.00	0.00	0.01	3.35E-07
Compressor	Vapor	Yearly (SS)	0	8.80E-03		0.00	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
Pump	Light Liquid	Monthly (SS)	12	1.30E-03		0.034	0.03439176	0.003439176	0	0.004539712	0.00	0.03	0.00	0.00	0.00	0.00
Valve	Heavy Liquid	Monthly (SS)	1	8.40E-06		1.85E-05	1.85186E-05	1.85186E-06	0	2.40742E-06	0.00E+00	0.00	0.00	0.00	0.00	0.00
Valve	Light Liquid	Monthly (SS)	1212	2.50E-03		6.68	6.679938	0.6679938	0	0.881751816	0.00	6.68	0.67	0.00	0.88	0.00
Valve	Vapor	Monthly (SS)	1072	4.50E-03		10.63	2.855137354	0.153396306	1.205275008	5.168871421	0.000183844	2.86	0.15	1.21	5.17	1.84E-04
		Total	**6669**			**Total lb/hr**	10.87	0.94	1.32	6.69	0.00	10.87	0.94	1.32	6.69	2.02E-04
						Total tpy	47.6	4.1	5.8	29.3	0.00	47.6	4.1	5.8	29.3	8.83E-04

Train 2
(240 cryo skid)

Equip Cat	Type	Monitor Frequency	# of Components	Factor[2] (kg/hr/source)	Control (%)	Uncontrolled Rate TOC (lb/hr)	VOC (lb/hr)	Total HAP (lb/hr)	CO_2 (lb/hr)	CH_4 (lb/hr)	H2S (lb/hr)	Controlled Rate VOC (lb/hr)	Total HAP (lb/hr)	CO_2 (lb/hr)	CH_4 (lb/hr)	H2S (lb/hr)
Connector	Vapor	Yearly (SS)	5446	2.00E-04		2.4013	0.644654976	0.034635003	0.272136306	1.167067735	4.15E-05	0.64	0.03	0.27	1.17	4.15E-05
Press Relief Device	Vapor	Yearly (SS)	10	8.80E-03		0.1940	0.052083766	0.002798274	0.021986775	0.094291187	3.35E-06	0.05	0.00	0.02	0.09	3.35E-06
Valve	Vapor	Monthly (SS)	1338	4.50E-03		13.2739	3.563594944	0.191459195	1.504345113	6.45144586	2.29E-04	3.56	0.19	1.50	6.45	2.29E-04
		Total	**6794**			Total lb/hr	4.26	0.23	1.80	7.71	2.74E-04	4.26	0.23	1.80	7.71	2.74E-04
						Total tpy	18.7	1.0	7.9	33.8	1.20E-03	18.7	1.0	7.9	33.8	1.20E-03

Train 3

Equip Cat	Type	Monitor Frequency	# of Components	Factor[2] (kg/hr/source)	Control (%)	Uncontrolled Rate TOC (lb/hr)	VOC (lb/hr)	Total HAP (lb/hr)	CO_2 (lb/hr)			Controlled Rate				
Connector	Vapor	Yearly (SS)	5446	2.00E-04		2.4013	0.644654976	0.034635003	0.272136306	1.167067735	4.15E-05	0.64	0.03	0.27	1.17	4.15E-05
Press Relief Device	Vapor	Yearly (SS)	10	8.80E-03		0.1940	0.052083766	0.002798274	0.021986775	0.094291187	3.35E-06	0.05	0.00	0.02	0.09	3.35E-06
Valve	Vapor	Monthly (SS)	1338	4.50E-03		13.2739	3.563594944	0.191459195	1.504345113	6.45144586	2.29E-04	3.56	0.19	1.50	6.45	2.29E-04
		Total	**6794**			Total lb/hr	4.26	0.23	1.80	7.71	2.74E-04	4.26	0.23	1.80	7.71	2.74E-04
						Total tpy	18.7	1.0	7.9	33.8	1.20E-03	18.7	1.0	7.9	33.8	1.20E-03

Train 4

Equip Cat	Type	Monitor Frequency	# of Components	Factor[2] (kg/hr/source)	Control (%)	Uncontrolled Rate						Controlled Rate				
						TOC (lb/hr)	VOC (lb/hr)	Total HAP (lb/hr)	CO_2 (lb/hr)							
Connector	Vapor	Yearly (SS)	5446	2.00E-04		2.4013	0.644654976	0.034635003	0.272136306	1.167067735	4.15E-05	0.64	0.03	0.27	1.17	4.15E-05
Press Relief Device	Vapor	Yearly (SS)	10	8.80E-03		0.1940	0.052083766	0.002798274	0.021986775	0.094291187	3.35E-06	0.05	0.00	0.02	0.09	3.35E-06
Valve	Vapor	Monthly (SS)	1338	4.50E-03		13.2739	3.563594944	0.191459195	1.504345113	6.45144586	2.29E-04	3.56	0.19	1.50	6.45	2.29E-04
		Total	**6794**			Total lb/hr	4.26	0.23	1.80	7.71	2.74E-04	4.26	0.23	1.80	7.71	2.74E-04
						Total tpy	18.7	1.0	7.9	33.8	1.20E-03	18.7	1.0	7.9	33.8	1.20E-03

Note

[1] Analyses based on inlet gas and liquid analyses fro Red Hills Gas Plant

[2] Emission factors from Table 2-4 of the EPA Protocol for Equipment Leak Emission Estimates, November 1995

[3] Hourly emissions are shown for informational purposes only.

[2] Control effectiveness for an LDAR Program from Table 5-2 of the EPA Protocol for Equipment Leak Emission Estimates, November 1995

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Fugitives Emissions

EPN	5FUG
Name	Train 5 & 6 Amine and Dehy

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)	

(1)

Gas Weight Percents From Analyses Tab:	
VOC wt %	24.6270
Benzene wt %	0.0564
H_2S wt %	0.0003

Gas

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
1072	Valve	0.009920	10.63424	46.5779712
	Pump Seal	0.005290	0	0
2290	Connector	0.000440	1.0076	4.413288
	Flange	0.000860	0	0
	Open-ended Line	0.004410	0	0
1	Other	0.019400	0.0194	0.084972
		Total:	11.66124	51.0762312

	VOC content (wt %)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	24.6270	0.0564	0.0003	0.0000
Pump Seal	24.6270	0.0564	0.0003	0.0000
Connector	24.6270	0.0564	0.0003	0.0000
Flange	24.6270	0.0564	0.0003	0.0000
Open-ended Line	24.6270	0.0564	0.0003	0.0000
Other	24.6270	0.0564	0.0003	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	2.62	11.47	0.00	0.00	0.01	0.03
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	0.25	1.09	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	0.02	0.00	0.00	0.00	0.00
Total:	2.87	12.58	0.00	0.00	0.01	0.03

(2)

Liquid Weight Percents From Analyses Tab:	
VOC wt %	#DIV/0!
Benzene wt %	#DIV/0!
H_2S wt %	#DIV/0!

Heavy Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
1	Valve	0.0000185	0.0000185	0.00008103
	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:	0.0000185	0.00008103

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	100.0000	10.0000	0.0000	0.0000
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 %	#DIV/0!

(3)

Light Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
1212	Valve	0.005500	6.666	29.19708
12	Pump Seal	0.028660	0.34392	1.5063696
2077	Connector	0.000463	0.961651	4.21203138
	Flange	0.000243	0	0
	Open-ended Line	0.003090	0	0
4	Other	0.016500	0.066	0.28908
		Total:	8.037571	35.204561

	VOC content (wt%)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	100.0000	10.0000	0.0000	0.0000
Pump Seal	100.0000	10.0000	0.0000	0.0000
Connector	100.0000	10.0000	0.0000	0.0000
Flange	100.0000	10.0000	0.0000	0.0000
Open-ended Line	100.0000	10.0000	0.0000	0.0000
Other	100.0000	10.0000	0.0000	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	6.67	29.20	0.00	0.00	0.67	2.92
Pump Seal	0.34	1.51	0.00	0.00	0.03	0.15
Connector	0.96	4.21	0.00	0.00	0.10	0.42
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	0.07	0.29	0.00	0.00	0.01	0.03
Total:	8.04	35.20	0.00	0.00	0.80	3.52

(4)

Water/Oil

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
	Valve	0.000216	0	0
	Pump Seal	0.000052	0	0
	Connector	0.000243	0	0
	Flange	0.000006	0	0
	Open-ended Line	0.000550	0	0
	Other	0.030900	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

Reference to Emission factors used:

1. Emission factors are for oil and gas production facilities (not refineries) come from the EPA's "Protocol for Equipment Leak Emission Estimates" November 1995, EPA 4531, R-95-017, Table 2-4.

2. 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.

(5)

Fugitive Total Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	10.91	47.78
benzene	0.81	3.55
H_2S	0.00	0.00

Notes:

Enter any notes here:

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Fugitives Emissions

EPN	6FUG
Name	Train 5, 6 & 7 (cryo)

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)	

(1) Gas

Gas Weight Percents From Analyses Tab:	
VOC wt %	24.6270
Benzene wt %	0.0564
H_2S wt %	0.0003

number	component	emission factor (lb/hr of TOC per component)	lb/hr	tpy
4014	Valve	0.009920	39.81888	174.406694
	Pump Seal	0.005290	0	0
16338	Connector	0.000440	7.18872	31.4865936
	Flange	0.000860	0	0
	Open-ended Line	0.004410	0	0
30	Other	0.019400	0.582	2.54916
		Total:	47.5896	208.442448

	VOC content (wt %)	Benzene content (wt%)	H_2S content (wt%)	Control Efficiency (%)
Valves	23.3305	0.0345	0.0006	0.0000
Pump Seal	23.3305	0.0345	0.0006	0.0000
Connector	23.3305	0.0345	0.0006	0.0000
Flange	23.3305	0.0345	0.0006	0.0000
Open-ended Line	23.3305	0.0345	0.0006	0.0000
Other	23.3305	0.0345	0.0006	0.0000

	VOC Emissions		H_2S Emissions		Benzene Emissions	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Valves	9.29	40.69	0.00	0.00	0.01	0.06
Pump Seal	0.00	0.00	0.00	0.00	0.00	0.00
Connector	1.68	7.35	0.00	0.00	0.00	0.01
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	0.14	0.59	0.00	0.00	0.00	0.00
Total:	11.10	48.63	0.00	0.00	0.02	0.07

(2) Heavy Oil

Liquid Weight Percents From Analyses Tab:	
VOC wt %	#DIV/0!
Benzene wt %	#DIV/0!
H_2S wt %	#DIV/0!

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 %	#DIV/0!

(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
	Valve	0.000216	0	0
	Pump Seal	0.000052	0	0
	Connector	0.000243	0	0
	Flange	0.000006	0	0
	Open-ended Line	0.000550	0	0
	Other	0.030900	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

Reference to Emission factors used:

1. Emission factors are for oil and gas production facilities (not refineries) come from the EPA's "Protocol for Equipment Leak Emission Estimates" November 1995, EPA 4531, R-95-017, Table 2-4.

2. 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.

(5)

Fugitive Total Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	11.10	48.63
benzene	0.02	0.07
H_2S	0.00	0.00

Notes:

Enter any notes here:

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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).
C) Make sure to select the correct *Emission Type* from the pull down menus below. A *VOC type* does not need to be

Heater and Boiler Emission Calculations (fueled by natural gas)

EPN	5-EP-1b	
Name	Train 5 - Amine/Glycol Reboiler 1	
Heater/Boiler rating (MMBtu/hr):	70	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled low NOx burner	(assume uncontrolled, unless specifically stated otherwise)
Operating hours/year:	8760	
Fuel Heat Value (Btu/SCF):	1020	

Pollutant	Emission Factor (lb/MMCF)	Emission Factor (lb/MMBtu)	lb/hr	tpy
VOC	5.5	-	0.377	1.653
NOx	50	-	3.431	15.029
CO	-	0.05	3.500	15.330
PM_{10}	7.6	-	0.522	2.284
$PM_{2.5}$	5.7	-	0.391	1.713
SO_2	0.6	-	0.348	1.526

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.3483**
SO_2 produced (tpy) =	**1.5258**

assumptions:

SO2 MW	64.06	lb/lb-mole
Ideal Gas L	378.61	SCF/lb-mole

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:	Using Emission Factor for CO from the Manufacturers spec and a safety factor of 25%.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	5-EP-1c	
Name	Cryo Train 5 - Mole Sieve Heater	
Heater/Boiler rating (MMBtu/hr):	7.29	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.039	0.172
NOx	50	0.357	1.565
CO	84	0.600	2.630
PM_{10}	7.6	0.054	0.238
$PM_{2.5}$	5.7	0.041	0.178
SO_2	0.6	0.036	0.159

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0363**
SO_2 produced (tpy) =	**0.1589**

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	5-EP-1d	
Name	Cryo Train 5 - HMO Heater	
Heater/Boiler rating (MMBtu/hr):	17.55	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.095	0.414
NOx	50	0.860	3.768
CO	84	1.445	6.330
PM_{10}	7.6	0.131	0.573
$PM_{2.5}$	5.7	0.098	0.430
SO_2	0.6	0.087	0.383

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0873**
SO_2 produced (tpy) =	**0.3825**

assumptions:

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

Enter any notes here:	PM EF = 0.014lb/MMBtu @16ppm

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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).
C) Make sure to select the correct *Emission Type* from the pull down menus below. A *VOC type* does not need to be

Heater and Boiler Emission Calculations (fueled by natural gas)

EPN	6-EP-1a	
Name	Train 5 - Amine/Glycol Reboiler 1	
Heater/Boiler rating (MMBtu/hr):	70	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(assume uncontrolled, unless specifically stated otherwise)
Operating hours/year:	8760	
Fuel Heat Value (Btu/SCF):	1020	

Pollutant	Emission Factor (lb/MMCF)	Emission Factor (lb/MMBtu)	lb/hr	tpy
VOC	5.5	-	0.377	1.653
NOx	50	-	3.431	15.029
CO	-	0.05	3.500	15.330
PM_{10}	7.6	-	0.522	2.284
$PM_{2.5}$	5.7	-	0.391	1.713
SO_2	0.6	-	0.348	1.526

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.3483**
SO_2 produced (tpy) =	**1.5258**

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

Emission Type: (pick from list)
Steady State (continuous)

Enter any notes here:	Using Emission Factor for CO from the Manufacturers spec and a safety factor of 25%.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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).
C) Make sure to select the correct *Emission Type* from the pull down menus below. A *VOC type* does not need to be

Heater and Boiler Emission Calculations (fueled by natural gas)

EPN	6-EP-1b	
Name	Train 5 - Amine/Glycol Reboiler 1	
Heater/Boiler rating (MMBtu/hr):	70	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(assume uncontrolled, unless specifically stated otherwise)
Operating hours/year:	8760	
Fuel Heat Value (Btu/SCF):	1020	

Pollutant	Emission Factor (lb/MMCF)	Emission Factor (lb/MMBtu)	lb/hr	tpy
VOC	5.5	-	0.377	1.653
NOx	50	-	3.431	15.029
CO	-	0.05	3.500	15.330
PM_{10}	7.6	-	0.522	2.284
$PM_{2.5}$	5.7	-	0.391	1.713
SO_2	0.6	-	0.348	1.526

If the heater/boiler is fueled by Sour Gas, <u>cannot</u> 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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.3483**
SO_2 produced (tpy) =	**1.5258**

assumptions:

SO2 MW	64.06	lb/lb-mole
Ideal Gas L	378.61	SCF/lb-mole

Emission Type: (pick from list)	
Steady State (continuous)	

Enter any notes here:	Using Emission Factor for CO from the Manufacturers spec and a safety factor of 25%.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	6-EP-1c	
Name	Cryo Train 6 - Mole Sieve Heater	
Heater/Boiler rating (MMBtu/hr):	7.29	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.039	0.172
NOx	50	0.357	1.565
CO	84	0.600	2.630
PM_{10}	7.6	0.054	0.238
$PM_{2.5}$	5.7	0.041	0.178
SO_2	0.6	0.036	0.159

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0363**
SO_2 produced (tpy) =	**0.1589**

assumptions:

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	6-EP-1d	
Name	Cryo Train 6 - HMO Heater	
Heater/Boiler rating (MMBtu/hr):	17.55	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.095	0.414
NOx	50	0.860	3.768
CO	84	1.445	6.330
PM_{10}	7.6	0.131	0.573
$PM_{2.5}$	5.7	0.098	0.430
SO_2	0.6	0.087	0.383

If the heater/boiler is fueled by Sour Gas, <u>cannot</u> 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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0873**
SO_2 produced (tpy) =	**0.3825**

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	7-EP-1c	
Name	Cryo Train 7 - Mole Sieve Heater	
Heater/Boiler rating (MMBtu/hr):	7.29	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.039	0.172
NOx	50	0.357	1.565
CO	84	0.600	2.630
PM_{10}	7.6	0.054	0.238
$PM_{2.5}$	5.7	0.041	0.178
SO_2	0.6	0.036	0.159

If the heater/boiler is fueled by Sour Gas, <u>cannot</u> 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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0363**
SO_2 produced (tpy) =	**0.1589**

assumptions:

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	7-EP-1d	
Name	Cryo Train 7 - HMO Heater	
Heater/Boiler rating (MMBtu/hr):	17.55	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.095	0.414
NOx	50	0.860	3.768
CO	84	1.445	6.330
PM_{10}	7.6	0.131	0.573
$PM_{2.5}$	5.7	0.098	0.430
SO_2	0.6	0.087	0.383

If the heater/boiler is fueled by Sour Gas, <u>cannot</u> 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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0873**
SO_2 produced (tpy) =	**0.3825**

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	4-EP-1g	
Name	Train 4 - Stabilizer Heater	
Heater/Boiler rating (MMBtu/hr):	4.5	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.024	0.106
NOx	50	0.221	0.966
CO	84	0.371	1.623
PM_{10}	7.6	0.034	0.147
$PM_{2.5}$	5.7	0.025	0.110
SO_2	0.6	0.022	0.098

If the heater/boiler is fueled by Sour Gas, <u>cannot</u> 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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0224**
SO_2 produced (tpy) =	**0.0981**

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

Enter any notes here:	These are updated emissions from 4-EP-1g. Previously permitted at 18MMBtu/hr heater/boiler rating.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	2-EP-1a	
Name	Train 2 - Mol Sieve Heater	
Heater/Boiler rating (MMBtu/hr):	5.6	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.030	0.132
NOx	50	0.275	1.202
CO	84	0.461	2.020
PM_{10}	7.6	0.042	0.183
$PM_{2.5}$	5.7	0.031	0.137
SO_2	0.6	0.028	0.122

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0279**
SO_2 produced (tpy) =	**0.1221**

assumptions:

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

Enter any notes here:	These are updated emissions from 2-EP-1a. These are low NOx burner, previously permitted at 'below 100 MMBtu/hr, uncontrolled'.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	2-EP-1b	
Name	Train 2 - HMO Heater	
Heater/Boiler rating (MMBtu/hr):	23.65	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.128	0.559
NOx	50	1.159	5.078
CO	84	1.948	8.531
PM_{10}	7.6	0.176	0.772
$PM_{2.5}$	5.7	0.132	0.579
SO_2	0.6	0.118	0.515

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.1177**
SO_2 produced (tpy) =	**0.5155**

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

Enter any notes here:	These are updated emissions from 2-EP-1b. These are low NOx burner, previously permitted at 'below 100 MMBtu/hr, uncontrolled'.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	3-EP-1a	
Name	Train 3 - Mol Sieve Heater	
Heater/Boiler rating (MMBtu/hr):	7.29	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.039	0.172
NOx	50	0.357	1.565
CO	84	0.600	2.630
PM_{10}	7.6	0.054	0.238
$PM_{2.5}$	5.7	0.041	0.178
SO_2	0.6	0.036	0.159

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0363**
SO_2 produced (tpy) =	**0.1589**

assumptions:

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

Enter any notes here:	These are updated emissions from 3-EP-1a. These are low NOx burner, previously permitted at 'below 100 MMBtu/hr, uncontrolled'.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	3-EP-1b	
Name	Train 3 - HMO Heater	
Heater/Boiler rating (MMBtu/hr):	17.55	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.095	0.414
NOx	50	0.860	3.768
CO	84	1.445	6.330
PM_{10}	7.6	0.131	0.573
$PM_{2.5}$	5.7	0.098	0.430
SO_2	0.6	0.087	0.383

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0873**
SO_2 produced (tpy) =	**0.3825**

assumptions:

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

Enter any notes here:	These are updated emissions from 3-EP-1b. These are low NOx burner, previously permitted at 'below 100 MMBtu/hr, uncontrolled'.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	4-EP-1a	
Name	Train 4 - Mol Sieve Heater	
Heater/Boiler rating (MMBtu/hr):	7.29	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.039	0.172
NOx	50	0.357	1.565
CO	84	0.600	2.630
PM_{10}	7.6	0.054	0.238
$PM_{2.5}$	5.7	0.041	0.178
SO_2	0.6	0.036	0.159

If the heater/boiler is fueled by Sour Gas, <u>cannot</u> 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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0363**
SO_2 produced (tpy) =	**0.1589**

assumptions:

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

Enter any notes here:	These are updated emissions from 4-EP-1a. These are low NOx burner, previously permitted at 'below 100 MMBtu/hr, uncontrolled'.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	4-EP-1b	
Name	Train 4 - HMO Heater	
Heater/Boiler rating (MMBtu/hr):	17.55	
Rating above is **(select from list)**:	below 100 MMBtu/hp-hr, controlled - low NOx burner	(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	0.095	0.414
NOx	50	0.860	3.768
CO	84	1.445	6.330
PM_{10}	7.6	0.131	0.573
$PM_{2.5}$	5.7	0.098	0.430
SO_2	0.6	0.087	0.383

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 %) =	**0.0030**
SO_2 produced (lb/hr) =	**0.0873**
SO_2 produced (tpy) =	**0.3825**

assumptions:

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

Enter any notes here:	These are updated emissions from 4-EP-1b. These are low NOx burner, previously permitted at 'below 100 MMBtu/hr, uncontrolled'.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Heaters-Boilers HAPs Emissions

Emission Unit EPN	Name	Heater Rating (MMBtu/hr)	Benzene		Toulene		Hexane	
			lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
5-EP-1a	Train 5 - Amine/Glycol Reboiler 1	75	0.0002	0.0007	0.0003	0.0011	0.1324	0.5797
5-EP-1b	Train 5 - Amine/Glycol Reboiler 2	70	0.0001	0.0006	0.0002	0.0010	0.1235	0.5411
5-EP-1c	Cryo Train 5 - Mole Sieve Heater	7.29	0.0000	0.0001	0.0000	0.0001	0.0129	0.0563
5-EP-1d	Cryo Train 5 - HMO Heater	17.55	0.0000	0.0002	0.0001	0.0003	0.0310	0.1357
6-EP-1c	Cryo Train 6 - Mole Sieve Heater	7.29	0.0000	0.0001	0.0000	0.0001	0.0129	0.0563
6-EP-1d	Cryo Train 6 - HMO Heater	17.55	0.0000	0.0002	0.0001	0.0003	0.0310	0.1357
6-EP-1a	Train 6 - Amine/Glycol Reboiler 1	70	0.0001	0.0006	0.0002	0.0010	0.1235	0.5411
6-EP-1b	Train 6 - Amine/Glycol Reboiler 2	70	0.0001	0.0006	0.0002	0.0010	0.1235	0.5411
7-EP-1c	Cryo Train 7 - Mole Sieve Heater	7.29	0.0000	0.0001	0.0000	0.0001	0.0129	0.0563
7-EP-1d	Cryo Train 7 - HMO Heater	17.55	0.0000	0.0002	0.0001	0.0003	0.0310	0.1357
5.5-EP-1a	AGI 2 HMO Heater	70	0.0001	0.0006	0.0002	0.0010	0.1235	0.5411
4-EP-1g	Train 4 - Stabilizer Heater	4.98	0.0000	0.0000	0.0000	0.0001	0.0088	0.0385
Total Emissions			0.0009	0.0039	0.0014	0.0063	0.7580	3.3199

Emission Factors

	Emission Factors from AP-42 Table 1.4-3 (lb/10^6scf)	Emission Factors (lb/MMBtu)
Benzene	2.10E-03	2.06E-06
Hexane	1.8	1.76E-03
Pyrene	5.00E-06	4.90E-09
Toulene	3.40E-03	3.33E-06

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Tank Emissions - Process Simulator

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

E) Make sure to answer the control device question.

Process Simulator

EPN	Tank Identifier	Throughput (gal/year)	Stream Identification	Turnovers per year	Mixture/Component	RVP (psia)	Temperature (°F)	Emissions Uncontrolled VOC (lb/hr)	Emissions Uncontrolled VOC (ton/yr)	Emissions Uncontrolled Benzene (lb/hr)	Emissions Uncontrolled Benzene (ton/yr)	Emissions Uncontrolled H_2S (lb/hr)	Emissions Uncontrolled H_2S (ton/yr)	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 (%)	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
3-T-1	Condensate Storage Tanks	7996128	10K Stabilizer – Stre	364	Condensate	8.91	111.21	5.25	22.995	0.08	0.3504	0	0	(B) cont. by flare/ VC/TO/VRU				5.25	23.00	0.08	0.35	0.00	0.00
3-T-2	Condensate Storage Tanks	7996128	10K Stabilizer – Stre	364	Condensate	8.91	111.21	5.25	22.995	0.08	0.3504	0	0	(B) cont. by flare/ VC/TO/VRU				5.25	23.00	0.08	0.35	0.00	0.00
3-T-3	Condensate Storage Tanks	7996128	10K Stabilizer – Stre	364	Condensate	8.91	111.21	5.25	22.995	0.08	0.3504	0	0	(B) cont. by flare/ VC/TO/VRU				5.25	23.00	0.08	0.35	0.00	0.00
3-T-4	Condensate Storage Tanks	7996128	10K Stabilizer – Stre	364	Condensate	8.91	111.21	5.25	22.995	0.08	0.3504	0	0	(B) cont. by flare/ VC/TO/VRU				5.25	23.00	0.08	0.35	0.00	0.00
3-T-5	Condensate Storage Tanks	7996128	10K Stabilizer – Stre	364	Condensate	8.91	111.21	5.25	22.995	0.08	0.3504	0	0	(B) cont. by flare/ VC/TO/VRU				5.25	23.00	0.08	0.35	0.00	0.00
3-T-6	Condensate Storage Tanks	7996128	10K Stabilizer – Stre	364	Condensate	8.91	111.21	5.25	22.995	0.08	0.3504	0	0	(B) cont. by flare/ VC/TO/VRU				5.25	23.00	0.08	0.35	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																	Totals:	31.50	137.97	0.48	2.10	0.00	0.00

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Tank Emissions - Process Simulator

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

Analysis of Head Space from Sour Water Tanks

Composition	Mol%	MW	grams per moles of gas	wt%	lb/hr	tpy
Hydrogen Sulfide	0.083%	34.076	0.03	0.05%	0.00	0.01
Nitrogen	4.397%	28.013	1.23	2.07%	0.06	0.28
Carbon Dioxide	0.023%	44.01	0.01	0.02%	0.00	0.00
Methane	4.015%	16.043	0.64	1.08%	0.03	0.15
Ethane	0.570%	30.07	0.17	0.29%	0.01	0.04
Propane	11.837%	44.097	5.22	8.78%	0.27	1.19
Isobutane	12.712%	58.123	7.39	12.43%	0.38	1.68
N-Butane	30.465%	58.123	17.71	29.79%	0.92	4.03
Isopentane	16.224%	72.15	11.71	19.69%	0.61	2.66
N-Pentane	11.506%	72.15	8.30	13.96%	0.43	1.89
Hexanes +	8.168%	86.178	7.04	11.84%	0.37	1.60
VOC Total	90.912%		59.45	96.49%	2.98	13.05
Total	100%			100.00%	3.09	13.52

Uncontrolled Emissions[1]

Unit	VOC tpy	Total HAP tpy	Benzene tpy	Toluene tpy	Ethylbenzene tpy	2,2,4-Trimethylpentane tpy	p-Xylene tpy	H2S tpy
4-T-1	13.05	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.006
4-T-2	13.05	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.006

Controlled Emissions[2]

Unit	VOC tpy	Total HAP tpy	Benzene tpy	Toluene tpy	Ethylbenzene tpy	2,2,4-Trimethylpentane tpy	p-Xylene tpy
Emissions from units 4-T are routed to the flare, unit EP-13. Controlled emissions are represented under unit EP-13.							

Stream Properties					
	Pressurized Inlet	Flashing Losses	Working Losses	Breathing Losses	Total Losses
MW [lb/lbmol]	18.03	40.00	34.08	34.08	
Heating Value [BTU/scf]	-	96.6	182.6	182.6	
Specific Gravity		-	-	-	-
Reid Vapor Pressure [psi]	2.48	-	-	-	-
Gas Volumetric Flow [scf/hr]	-	6.18	0.00	13.82	19.99

SHAMROCK GAS ANALYSIS, INC.

LABORATORY REFERENCE NUMBER : **E46489 - FT7374**

LUCID ENERGY

ID:	**RED HILLS PLANT ACID GAS**	LINE PRESSURE:	**10 PSI**
AREA:	**NOT/REC**	LINE TEMPERATURE:	**99 F**
METER:	**SOUR WATER TANKS**	CYLINDER NUMBER:	**6341**
LEASE:	**SOUR WATER TANKS**	EFFECTIVE DATE:	**6/1/2018**
OPERATOR:	**LUCID**	SAMPLED BY:	**M. BRENNAN**
STATION:	**RED HILLS PLANT ACID GAS**	ANALYZED BY:	**BRENNAN**
SAMPLE DATE:	**5/30/2018**	ANALYZED DATE:	**6/1/2018**
SAMPLE OF:	**GAS**	SAMPLE TYPE:	**SPOT**

For: LUCID ENERGY
Attn: T. KIRK
288 KINCAID ROAD
ARTESIA, NEW MEXICO 88210

Physical Properties per GPA 2145-09 — **Calculations per GPA 2172-09**

Note: Zero = Less than detection limit

	MOL%	GPM @ 14.73
HYDROGEN SULFIDE	0.083	0.012
NITROGEN	4.397	0.501
CARBON DIOXIDE	0.023	0.004
METHANE	4.015	0.705
ETHANE	0.570	0.158
PROPANE	11.837	3.376
ISOBUTANE	12.712	4.306
N-BUTANE	30.465	9.943
ISOPENTANE	16.224	6.142
N-PENTANE	11.506	4.318
HEXANES PLUS	8.168	3.690
	100.000	33.155

BTU	Vol. Ideal Gas Fuel	Vol. Real Gas Fuel
BTU @ 14.73 PSIA (DRY)	3293.1	3410.0
BTU @ 14.73 PSIA (SAT.)	3235.8	3352.1
Specific Gravity	2.0723	2.1449
Compressibility (Z)	0.9657	

Gasoline Content (Gallons Per Thousand - GPM)

Ethane & Heavier	31.933
Propane & Heavier	31.775
Butane & Heavier	28.399
Pentane & Heavier	14.150
Total 26 psi Reid V.P. Gasoline GPM	19.438

Remarks: Field H2S ppm = 830 (TUTWILER) HEAD SPACE FROM SOUR WATER TANKS
Remarks: NO PREVIOUS BTU AVAILABLE

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Tank Emissions - Process Simulator

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

E) Make sure to answer the control device question.

Process Simulator

EPN	Tank Identifier	Throughput (gal/year)	Stream Identification	Turnovers per year	Mixture/Component	RVP (psia)	Temperature (°F)	Emissions Uncontrolled VOC (lb/hr)	Emissions Uncontrolled VOC (ton/yr)	Emissions Uncontrolled Benzene (lb/hr)	Emissions Uncontrolled Benzene (ton/yr)	Emissions Uncontrolled H_2S (lb/hr)	Emissions Uncontrolled H_2S (ton/yr)	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 (%)	Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)	VOC Results (lb/hr)	VOC Results (tpy)	Benzene Results (lb/hr)	Benzene Results (tpy)	H_2S Results (lb/hr)	H_2S Results (tpy)
5-T-1	Slop Tanks	927465	Mol Sieve – Stream 1	55	Slop	1.04	111.62	0.083	0.36354	0.006	0.02628	0	0	(A) uncontrolled				0.08	0.36	0.01	0.03	0.00	0.00
5-T-2	Slop Tanks	927465	Mol Sieve – Stream 1	55	Slop	1.04	111.62	0.083	0.36354	0.006	0.02628	0	0	(A) uncontrolled				0.08	0.36	0.01	0.03	0.00	0.00
5-T-3	Slop Tanks	927465	Mol Sieve – Stream 1	55	Slop	1.04	111.62	0.083	0.36354	0.006	0.02628	0	0	(A) uncontrolled				0.08	0.36	0.01	0.03	0.00	0.00
5-T-4	Slop Tanks	927465	Mol Sieve – Stream 1	55	Slop	1.04	111.62	0.083	0.36354	0.006	0.02628	0	0	(A) uncontrolled				0.08	0.36	0.01	0.03	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																		0.00	0.00	0.00	0.00	0.00	0.00
																	Totals:	**0.33**	**1.45**	**0.02**	**0.11**	**0.00**	**0.00**

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	2-LOAD
Identifier	Sour Water Tanks Truck Loading

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 =	18.27	True vapor pressure of liquid loaded (psia)
M =	41.52	Molecular Weight of Vapors (lb/lb-mole)
T =	554.67	Temperature of bulk liquid loaded (in degrees Rankine)
Hourly Loading Rate	8000	Gallons Loaded per Hour
L_L =	10.22	Loading Loss (lb VOC released/1000 gal liquid loaded)
	81.79	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?	(B) cont. by flare/ VC/TO/VRU

Vapor Weight Percents		
VOC	96.49	Vapor VOC wt%
benzene	0.00	Vapor Benzene wt%
H_2S	0.05	Vapor H_2S wt%
Produced Water Reduction		
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	78.92	Emissions Uncontrolled VOC (lb/hr)
benzene	0.00	Emissions Uncontrolled Benzene (lb/hr)
H_2S	0.04	Emissions Uncontrolled H_2S (lb/hr)
Collection Efficiency		
	70.00	Collection Efficiency (%)
Vapors Uncaptured by Control Device		
VOC	23.68	VOC Uncaptured Vapors (lb/hr)
benzene	0.00	benzene Uncaptured Vapors (lb/hr)
H_2S	0.01	H_2S Uncaptured Vapors (lb/hr)
Vapors Captured by Control Device		
VOC	55.25	VOC Uncaptured Vapors (lb/hr)
benzene	0.00	benzene Uncaptured Vapors (lb/hr)
H_2S	0.03	H_2S Uncaptured Vapors (lb/hr)
Control Efficiency		
VOC	95.00	VOC Control Efficiency (%)
H_2S	95.00	H_2S Control Efficiency (%)
Vapors Uncontrolled by Control Device (Controlled Emissions)		
VOC	2.76	VOC Results (lb/hr)
benzene	0.00	Benzene Results (lb/hr)
H_2S	0.00	H_2S Results (lb/hr)

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

Enter Barrels of Liquid	Gallons of liquid:
600	25200

Enter gallons per year	Barrels per day:
9198000	600

Enter any notes here:
Updating the percentages used in the previous application.

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 =	18.27	= True vapor pressure of liquid loaded (psia)
M =	41.52	= Molecular Weight of Vapors (lb/lb-mole)
T =	522.07	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	9198000	= Gallons Loaded per Year
L_L =	10.86	Loading Loss (lb VOC released/1000 gal liquid loaded)
	49.95	VOC Uncontrolled Emissions (ton/yr)
	Vapor Weight Percents	
VOC	96.49	Vapor VOC wt%
benzene	0.00	Vapor Benzene wt%
H_2S	0.05	Vapor H_2S wt%
	Produced Water Reduction	
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
	Uncontrolled Emissions	
VOC	48.20	Emissions Uncontrolled VOC (ton/yr)
benzene	0.00	Emissions Uncontrolled Benzene (ton/yr)
H_2S	0.02	Emissions Uncontrolled H_2S (ton/yr)
	Collection Efficiency	
	70.00	Collection Efficiency (%)
	Vapors Uncaptured by Control Device	
VOC	14.46	VOC Uncaptured Vapors (ton/yr)
benzene	0.00	benzene Uncaptured Vapors (ton/yr)
H_2S	0.01	H_2S Uncaptured Vapors (ton/yr)
	Vapors Captured by Control Device	
VOC	33.74	VOC captured Vapors (lb/hr)
benzene	0.00	benzene captured Vapors (lb/hr)
H_2S	0.02	H_2S captured Vapors (lb/hr)
	Control Efficiency	
VOC	95.00	VOC Control Efficiency (%)
H_2S	95.00	H_2S Control Efficiency (%)
	Vapors Uncontrolled by Control Device (Controlled Emissions)	
VOC	1.69	VOC Results (ton/yr)
benzene	0.00	Benzene Results (ton/yr)
H_2S	0.00	H_2S Results (ton/yr)

Loading Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	23.68	14.46
benzene	0.00	0.00
H_2S	0.01	0.01

0.012269

Enter temperature in Fahrenheit °F:	Temperature in Rankine (°R):
62.4	522.07

Enter Barrels of Liquid	Gallons of liquid:
600	25200

Enter gallons per year	Barrels per day:
9198000	600

Enter any notes here:

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	3-LOAD
Identifier	Condensate Tanks Truck Loading

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 =	9.06	True vapor pressure of liquid loaded (psia)
M =	75.03	Molecular Weight of Vapors (lb/lb-mole)
T =	570.88	Temperature of bulk liquid loaded (in degrees Rankine)
Hourly Loading Rate	8000	Gallons Loaded per Hour
L_L =	8.90	Loading Loss (lb VOC released/1000 gal liquid loaded)
	71.22	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?	(B) cont. by flare/ VC/TO/VRU

Vapor Weight Percents

VOC	100.00	Vapor VOC wt%
benzene	1.49	Vapor Benzene wt%
H_2S	0.00	Vapor H_2S wt%

Produced Water Reduction

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

Uncontrolled Emissions

VOC	71.22	Emissions Uncontrolled VOC (lb/hr)
benzene	1.06	Emissions Uncontrolled Benzene (lb/hr)
H_2S	0.00	Emissions Uncontrolled H_2S (lb/hr)

Collection Efficiency

	70.00	Collection Efficiency (%)

Vapors Uncaptured by Control Device

VOC	21.37	VOC Uncaptured Vapors (lb/hr)
benzene	0.32	benzene Uncaptured Vapors (lb/hr)
H_2S	0.00	H_2S Uncaptured Vapors (lb/hr)

Vapors Captured by Control Device

VOC	49.85	VOC Uncaptured Vapors (lb/hr)
benzene	0.74	benzene Uncaptured Vapors (lb/hr)
H_2S	0.00	H_2S Uncaptured Vapors (lb/hr)

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):
111.21	570.88

Enter Barrels of Liquid	Gallons of liquid:
3129.6	131443.2

Enter gallons per year	Barrels per day:
47976768	3129.6

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 =	4.08	= True vapor pressure of liquid loaded (psia)
M =	75.03	= Molecular Weight of Vapors (lb/lb-mole)
T =	522.07	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	47976768	= Gallons Loaded per Year
L_L =	4.38	Loading Loss (lb VOC released/1000 gal liquid loaded)
	105.14	VOC Uncontrolled Emissions (ton/yr)

Vapor Weight Percents

VOC	100.00	Vapor VOC wt%
benzene	1.49	Vapor Benzene wt%
H_2S	0.00	Vapor H_2S wt%

Produced Water Reduction

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

Uncontrolled Emissions

VOC	105.14	Emissions Uncontrolled VOC (ton/yr)
benzene	1.57	Emissions Uncontrolled Benzene (ton/yr)
H_2S	0.00	Emissions Uncontrolled H_2S (ton/yr)

Collection Efficiency

	70.00	Collection Efficiency (%)

Vapors Uncaptured by Control Device

VOC	31.54	VOC Uncaptured Vapors (ton/yr)
benzene	0.47	benzene Uncaptured Vapors (ton/yr)
H_2S	0.00	H_2S Uncaptured Vapors (ton/yr)

Vapors Captured by Control Device

VOC	73.59	VOC captured Vapors (lb/hr)
benzene	1.10	benzene captured Vapors (lb/hr)
H_2S	0.00	H_2S captured Vapors (lb/hr)

Loading Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	21.37	31.54
benzene	0.32	0.47
H_2S	0.00	0.00

Enter temperature in Fahrenheit °F:	Temperature in Rankine (°R):
62.4	522.07

Enter Barrels of Liquid	Gallons of liquid:
3129.6	131443.2

Enter gallons per year	Barrels per day:
47976768	3129.6

Enter any notes here:

Truck loading will be vented back to the tank which will then vent to the tank combustor.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	4-LOAD
Identifier	Sour Water Tanks Truck Loading

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 =	16.49	True vapor pressure of liquid loaded (psia)
M =	40.00	Molecular Weight of Vapors (lb/lb-mole)
T =	570.56	Temperature of bulk liquid loaded (in degrees Rankine)
Hourly Loading Rate	8000	Gallons Loaded per Hour
L_L =	8.64	Loading Loss (lb VOC released/1000 gal liquid loaded)
	69.13	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?	(B) cont. by flare/ VC/TO/VRU

Vapor Weight Percents

VOC	96.49	Vapor VOC wt%
benzene	0.00	Vapor Benzene wt%
H_2S	0.05	Vapor H_2S wt%

Produced Water Reduction

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

Uncontrolled Emissions

VOC	66.70	Emissions Uncontrolled VOC (lb/hr)
benzene	0.00	Emissions Uncontrolled Benzene (lb/hr)
H_2S	0.03	Emissions Uncontrolled H_2S (lb/hr)

Collection Efficiency

	70.00	Collection Efficiency (%)

Vapors Uncaptured by Control Device

VOC	20.01	VOC Uncaptured Vapors (lb/hr)
benzene	0.00	benzene Uncaptured Vapors (lb/hr)
H_2S	0.01	H_2S Uncaptured Vapors (lb/hr)

Vapors Captured by Control Device

VOC	46.69	VOC Uncaptured Vapors (lb/hr)
benzene	0.00	benzene Uncaptured Vapors (lb/hr)
H_2S	0.02	H_2S Uncaptured Vapors (lb/hr)

Control Efficiency

VOC		VOC Control Efficiency (%)
H_2S		H_2S Control Efficiency (%)

Vapors Uncontrolled by Control Device (Controlled Emissions)

VOC	46.69	VOC Results (lb/hr)
benzene	0.00	Benzene Results (lb/hr)
H_2S	0.02	H_2S Results (lb/hr)

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):
110.89	570.56

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 =	12.18	= True vapor pressure of liquid loaded (psia)
M =	40.00	= Molecular Weight of Vapors (lb/lb-mole)
T =	522.07	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	1333710	= Gallons Loaded per Year
L_L =	6.98	Loading Loss (lb VOC released/1000 gal liquid loaded)
	4.65	VOC Uncontrolled Emissions (ton/yr)
Vapor Weight Percents		
VOC	96.49	Vapor VOC wt%
benzene	0.00	Vapor Benzene wt%
H_2S	0.05	Vapor H_2S wt%
Produced Water Reduction		
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	4.49	Emissions Uncontrolled VOC (ton/yr)
benzene	0.00	Emissions Uncontrolled Benzene (ton/yr)
H_2S	0.00	Emissions Uncontrolled H_2S (ton/yr)
Collection Efficiency		
	70.00	Collection Efficiency (%)
Vapors Uncaptured by Control Device		
VOC	1.35	VOC Uncaptured Vapors (ton/yr)
benzene	0.00	benzene Uncaptured Vapors (ton/yr)
H_2S	0.00	H_2S Uncaptured Vapors (ton/yr)
Vapors Captured by Control Device		
VOC	3.14	VOC captured Vapors (lb/hr)
benzene	0.00	benzene captured Vapors (lb/hr)
H_2S	0.00	H_2S captured Vapors (lb/hr)
Control Efficiency		
VOC		VOC Control Efficiency (%)
H_2S		H_2S Control Efficiency (%)
Vapors Uncontrolled by Control Device (Controlled Emissions)		
VOC	3.14	VOC Results (ton/yr)
benzene	0.00	Benzene Results (ton/yr)
H_2S	0.00	H_2S Results (ton/yr)

Loading Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	20.01	1.35
benzene	0.00	0.00
H_2S	0.01	0.00

0.009867

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):
62.4	522.07

Enter Barrels of Liquid	Gallons of liquid:
87	3654

Enter gallons per year	Barrels per day:
1333710	87

Enter any notes here:

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

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	5-LOAD
Identifier	Slop Tanks Truck Loading

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 =	15.39	True vapor pressure of liquid loaded (psia)
M =	19.56	Molecular Weight of Vapors (lb/lb-mole)
T =	571.29	Temperature of bulk liquid loaded (in degrees Rankine)
Hourly Loading Rate	8000	Gallons Loaded per Hour
L_L =	3.94	Loading Loss (lb VOC released/1000 gal liquid loaded)
	31.52	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	11.16	Vapor VOC wt%
benzene	0.84	Vapor Benzene wt%
H_2S	0.00	Vapor H_2S wt%

Produced Water Reduction

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

Uncontrolled Emissions

VOC	3.52	Emissions Uncontrolled VOC (lb/hr)
benzene	0.26	Emissions Uncontrolled Benzene (lb/hr)
H_2S	0.00	Emissions Uncontrolled H_2S (lb/hr)

Control Efficiency

VOC		VOC Control Efficiency (%)
H_2S		H_2S Control Efficiency (%)

Vapors Uncontrolled by Control Device (Controlled Emissions)

VOC	0.00	VOC Results (lb/hr)
benzene	0.00	Benzene Results (lb/hr)
H_2S	0.00	H_2S Results (lb/hr)

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):
111.62	571.29

Enter Barrels of Liquid	Gallons of liquid:
242	10164

Enter gallons per year	Barrels per day:
3709860	242

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 =	11.36	= True vapor pressure of liquid loaded (psia)
M =	19.56	= Molecular Weight of Vapors (lb/lb-mole)
T =	522.07	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	3709860	= Gallons Loaded per Year
L_L =	3.18	Loading Loss (lb VOC released/1000 gal liquid loaded)
	5.90	VOC Uncontrolled Emissions (ton/yr)
		Vapor Weight Percents
VOC	11.16	Vapor VOC wt%
benzene	0.84	Vapor Benzene wt%
H_2S	0.00	Vapor H_2S wt%
		Produced Water Reduction
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
		Uncontrolled Emissions
VOC	0.66	Emissions Uncontrolled VOC (ton/yr)
benzene	0.05	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)

Loading Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC	3.52	0.66
benzene	0.26	0.05
H_2S	0.00	0.00

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):
62.4	522.07

Enter Barrels of Liquid	Gallons of liquid:
242	10164

Enter gallons per year	Barrels per day:
3709860	242

Enter any notes here:

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Glycol Dehydrator Emissions

Calculated Using GRI-GLYCalc or a Process Simulator

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (if applicable). VOC, benzene, and H_2S regenerator condenser efficiencies may also be entered (if applicable).

C) There are two separate areas to enter information about the two emissions points, the flash tank and the regenerator. Then underneath, there is a table of the sum of flash tank and regenerator emissions.

D) The program results and any lab analysis results used as the calculation basis must be provided.

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.

EPN	5-EP-1e
Identifier	Train 5 - Glycol Dehy

Glycol Dehydrator Unit Information	
Are you using GLYCalc or a Process Simulator?	Process Simulator
GLYCalc Calculation Method (if using GLYCalc)	NA
Type of Glycol Used:	TEG
Annual Hours of Operation (hrs/yr):	8760
Dry Gas Flow Rate (MMscf/day)	230.586
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.)	Site specific
At what point in the process was the sample taken?	
Wet Gas Temperature (°F)	120
Wet Gas Pressure (psig)	864.696
Lean Glycol Pump Type	electric
Lean Glycol Pump Make and Model	
Lean Glycol Flow Rate (gpm)	63.2206
Number of Pump Stokes per Minute for the Lean Glycol Pump (pump strokes/min, if applicable)	NA
Flash Tank Temperature (°F)	134.689
Flash Tank Pressure (psig)	60.999951

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)	112.6996	493.624248
Emissions Uncontrolled Benzene, (lb/hr, tpy)	0.366365	1.6046787
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0	0
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 (%)	100	-
H_2S Control Efficiency (%)	100	-
VOC Results, (lb/hr, tpy)	0	0
Benzene Results, (lb/hr, tpy)	0	0
H_2S Results, (lb/hr, tpy)	0	0

Regenerator		
	lb/hr	tpy
Emissions Uncontrolled VOC (lb/hr, tpy)	146.9236	643.525368
Emissions Uncontrolled Benzene, (lb/hr, tpy)	21.0816	92.337408
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0	0
Are regenerator vapors controlled by a condenser?	Yes	-
VOC Condenser Efficiency (%) - *if applicable*	0	-
Benzene Condenser Efficiency (%) - *if applicable*	0	-
H_2S Condenser Efficiency (%) - *if applicable*	0	-
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?	(B) cont. by flare/ VC/TO/VRU	-
VOC Results, (lb/hr, tpy)	146.9236	643.525368
Benzene Results, (lb/hr, tpy)	21.0816	92.337408
H_2S Results, (lb/hr, tpy)	0	0

Sum of Flash Tank and Regenerator Results		
	lb/hr	tpy
VOC Results	0	0
Benzene Results	0	0
H_2S Results	0	0

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.	The permittee shall monitor as required by 40 CFR 63.772(b)(2) to demonstrate facility is exempt from general standards. The permittee shall generate and maintain the

Enter any notes here:

TEG Flash routed back to the process. Regenerator stream is routed to thermal oxidizer, EP-10

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Glycol Dehydrator Emissions

Calculated Using GRI-GLYCalc or a Process Simulator

A) Enter information into the yellow boxes.

B) VOC and H_2S control efficiencies may be entered (if applicable). VOC, benzene, and H_2S regenerator condenser efficiencies may also be entered (if applicable).

C) There are two separate areas to enter information about the two emissions points, the flash tank and the regenerator. Then underneath, there is a table of the sum of flash tank and regenerator emissions.

D) The program results and any lab analysis results used as the calculation basis must be provided.

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.

EPN	6-EP-1e
Identifier	Train 6 - Glycol Dehy

Glycol Dehydrator Unit Information	
Are you using GLYCalc or a Process Simulator?	Process Simulator
GLYCalc Calculation Method (if using GLYCalc)	NA
Type of Glycol Used:	TEG
Annual Hours of Operation (hrs/yr):	8760
Dry Gas Flow Rate (MMscf/day)	230.586
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.)	Site specific
At what point in the process was the sample taken?	
Wet Gas Temperature (°F)	120
Wet Gas Pressure (psig)	864.696
Lean Glycol Pump Type	electric
Lean Glycol Pump Make and Model	
Lean Glycol Flow Rate (gpm)	63.2206
Number of Pump Stokes per Minute for the Lean Glycol Pump (pump strokes/min, if applicable)	NA
Flash Tank Temperature (°F)	134.689
Flash Tank Pressure (psig)	60.999951

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)	112.6996	493.624248
Emissions Uncontrolled Benzene, (lb/hr, tpy)	0.366365	1.6046787
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0	0
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 (%)	100	-
H_2S Control Efficiency (%)	100	-
VOC Results, (lb/hr, tpy)	0	0
Benzene Results, (lb/hr, tpy)	0	0
H_2S Results, (lb/hr, tpy)	0	0

Regenerator		
	lb/hr	tpy
Emissions Uncontrolled VOC (lb/hr, tpy)	146.9236	643.525368
Emissions Uncontrolled Benzene, (lb/hr, tpy)	21.0816	92.337408
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0	0
Are regenerator vapors controlled by a condenser?	Yes	-
VOC Condenser Efficiency (%) - *if applicable*	0	-
Benzene Condenser Efficiency (%) - *if applicable*	0	-
H_2S Condenser Efficiency (%) - *if applicable*	0	-
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?	(B) cont. by flare/ VC/TO/VRU	-
VOC Results, (lb/hr, tpy)	146.9236	643.525368
Benzene Results, (lb/hr, tpy)	21.0816	92.337408
H_2S Results, (lb/hr, tpy)	0	0

Sum of Flash Tank and Regenerator Results		
	lb/hr	**tpy**
VOC Results	0	0
Benzene Results	0	0
H_2S Results	0	0

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.	The permittee shall monitor as required by 40 CFR 63.772(b)(2) to demonstrate facility is exempt from general standards. The permittee shall generate and maintain the

Enter any notes here:
TEG Flash routed back to the process. Regenerator stream is routed to thermal oxidizer, EP-10

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Amine Unit Emissions

Calculated Using AmineCalc or a Process Simulator

A) Enter information into the yellow boxes.

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

C) There are two separate areas to enter information about the two emissions points, the flash tank and the regenerator. Then underneath, there is a table of the sum of flash tank and regenerator emissions.

D) The program results and any lab analysis results used as the calculation basis must be provided.

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.

EPN	5-EP-1f
Identifier	Train 5 - Amine

Amine Unit Information	
Are you using AmineCalc or a Process Simulator?	Process Simulator
AmineCalc Model Selection (if using AmineCalc):	NA
Type of Amine Used:	MDEA
Annual Hours of Operation (hrs/yr):	8760
Feed Gas Flow Rate (MMscf/day):	247.294
Laboratory Feed Gas Analysis Provided? If not, explain why. (Use notes box below if more space needed.)	Yes
Date of Sample:	ProMax
Is sample site specific or representative? If representative, please justify. (Use notes box below if more space needed.)	Site Specific
At what point in the process was the sample taken?	
Feed Gas Temperature (°F)	70
Feed Gas Pressure (psia)	914.696
Lean Amine Flow Rate (gpm)	1726.83
Flash Tank Temperature (°F)	169.838
Flash Tank Pressure (psia)	74.6959

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)	141.3043	618.912834
Emissions Uncontrolled Benzene, (lb/hr, tpy)	1.89568	8.3030784
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0.0103932	0.045522216
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 (%)	100	-
H_2S Control Efficiency (%)	100	-
VOC Results, (lb/hr, tpy)	0	0
Benzene Results, (lb/hr, tpy)	0	0
H_2S Results, (lb/hr, tpy)	0	0

Regenerator		
	lb/hr	tpy
Emissions Uncontrolled VOC (lb/hr, tpy)	35.82654	156.9202452
Emissions Uncontrolled Benzene, (lb/hr, tpy)	16.4551	72.073338
Emissions Uncontrolled H_2S, (lb/hr, tpy)	1.87409	8.2085142
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?	(B) cont. by flare/ VC/TO/VRU	-
VOC Results, (lb/hr, tpy)	35.82654	156.9202452
Benzene Results, (lb/hr, tpy)	16.4551	72.073338
H_2S Results, (lb/hr, tpy)	1.87409	8.2085142

Sum of Flash Tank and Regenerator Results		
	lb/hr	tpy
VOC Results	0	0
Benzene Results	0	0
H_2S Results	0	0

Federal Applicability	
40 CFR Part 60 - Subpart LLL	
Is this subpart applicable?	No
If yes, how will compliance be achieved? If no, please explain why.	The facility is a natural gas processing plant, however, there is not sulfur recovery plant, thus this location does not meet the applicability criteria of 40

Enter any notes here:

Amine flash is routed back to the process and regenerator stream is routed to the thermal oxidizer, EP-10.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Amine Unit Emissions

Calculated Using AmineCalc or a Process Simulator

A) Enter information into the yellow boxes.

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

C) There are two separate areas to enter information about the two emissions points, the flash tank and the regenerator. Then underneath, there is a table of the sum of flash tank and regenerator emissions.

D) The program results and any lab analysis results used as the calculation basis must be provided.

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.

EPN	6-EP-1f
Identifier	Train 6 - Amine

Amine Unit Information	
Are you using AmineCalc or a Process Simulator?	Process Simulator
AmineCalc Model Selection (if using AmineCalc):	NA
Type of Amine Used:	MDEA
Annual Hours of Operation (hrs/yr):	8760
Feed Gas Flow Rate (MMscf/day):	247.294
Laboratory Feed Gas Analysis Provided? If not, explain why. (Use notes box below if more space needed.)	Yes
Date of Sample:	ProMax
Is sample site specific or representative? If representative, please justify. (Use notes box below if more space needed.)	Site Specific
At what point in the process was the sample taken?	
Feed Gas Temperature (°F)	70
Feed Gas Pressure (psia)	914.696
Lean Amine Flow Rate (gpm)	1726.83
Flash Tank Temperature (°F)	169.838
Flash Tank Pressure (psia)	74.6959

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)	141.3043	618.912834
Emissions Uncontrolled Benzene, (lb/hr, tpy)	1.89568	8.3030784
Emissions Uncontrolled H_2S, (lb/hr, tpy)	0.0103932	0.045522216
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 (%)	100	-
H_2S Control Efficiency (%)	100	-
VOC Results, (lb/hr, tpy)	0	0
Benzene Results, (lb/hr, tpy)	0	0
H_2S Results, (lb/hr, tpy)	0	0

Regenerator		
	lb/hr	tpy
Emissions Uncontrolled VOC (lb/hr, tpy)	35.82654	156.9202452
Emissions Uncontrolled Benzene, (lb/hr, tpy)	16.4551	72.073338
Emissions Uncontrolled H_2S, (lb/hr, tpy)	1.87409	8.2085142
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?	(B) cont. by flare/ VC/TO/VRU	-
VOC Results, (lb/hr, tpy)	35.82654	156.9202452
Benzene Results, (lb/hr, tpy)	16.4551	72.073338
H_2S Results, (lb/hr, tpy)	1.87409	8.2085142

Sum of Flash Tank and Regenerator Results		
	lb/hr	tpy
VOC Results	0	0
Benzene Results	0	0
H_2S Results	0	0

Federal Applicability	
40 CFR Part 60 - Subpart LLL	
Is this subpart applicable?	No
If yes, how will compliance be achieved? If no, please explain why.	The facility is a natural gas processing plant, however, there is not sulfur recovery plant, thus this location does not meet the applicability criteria of 40

Enter any notes here:
Amine flash is routed back to the process and regenerator stream is routed to the thermal oxidizer, EP-10.

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Flare / Vapor Combustor

A) Enter information into the blue boxes.

B) See notes/instructions included below.

Unit EPN 5-EP-2
Unit Name Cryo 5 & 6 Flare SSM

Flare EPN: 5-EP-2							
	Gas Stream 1	Gas Stream 2	Gas Stream 3		Gas Stream 1	Gas Stream 2	Gas Stream 3
Emission Unit ID	Sweep Gas	To Mole Sieve Stream		Hourly Gas Routed to Flare (MMBtu/hr)	2.295	12017.60166	
Hourly Gas Stream to Flare (Mscf/hr)	2.25	9607.63		Annual Gas Routed to Flare (MMBtu/yr)	20104.2	144211.22	
Annual Gas Stream to Flare (MMscf/yr)	19.71	115.29		Pilot Gas Routed to Flare (MMBtu/hr)	0.1989	0	
Max. Heat Value of Gas (Btu/scf)	1020	1250.84		Gas MW (lb/lbmol)	16.82	21.23	
Flare operational time (hr/yr)	8760	12		Gas Pressure (psia)	14.7	863.196	
Field Gas Mol Fraction (lbmol H2S/lb-mol)	-	-	-	Gas Temperature (°F)	70	123.308	
Field Gas Sulfur Content (S grains/100scf)	-	-	-	Field Gas H2S Wt.% to Flare (%)	0.0061	0.0000	
Pilot Gas to Flare (Mscf/hr)	0.195			Flare Control Efficiency	98	98	
Max. Heat Value of Pilot Gas (Btu/scf)	1020			Total VOC wt.% to Flare (%)	0.1573	22.6264	
Pilot Gas H2S Wt.% to Flare (%)	0.0061			Source of Flare Emission Factors	TCEQ	TCEQ	
Pilot Gas MW (lb/lbmol)	16.82			Use Highest NO_x & CO Emission Factors From AP-42 or TCEQ	NO	NO	

Flare, Vapor Combustion Devices & Enclosed Devices Emission Factors			
Contaminant	Assist Type	AP-42 Emission Factor (lb/MMBtu)	TCEQ Emission Factors (lb/MMBtu)
NO_x	Steam (Btu/scf >1000)	0.068	0.0485
	Steam (Btu/scf <1000)	0.068	0.068
	Air or Unassisted (Btu/scf >1000)	0.068	0.138
	Air or Unassisted (Btu/scf <1000)	0.068	0.0641
CO	Steam (Btu/scf >1000)	0.31	0.3503
	Steam (Btu/scf <1000)	0.31	0.3465
	Air or Unassisted (Btu/scf >1000)	0.31	0.2755
	Air or Unassisted (Btu/scf <1000)	0.31	0.5496
VOC	Air or Unassisted	0.0054	--

Total Emissions to Flare

Pollutant	NO_x			CO			VOC			SO_2			H_2S		
Gas Stream To Flare	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Uncontrolled (pph)	0.00	0.00	0.00	0.00	0.00	0.00	0.15	121549.60	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Uncontrolled (tpy)	0.00	0.00	0.00	0.00	0.00	0.00	0.68	729.30	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Field Gas (pph)	0.32	1658.43	0.00	0.63	3310.85	0.00	0.00	2430.99	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Field Gas (tpy)	1.39	9.95	0.00	2.77	19.87	0.00	0.01	14.59	0.00	0.00	0.00	0.00	0.001	0.00	0.00
Pilot Gas (pph)	0.0274	0.0000	0.0000	0.0548	0.0000	0.0000	0.0011	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000
Pilot Gas (tpy)	0.1202	0.0000	0.0000	0.2400	0.0000	0.0000	0.0047	0.0000	0.0000	0.0043	0.0000	0.0000	0.0000	0.0000	0.0000
Subtotal Flare (pph)	0.3442	1658.4290	0.0000	0.6871	3310.8493	0.0000	0.0042	2430.9920	0.0000	0.0122	0.0000	0.0000	0.0001	0.0000	0.0000
Subtotal Flare (tpy)	1.5074	9.9506	0.0000	3.0094	19.8651	0.0000	0.0182	14.5860	0.0000	0.0043	0.0000	0.0000	0.0006	0.0000	0.0000
Total Flare (pph)	**1658.7732**			**3311.5363**			**2430.9962**			**0.0122**			**0.0001**		
Total Flare (tpy)	**11.4580**			**22.8745**			**14.6042**			**0.0043**			**0.0006**		

Notes:
MW of SO2 = 64.066
MW of H2S = 34.1

Sample Calculations:

$$NOx\ pph = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{hr}\right)\ X\ NOx\ Emission\ Factor\ \left(\frac{lb}{MMTBtu}\right)$$

$$NOx\ tpy = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{yr}\right)\ X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right)\ X\ \frac{1}{2000}\left(\frac{ton}{lbs}\right)$$

$$SO2\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right)\ x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}$$

$$Residual\ H2S\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right)\ x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}\ x\ Flare\ efficiency$$

Lucid Energy Group - Red Hills Gas Processing Plant
Emergency Cryo Flare

Emission Unit: 5-EP-2 and 7-EP-2

Fuel Data

Flare Pilot	195	scf/hr	Max design	
	0.000195	MMscf/hr		
	1020.00	Btu/scf	Pipeline Gas, HHV	
	0.199	MMBtu/hr		
Sweep Gas	54.000	Mscf/day	Design	
	2.2500	Mscf/hr	Mscf/d / 24 hr/day	
	2.25E-03	MMscf/hr	Mscf/hr / 1000	
	1020.00	Btu/scf	Pipeline Gas, HHV	
	2.2950	MMBtu/hr	MMscf/hr * Btu/scf	
Flared Gas - Short Term	9.608	MMscf/hr	Effective hourly flowrate	
	1,251	Btu/scf		
	12,017	MMBtu/hr	Hourly heat rate = Heating value * Effective hourly flow rate.	
	12	hr/yr	Hours of operation	
Flared Gas - Annual	144209.34	MMscf/yr	Estimated Maximum annual SSM flow rate. Not a requested limit; for calculation only.	
Flare Design	1052040.00	lb/hr	Design flowrate	
	21.20	lb/lb-mole	Molecular weight	
	1104.0	Btu/scf	Heating value	
	385.0	scf/lb-mole	Molar volume	
	1000000.0	btu/MMBtu		
	21,092.4	MMBtu/hr	Flare design rate	
	55%		Safety Factor	
	11556.320	MMBtu/hr	Limited Design rate	
Pilot+ Sweep Gas only	16.8		Pilot & Sweep gas molecular weight	Mol. wt. of methane, the dominant species
	1.75E+05	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	1.40E+05		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	0.3744	m	Effective stack diameter (D)	$D = (10^{-6}q_n)^{1/2}$
Flared Gas MW				
	21.2	g/mol	MW flare gas	
	16.8	g/mol	MW assist gas, purge gas	
Flaring Volumes	0.255	MMscf/hr	vol flared gas	
	0.0833	MMscf/hr	vol assist gas	
	Flare (SSM)			
	0.0833	MMscf/hr	vol assist gas	
	0.002445	MMscf/hr	vol pilot + sweep gas	
	15.89	g/mol	vol. weighted % flare gas	
	4.11	g/mol	vol. weighted % assist gas	
	1.21E-01	g/mol	vol. weighted % pilot + sweep gas	
Pilot+Flared Gas+ Assist gas	20.12	g/mol	weighted-averaged Flared gas molecular weight	
	8.09E+08	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	6.35E+08		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	25.195	m	Effective stack diameter (D)	$D = (10^{-6}q_n)^{1/2}$

ZEECO

Air Assisted Flare Tip Specification Sheet

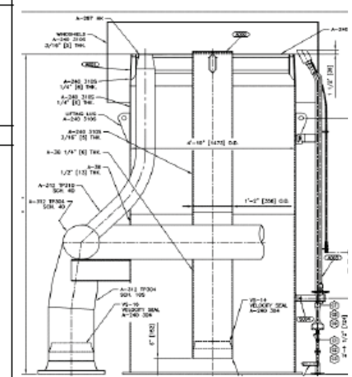
Client:	Lucid Midstream	Zeeco Ref.:	2019-03373FL-01	Date:	21-May-
Location:	Jal, NM	Client Ref.:	"Red Hills V"	Rev.	0

General Information:

Tag No.: FL-5100
Model: AFDSMJW-20/80 - 26 Type: Air-Assisted
Length: 10'- 0 "
Weight: 6000 lbs
No. of Pilots 3

Design Case:

Governing Case:	Cold Case 1
Molecular weight:	21.2
L. H. V. :	1,104 BTU/SCF
Temperature:	9 Deg. F
Available Static Pressure:	40.0 psig
Design Flow Rate:	1,052,040 lbs/hr
Governing Smokeless Case:	Case A
Design Smokeless Rate:	210,408 lbs/hr
Approximate Exit Velocity:	1194 ft/s
Mach No.:	1.00
Approx. Tip Press. Drop:	14.54 psig



(Typical drawing only)

Construction:

Upper Section: 310 SS Flame Retention Hub: 310 SS

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Flare / Vapor Combustor

A) Enter information into the blue boxes.

B) See notes/instructions included below.

Unit EPN 7-EP-2
Unit Name Cryo 7 Flare SSM

Flare EPN: 7-EP-2

	Gas Stream 1	Gas Stream 2	Gas Stream 3		Gas Stream 1	Gas Stream 2	Gas Stream 3
Emission Unit ID	Sweep Gas	To Mole Sieve Stream		**Hourly Gas Routed to Flare (MMBtu/hr)**	2.295	12017.60166	
Hourly Gas Stream to Flare (Mscf/hr)	2.25	9607.63		**Annual Gas Routed to Flare (MMBtu/yr)**	20104.2	144211.22	
Annual Gas Stream to Flare (MMscf/yr)	19.71	115.29		**Pilot Gas Routed to Flare (MMBtu/hr)**	0.1989	0	
Max. Heat Value of Gas (Btu/scf)	1020	1250.84		**Gas MW (lb/lbmol)**	16.82	21.23	
Flare operational time (hr/yr)	8760	12		**Gas Pressure (psia)**	14.7	863.196	
Field Gas Mol Fraction (lbmol H2S/lb-mol)	-	-	-	**Gas Temperature (°F)**	70	123.308	
Field Gas Sulfur Content (S grains/100scf)	-	-	-	**Field Gas H2S Wt.% to Flare (%)**	0.0061	0.0000	
Pilot Gas to Flare (Mscf/hr)	0.195			**Flare Control Efficiency**	98	98	
Max. Heat Value of Pilot Gas (Btu/scf)	1020			**Total VOC wt.% to Flare (%)**	0.1573	22.6264	
Pilot Gas H2S Wt.% to Flare (%)	0.0061			**Source of Flare Emission Factors**	TCEQ	TCEQ	
Pilot Gas MW (lb/lbmol)	16.82			**Use Highest NO_x & CO Emission Factors From AP-42 or TCEQ**	NO	NO	

Flare, Vapor Combustion Devices & Enclosed Devices Emission Factors

Contaminant	Assist Type	AP-42 Emission Factor (lb/MMBtu)	TCEQ Emission Factors (lb/MMBtu)
NO_x	Steam (Btu/scf >1000)	0.068	0.0485
	Steam (Btu/scf <1000)	0.068	0.068
	Air or Unassisted (Btu/scf >1000)	0.068	0.138
	Air or Unassisted (Btu/scf <1000)	0.068	0.0641
CO	Steam (Btu/scf >1000)	0.31	0.3503
	Steam (Btu/scf <1000)	0.31	0.3465
	Air or Unassisted (Btu/scf >1000)	0.31	0.2755
	Air or Unassisted (Btu/scf <1000)	0.31	0.5496
VOC	Air or Unassisted	0.0054	--

Total Emissions to Flare

Pollutant	NO_x			CO			VOC			SO_2			H_2S		
Gas Stream To Flare	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Uncontrolled (pph)	0.00	0.00	0.00	0.00	0.00	0.00	0.15	121549.60	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Uncontrolled (tpy)	0.00	0.00	0.00	0.00	0.00	0.00	0.68	729.30	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Field Gas (pph)	0.32	1658.43	0.00	0.63	3310.85	0.00	0.00	2430.99	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Field Gas (tpy)	1.39	9.95	0.00	2.77	19.87	0.00	0.01	14.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pilot Gas (pph)	0.0274	0.0000	0.0000	0.0548	0.0000	0.0000	0.0011	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000
Pilot Gas (tpy)	0.1202	0.0000	0.0000	0.2400	0.0000	0.0000	0.0047	0.0000	0.0000	0.0043	0.0000	0.0000	0.0000	0.0000	0.0000
Subtotal Flare (pph)	0.3442	1658.4290	0.0000	0.6871	3310.8493	0.0000	0.0042	2430.9920	0.0000	0.0122	0.0000	0.0000	0.0001	0.0000	0.0000
Subtotal Flare (tpy)	1.5074	9.9506	0.0000	3.0094	19.8651	0.0000	0.0182	14.5860	0.0000	0.0043	0.0000	0.0000	0.0006	0.0000	0.0000
Total Flare (pph)	**1658.7732**			**3311.5363**			**2430.9962**			**0.0122**			**0.0001**		
Total Flare (tpy)	**11.4580**			**22.8745**			**14.6042**			**0.0043**			**0.0006**		

Notes:
MW of SO2 = 64.066
MW of H2S = 34.1

Sample Calculations:

$$NOx\ pph = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{hr}\right) X\ NOx\ Emission\ Factor\ \left(\frac{lb}{MMTBtu}\right)$$

$$NOx\ tpy = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{yr}\right) X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right) X \frac{1}{2000}\left(\frac{ton}{lbs}\right)$$

$$SO2\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right)\ x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}$$

$$Residual\ H2S\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right)\ x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}\ x\ Flare\ efficiency$$

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Flare / Vapor Combustor

A) Enter information into the blue boxes.

B) See notes/instructions included below.

Unit EPN 5.5-EP-1b
Unit Name AGI 2 Flare SSM

Flare EPN: 5.5-EP-1b							
	Gas Stream 1	Gas Stream 2	Gas Stream 3		Gas Stream 1	Gas Stream 2	Gas Stream 3
Emission Unit ID	Added Fuel Stream	Compressor Stream (900 gpm)	AGI 2 Compressors and VRU Blowdown	Hourly Gas Routed to Flare (MMBtu/hr)	85.00	9.57	0.15
Hourly Gas Stream to Flare (Mscf/hr)	83.33	126.39	1.999	Annual Gas Routed to Flare (MMBtu/yr)	5212.20	1173.34	0.30
Annual Gas Stream to Flare (MMscf/yr)	5.110	15.500	0.004	Pilot Gas Routed to Flare (MMBtu/hr)	0.39	0.00	0.00
Max. Heat Value of Gas (Btu/scf)	1020	75.7	75.7	Gas MW (lb/lbmol)	16.82	40.89	40.89
Flare operational time (hr/yr)	61.32	122.64	2	Gas Pressure (psia)	14.7	24.2	24.2
Field Gas Mol Fraction (lbmol H2S/lb-mol)	-	-	-	Gas Temperature (°F)	70	120	120
Field Gas Sulfur Content (S grains/100scf)	-	-	-	Field Gas H2S Wt.% to Flare (%)	0.0061	10.48	10.48
Pilot Gas to Flare (Mscf/hr)	0.38			Flare Control Efficiency	98	98	98
Max. Heat Value of Pilot Gas (Btu/scf)	1020			Total VOC wt.% to Flare (%)	0.1573	3.1622	3.1622
Pilot Gas H2S Wt.% to Flare (%)	0.0061			Source of Flare Emission Factors	TCEQ	TCEQ	TCEQ
Pilot Gas MW (lb/lbmol)	16.82			Use Highest NO_x & CO Emission Factors From AP-42 or TCEQ	NO	NO	NO

Flare, Vapor Combustion Devices & Enclosed Devices Emission Factors

Contaminant	Assist Type	AP-42 Emission Factor (lb/MMBtu)	TCEQ Emission Factors (lb/MMBtu)
NO_x	Steam (Btu/scf >1000)	0.068	0.0485
	Steam (Btu/scf <1000)	0.068	0.068
	Air or Unassisted (Btu/scf >1000)	0.068	0.138
	Air or Unassisted (Btu/scf <1000)	0.068	0.0641
CO	Steam (Btu/scf >1000)	0.31	0.3503
	Steam (Btu/scf <1000)	0.31	0.3465
	Air or Unassisted (Btu/scf >1000)	0.31	0.2755
	Air or Unassisted (Btu/scf <1000)	0.31	0.5496
VOC	Air or Unassisted	0.0054	--

Total Emissions to Flare

Pollutant	NO_x			CO			VOC			SO_2			H_2S		
Gas Stream To Flare	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Uncontrolled (pph)	0.00	0.00	0.00	0.00	0.00	0.00	5.73	424.46	6.71	0.00	0.00	0.00	0.22	1406.48	22.25
Uncontrolled (tpy)	0.00	0.00	0.00	0.00	0.00	0.00	0.18	26.03	0.01	0.00	0.00	0.00	0.01	86.25	0.02
Field Gas (pph)	11.73	0.61	0.01	23.42	5.26	0.08	0.46	8.49	0.13	0.42	2642.45	41.79	0.00	28.13	0.44
Field Gas (tpy)	0.36	0.04	0.00	0.72	0.32	0.00	0.01	0.52	0.00	0.01	162.03	0.04	0.00	1.72	0.00
Pilot Gas (pph)	0.0535	0.0000	0.0000	0.1068	0.0000	0.0000	0.0021	0.0000	0.0000	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000
Pilot Gas (tpy)	0.2343	0.0000	0.0000	0.4677	0.0000	0.0000	0.0092	0.0000	0.0000	0.0083	0.0000	0.0000	0.0001	0.0000	0.0000
Subtotal Flare (pph)	11.7835	0.6133	0.0097	23.5243	5.2582	0.0832	0.4604	8.4892	0.1343	0.4177	2642.45	41.7948	0.0044	28.1296	0.4449
Subtotal Flare (tpy)	0.5939	0.0376	0.0000	1.1857	0.3224	0.0001	0.0232	0.5206	0.0001	0.0211	162.0350	0.0418	0.0002	1.7249	0.0004
Total Flare (pph)	**12.4065**			**28.8657**			**9.0839**			**2684.6612**			**28.5789**		
Total Flare (tpy)	**0.6315**			**1.5082**			**0.5439**			**162.0978**			**1.7256**		

Notes: Pilot Gas to Flare (Cell D22) includes Pilot Gas and Sweep Gas.
MW of SO2 = 64.066
MW of H2S = 34.1
The acid gas routed to the flare will also be curtailed to half by reducing the inlet flow during startup, maintenance, and shut down. This is achieved by switching to the backup compressor within 30 minutes or by reducing the inlet flow for these periods.

Sample Calculations:

$$NOx\ pph = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{hr}\right) X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right)$$

$$NOx\ tpy = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{yr}\right) X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right) X \frac{1}{2000}\left(\frac{ton}{lbs}\right)$$

$$SO2\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right) x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}$$

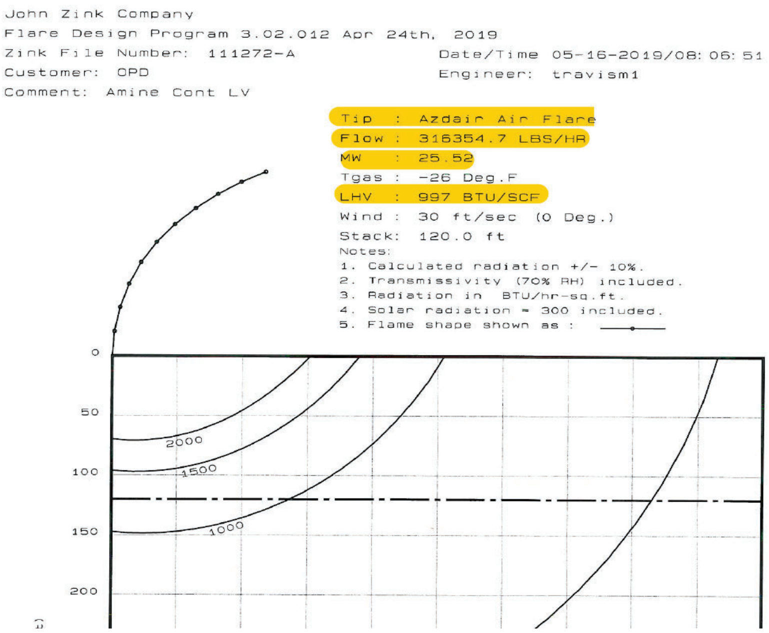
$$Residual\ H2S\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right) x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}\ x\ Flare\ efficiency$$

Lucid Energy Group - Red Hills Gas Processing Plant
Emergency AGI Flare

Emission Unit: 5.5-EP-1b

Fuel Data

Flare Pilot	150	scf/hr	Max design	
	0.00015	MMscf/hr		
	1020.00	Btu/scf	Pipeline Gas, HHV	
	0.153	MMBtu/hr		
Sweep Gas	5.520	Mscf/day	Design	
	0.2300	Mscf/hr	Mscf/d / 24 hr/day	
	2.30E-04	MMscf/hr	Mscf/hr / 1000	
	1020.00	Btu/scf	Pipeline Gas, HHV	
	0.2346	MMBtu/hr	MMscf/hr * Btu/scf	
Assist Gas	0.0833	MMscf/hr	Assist gas volume	
	1,020.0	Btu/scf	Assist gas-assumed sweet	
Assist gas - Annual	0.0	MMscf/yr	Estimated Maximum annual SSM flow rate.	
Flared Gas - Short Term	0.255	MMscf/hr	Effective hourly flowrate	
	76	Btu/scf		
	19	MMBtu/hr	Hourly heat rate = Heating value * Effective hourly flow rate.	
	123	hr/yr	Hours of operation	
Flared Gas - Annual	2,367.38	MMscf/yr	Estimated Maximum annual SSM flow rate. Not a requested limit; for calculation only.	
Flare Design	316354.70	lb/hr	Design flowrate	
	25.52	lb/lb-mole	Molecular weight	
	997.0	Btu/scf	Heating value	
	385.0	scf/lb-mole	Molar volume	
	1000000.0	btu/MMBtu		
	4,758.3	MMBtu/hr	Flare design rate	
	55%			
	2593.916	MMBtu/hr	Limited Design rate	
Pilot+ Sweep Gas only	16.8		Pilot & Sweep gas molecular weight	Mol. wt. of methane, the dominant species
	2.71E+04	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	2.18E+04		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	0.1476	m	Effective stack diameter (D)	$D = (10^{-6} q_n)^{1/2}$
Flared Gas MW				
	40.8	g/mol	MW flare gas	
	16.8	g/mol	MW assist gas, purge gas	
Flaring Volumes	0.255	MMscf/hr	vol flared gas	
	0.0833	MMscf/hr	vol assist gas	
	Flare (SSM)			
	0.0833	MMscf/hr	vol assist gas	
	0.000380	MMscf/hr	vol pilot + sweep gas	
	30.72	g/mol	vol. weighted % flare gas	
	4.14	g/mol	vol. weighted % assist gas	
	1.89E-02	g/mol	vol. weighted % pilot + sweep gas	
Pilot+Flared Gas+ Assist gas	34.87	g/mol	weighted-averaged Flared gas molecular weight	
	1.82E+08	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	1.30E+08		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	11.4064	m	Effective stack diameter (D)	$D = (10^{-6} q_n)^{1/2}$



Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Flare / Vapor Combustor

A) Enter information into the blue boxes.

B) See notes/instructions included below.

Unit EPN EP-12
Unit Name Condensate Tanks Combustor

Flare EPN: EP-12							
	Gas Stream 1	Gas Stream 2	Gas Stream 3		Gas Stream 1	Gas Stream 2	Gas Stream 3
Emission Unit ID	Condensate Tanks	3-LOAD		Hourly Gas Routed to Flare (MMBtu/hr)	0.08	1.06	
Hourly Gas Stream to Flare (Mscf/hr)	0.02	0.26		Annual Gas Routed to Flare (MMBtu/yr)	725.44	1564.76	
Annual Gas Stream to Flare (MMscf/yr)	0.175	0.38		Pilot Gas Routed to Flare (MMBtu/hr)	0.07	0.00	
Max. Heat Value of Gas (Btu/scf)	4142.72	4142.72		Gas MW (lb/lbmol)	75.03	75.03	
Flare operational time (hr/yr)	8760	5997		Gas Pressure (psia)	11.428	14.7	
Field Gas Mol Fraction (lbmol H2S/lb-mol)	-	-	-	Gas Temperature (°F)	111.21	111.21	
Field Gas Sulfur Content (S grains/100scf)	-	-	-	Field Gas H2S Wt.% to Flare (%)	0.00	0.00	
Pilot Gas to Flare (Mscf/hr)	0.065			Flare Control Efficiency	95	95	
Max. Heat Value of Pilot Gas (Btu/scf)	1020			Total VOC wt.% to Flare (%)	100.00	100.00	
Pilot Gas H2S Wt.% to Flare (%)	0.0061			Source of Flare Emission Factors	TCEQ	TCEQ	
Pilot Gas MW (lb/lbmol)	16.82			Use Highest NO_x & CO Emission Factors From AP-42 or TCEQ	NO	NO	

Flare, Vapor Combustion Devices & Enclosed Devices Emission Factors			
Contaminant	Assist Type	AP-42 Emission Factor (lb/MMBtu)	TCEQ Emission Factors (lb/MMBtu)
NO_x	Steam (Btu/scf >1000)	0.068	0.0485
	Steam (Btu/scf <1000)	0.068	0.068
	Air or Unassisted (Btu/scf >1000)	0.068	0.138
	Air or Unassisted (Btu/scf <1000)	0.068	0.0641
CO	Steam (Btu/scf >1000)	0.31	0.3503
	Steam (Btu/scf <1000)	0.31	0.3465
	Air or Unassisted (Btu/scf >1000)	0.31	0.2755
	Air or Unassisted (Btu/scf <1000)	0.31	0.5496
VOC	Air or Unassisted	0.0054	--

Total Emissions to Flare

Pollutant	NO_x			CO			VOC			SO_2			H_2S		
Gas Stream To Flare	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Uncontrolled (pph)	0.00	0.00	0.00	0.00	0.00	0.00	31.50	49.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uncontrolled (tpy)	0.00	0.00	0.00	0.00	0.00	0.00	137.97	73.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Field Gas (pph)	0.01	0.15	0.00	0.02	0.29	0.00	1.58	2.49	0.00	0.000	0.000	0.000	0.00	0.00	0.00
Field Gas (tpy)	0.05	0.11	0.00	0.10	0.22	0.00	6.90	3.68	0.00	0.000	0.000	0.000	0.00	0.00	0.00
Pilot Gas (pph)	0.0091	0.0000	0.0000	0.0183	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pilot Gas (tpy)	0.0401	0.0000	0.0000	0.0800	0.0000	0.0000	0.0016	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Subtotal Flare (pph)	0.0206	0.1462	0.0000	0.0411	0.2919	0.0000	1.5754	2.4925	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Subtotal Flare (tpy)	0.0901	0.1080	0.0000	0.1799	0.2155	0.0000	6.9001	3.6805	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
Total Flare (pph)	0.1668			0.3330			4.0679			0.00002			0.00001		
Total Flare (tpy)	0.1981			0.3955			10.5806			0.0001			0.0000		

Notes: VOC Stream 1 input from emissions from tanks (3-T-1 thru 3-T-6) and Stream 2 input from 3-LOAD emissions captured and routed to the combustor.
MW of SO2 = 64.066
MW of H2S = 34.1

Sample Calculations:

$$NOx\ pph = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{hr}\right) X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right)$$

$$NOx\ tpy = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{yr}\right) X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right) X \frac{1}{2000}\left(\frac{ton}{lbs}\right)$$

$$SO2\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right) x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}$$

$$Residual\ H2S\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right) x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}\ x\ Flare\ efficiency$$

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Flare / Vapor Combustor

A) Enter information into the blue boxes.

B) See notes/instructions included below.

Unit EPN	EP-13
Unit Name	Sour Water Tanks Flare

Flare EPN: EP-13

	Gas Stream 1	Gas Stream 2	Gas Stream 3		Gas Stream 1	Gas Stream 2	Gas Stream 3	
Emission Unit ID	**Sour Tanks**	**4-LOAD**		**Hourly Gas Routed to Flare (MMBtu/hr)**	0.06	1.43		
Hourly Gas Stream to Flare (Mscf/hr)	0.01990	0.43375		**Annual Gas Routed to Flare (MMBtu/yr)**	523.84	12508.82		
Annual Gas Stream to Flare (MMscf/yr)	0.174	3.800		**Pilot Gas Routed to Flare (MMBtu/hr)**	0.36	0.00		
Max. Heat Value of Gas (Btu/scf)	3005	3292.1		**Gas MW (lb/lbmol)**	59.45	59.45		from the head space analysis
Flare operational time (hr/yr)	8760	167		**Gas Pressure (psia)**	10	10		from the head space analysis
Field Gas Mol Fraction (lbmol H2S/lb-mol)	-	-		**Gas Temperature (°F)**	99	99		from the head space analysis
Field Gas Sulfur Content (S grains/100scf)	-	-		**Field Gas H2S Wt.% to Flare (%)**	0.05	0.05		
Pilot Gas to Flare (Mscf/hr)	0.35	0		**Flare Control Efficiency**	95	95		2295.461566 weighted btu/scf
Max. Heat Value of Pilot Gas (Btu/scf)	1020			**Total VOC wt.% to Flare (%)**	96.49	96.49		40.88227179 weighted MW
Pilot Gas H2S Wt.% to Flare (%)	0.0061			**Source of Flare Emission Factors**	TCEQ	TCEQ		
Pilot Gas MW (lb/lbmol)	16.82			**Use Highest NO_x & CO Emission Factors From AP-42 or TCEQ**	NO	NO		

Flare, Vapor Combustion Devices & Enclosed Devices Emission Factors

Contaminant	Assist Type	AP-42 Emission Factor (lb/MMBtu)	TCEQ Emission Factors (lb/MMBtu)
NO_x	Steam (Btu/scf >1000)	0.068	0.0485
	Steam (Btu/scf <1000)	0.068	0.068
	Air or Unassisted (Btu/scf >1000)	0.068	0.138
	Air or Unassisted (Btu/scf <1000)	0.068	0.0641
CO	Steam (Btu/scf >1000)	0.31	0.3503
	Steam (Btu/scf <1000)	0.31	0.3465
	Air or Unassisted (Btu/scf >1000)	0.31	0.2755
	Air or Unassisted (Btu/scf <1000)	0.31	0.5496
VOC	Air or Unassisted	0.0054	--

Total Emissions to Flare

Pollutant	NO_x			CO			VOC			SO_2			H_2S		
Gas Stream To Flare	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Uncontrolled (pph)	0.00	0.00	0.00	0.00	0.00	0.00	2.98	69.41	0.00	0.0000	0.00	0.00	0.0015	0.0400	0.00
Uncontrolled (tpy)	0.00	0.00	0.00	0.00	0.00	0.00	13.05	4.67	0.00	0.0000	0.00	0.00	0.0064	0.0024	0.00
Field Gas (pph)	0.01	0.09	0.00	0.02	0.78	0.00	0.15	3.47	0.00	0.0027	0.08	0.00	0.0001	0.00	0.00
Field Gas (tpy)	0.04	0.86	0.00	0.07	3.44	0.00	0.65	0.23	0.00	0.0120	0.01	0.00	0.0003	0.00	0.00
Pilot Gas (pph)	0.0493	0.0000	0.0000	0.0984	0.0000	0.0000	0.0019	0.0000	0.0000	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000
Pilot Gas (tpy)	0.2158	0.0000	0.0000	0.4308	0.0000	0.0000	0.0084	0.0000	0.0000	0.0076	0.0000	0.0000	0.0001	0.0000	0.0000
Subtotal Flare (pph)	0.0575	0.0915	0.0000	0.1148	0.7848	0.0000	0.1508	3.4705	0.0000	0.004	0.0752	0.0000	0.0001	0.0020	0.0000
Subtotal Flare (tpy)	0.2519	0.8631	0.0000	0.5029	3.4374	0.0000	0.6607	0.2335	0.0000	0.0197	0.0063	0.0000	0.0004	0.0002	0.0000
Total Flare (pph)	**0.1490**			**0.8996**			**3.6213**			**0.0796**			**0.0021**		
Total Flare (tpy)	**1.1150**			**3.9404**			**0.8942**			**0.0259**			**0.0006**		

Notes: Pilot Gas to Flare (Cell D22) includes Pilot Gas and Sweep Gas.
MW of SO2 = 64.066
MW of H2S = 34.1

Sample Calculations:

$$NOx\ pph = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{hr}\right) X\ NOx\ Emission\ Factor\ \left(\frac{lb}{MMTBtu}\right)$$

$$NOx\ tpy = Hourly\ gas\ routed\ to\ the\ flare\ \left(\frac{MMBtu}{yr}\right) X\ NOx\ Emission\ Factor\left(\frac{lb}{MMTBtu}\right) X \frac{1}{2000}\left(\frac{ton}{lbs}\right)$$

$$SO2\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right)\ x\ \frac{MW\ of\ SO2}{MW\ \ of\ H2S}$$

$$Residual\ H2S\ pph = \frac{Weight\ \%\ H2S}{100}\ x\ \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\ \left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right) x\ \frac{MW\ of\ SO2}{MW\ \ of\ H2S}\ x\ Flare\ efficiency$$

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Thermal Oxidizer

A) Enter information into the yellow boxes.

B) See notes/instructions incuded below.

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

D) Make sure to select the correct *Emission Type* from the pull down menu below.

General Information	
Unit Name:	Thermal Oxidizer
Unit EPN:	EP-10
What kind of device is this? Enter a short description of the device type.	Thermal Oxidizer Controls emissions from Train 5 & 6 - Amine and Dehy regenerators.

Emission Factors

Emission Factors from AP-42 Table 1.4-1, 1.4-2, and 1.4-3 (lb/MMscf)

NOx	100	
CO	84	
PM10, PM2.5	7.6	5.7
SO_2	0.6	
VOC	5.5	
benzene	2.10E-03	

NOx and CO Emission Factors		
For Waste Gas:		
NOx	100	lb/MMscf
CO	84	lb/MMscf
For Pilot Stream(s):		
If there is one or more pilot streams, are they made up of pipeline quality natural gas, propane, or field gas? Pick from drop down list to the right and follow instructions below.	pipeline quality natural gas	
NOx	100	lb/MMscf
CO	84	lb/MMscf
Enter pilot stream information into the column for Stream No. 1 below. If there is more than one pilot stream, please enter it as one combined stream.", "Since there is no pilot, you do not need to enter anything in the column for Stream No. 1 below.		
For Added Fuel Stream(s):		
If there is one or more added fuel streams, are they made up of pipeline quality natural gas, propane, or field gas? Pick from drop down list to the right and follow instructions below.	no added fuel	
NOx	0	
CO	0	

Constants

Btu/MMBtu	1,000,000
scf/MMscf	1,000,000
lb/ton	2,000
H_2S molecular weight	34.08
SO_2 molecular weight	64.06

Destruction Efficiency	
VOC percent destruction efficiency (%)	99
H_2S percent destruction efficiency (%)	98

Stream Information

Each numbered column represents a stream. The first two columns are always for pilot and added fuel streams. The next ten columns, Columns 3-12, are for any streams sent to the control device, such as "tank 1", "amine regenerator vent", etc. Under the column numbers, these columns should be labeled with the stream name. Information only needs to be entered for the number of streams sent to the flare. If for example, there are only two process/waste streams routed to the flare, only colums 3 and 4 need to be filled out, and potentially 1 and 2 if there are also any pilot or added fuel streams.

Stream Sent to Thermal Oxidizer No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stream Sent to Thermal Oxidizer Name (Enter Names of Each Stream Here)	pilot(s)	added fuel stream(s)	To Thermal oxidizer stream										Total
Maximum Expected Hourly Volumtric Flow Rate of Stream (scf/hr)	1000		1236350										1237350
Amount of Time Stream Routed to Flare/Vapor Combustor (hrs/yr)	0.5		8584.8										-
Maximum Expected Annual Volumtric Flow Rate of Stream (scf/yr)	500		10613817480										1.06E+10
Heat Value of Stream - from program results or gas analysis (Btu/scf)	1020		12.6281										13.44224

It is suggested that you link these cells below to the cells in the other tabs of this spreadsheet which contain the calculated uncontrolled emissions for the stream.

Mass Flow Rates of the Vapors Sent to this Control Device, Hourly Basis (lb/hr)

Stream Sent to Thermal Oxidizer No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stream Sent to Thermal Oxidizer Name	pilot(s)	added fuel stream(s)	To Thermal oxidizer stream										-
H2S	-	-	3.74818										7.2994
Crude or Condensate VOC	-	-											0
Natural Gas VOC	-	-	365.50028										872.1926
Total VOC	-	-	365.50028										872.1926
benzene	-	-	75.0734										79.3206

Mass Flow Rates of the Vapors Sent to this Control Device, Annual Basis (tpy)

	1	2	3	4	5	6	7	8	9	10	11	12	Total
H2S	-	-	16.08868783										31.33194
Crude or Condensate VOC	-	-											0
Natural Gas VOC	-	-	1568.873402										3743.8
Total VOC	-	-	1568.873402										3743.8
benzene	-	-	322.2450622										340.4757

Controlled Emissions

Hourly (lb/hr)

Stream Sent to Thermal Oxidizer No.													Total
Stream Sent to Thermal Oxidizer Name	pilot(s)	added fuel stream(s)	To Thermal oxidizer stream										-
NOx	0.10	0.00	16.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**16.40**
CO	0.08	0.00	9.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.98**
PM2.5	0.01	0.00	7.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**7.05**
PM10	0.01	0.00	9.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.40**
H2S	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.08**
SO2	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.74**
Crude or Condensate VOC	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Natural Gas VOC	0.01	0.00	3.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3.66**
Total VOC	0.01	0.00	3.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3.66**
benzene	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.75**

Annual (tpy)

Stream Sent to Thermal Oxidizer No.													Total
Stream Sent to Thermal Oxidizer Name	pilot(s)	added fuel stream(s)	To Thermal oxidizer stream										-
NOx	0.00	0.00	69.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**69.97**
CO	0.00	0.00	42.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**42.49**
PM2.5	0.00	0.00	30.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**30.25**
PM10	0.00	0.00	40.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**40.33**
H2S	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.32**
SO2	0.00	0.00	30.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**30.24**
Crude or Condensate VOC	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Natural Gas VOC	0.00	0.00	15.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**15.69**
Total VOC	0.00	0.00	15.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**15.69**
benzene	0.00	0.00	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3.22**

Thermal Oxidizer Total Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total Crude Oil or Condensate VOC	0.00	0.00
Total Natural Gas VOC	3.66	15.69
Total VOC	3.66	15.69
NOx	16.40	69.97
CO	9.98	42.49
PM2.5	7.05	30.25
PM10	9.40	40.33
H2S	0.08	0.32
SO2	0.74	30.24
benzene	0.75	3.22

Enter any notes here as needed. You must address the following:
(1) How is this control efficiency justified? Please be specific.
(2) Explain what happens when this unit is down. Include how long the unit could be down for.

Notes: NOx and CO hourly emission rates from the thermal oxidizer spec sheet

Company Name
Site Name

Other Emissions

A) Enter information into the yellow boxes.

B) 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).

C) Since these emissions fall into the category of "Other", which does not have a pre-made emission estimation sheet with pre-approved methods, the time to review this project cannot be guaranteed to be as quick as if only pre-made sheets had been used.

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

E) Make sure to answer the control device question.

EPN:	EP-11
Name:	Thermal Oxidizer SSM

Are these 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

Uncontrolled Emissions			
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Control Efficiency
Total VOC	365.50	32.02	0
NOx	0.00	0.00	0
CO	0.00	0.00	0
PM2.5	0.00	0.00	0
PM10	0.00	0.00	0
H2S	3.75	0.33	0
SO2	0.00	0.00	0
benzene	75.07	6.58	0
formaldehyde	0.00	0.00	0

Total Emissions (control efficiencies factored in if applicable)		
	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Total VOC	365.50	32.02
NOx	0.00	0.00
CO	0.00	0.00
PM2.5	0.00	0.00
PM10	0.00	0.00
H2S	3.75	0.33
SO2	0.00	0.00
benzene	75.07	6.58
formaldehyde	0.00	0.00

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Flare / Vapor Combustor HAPs

Emission Unit EPN	Name	Flare Efficiency	Hours of Operation (hrs/hr)	Benzene lb/hr	Benzene tpy	Toluene lb/hr	Toluene tpy	Ethylbenzene lb/hr	Ethylbenzene tpy	n-Hexane lb/hr	n-Hexane tpy	Xylene lb/hr	Xylene tpy	2,2,4-Trimethylpentane lb/hr	2,2,4-Trimethylpentane tpy
5-EP-2	Cryo 5 & 6 Flare SSM	98%	12	3.60	0.022	0.89	0.01	0.04	0.0002	139.59	0.84	0.16	0.001	0.86	0.01
7-EP-2	Cryo 7 Flare SSM	98%	12	3.60	0.022	0.89	0.01	0.04	0.0002	139.59	0.84	0.16	0.001	0.86	0.01
5.5-EP-1b	AGI 2 Flare SSM	98%	66	0.000	0.00	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EP-12	Condensate Tanks Combustor	95%	8760	0.024	0.10	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
EP-10	Thermal Oxidizer	99%	8585	0.751	3.22	0.24	1.05	0.01	0.04	0.60	2.58	0.05	0.21	0.006	0.03
EP-11	Thermal Oxidizer SSM	0%	174	75.073	6.54	24.40	2.12	0.99	0.09	60.17	5.24	4.83	0.42	0.003	0.0003
EP-13	Sour Water Tanks Flare	95%	167	0.000	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.000	0.0000
Total				7.22	0.15	1.78	0.01	0.07	0.00	279.18	1.68	0.33	0.01	1.73	0.04

AGI 2 Flare Inlet Gas Analysis

Composition	Mol%	MW1	MW*Mol%	Spec. Volume (scf/lb)	Heating Value (Btu/scf)1	Mass Flow (lb/hr)
Carbon Dioxide	80.185%	44.01	35.290	8.623	0.0	10188.0
Nitrogen	0.000%	28.013	0.000	13.547	0.0	0.0
Hydrogen Sulfide	12.571%	34.076	4.284	11.136	637.0	1236.8
Methane	0.091%	16.043	0.015	23.65	1009.7	4.2
Ethane	0.026%	30.07	0.008	12.62	1768.7	2.2
Propane		44.097	0.000	8.606	2517.2	0.0
i-Butane		58.123	0.000	6.529	3252.6	0.0
n-Butane		58.123	0.000	6.529	3262	0.0
i-Pentane		72.15	0.000	5.26	3999.7	0.0
n-Pentane		72.15	0.000	5.26	4008.7	0.0
Hexanes		86.178	0.000	4.4	4756.1	0.0
Heptanes		100.205	0.000	3.787	5502.8	0.0
Benzene		78.114	0.000	4.858	3741.9	0.0
Toluene		92.141	0.000	4.119	4474.8	0.0
Xylene		106.16	0.000	3.574	4957	0.0
Ethylbenzene		106.17	0.000	3.574	4970.6	0.0
Octane		114.23	0.000	3.322	5796.1	0.0
Water	7.101%	18.04	1.281	0.016	0	486241.0
VOC Total	**0.0%**		**0.00**			**0.0**
Total	**100%**		**40.88**			**11,431.2**

Train 5,6 & 7 Flare Inlet Gas Analysis (Mole Sieve Stream)

Composition	Mass Flow (lb/hr)
N2	16143.9
C1	312132.0
CO2	79.6
C2	87557.7
H2S	0.0
C3	66142.8
iC4	10577.4
nC4	24412.2
iC5	6371.0
nC5	6249.8
C6	6755.2
C7	72.2
C8	22.8
C9	12.7
C10	0.0
Cyclopentan	342.2
Benzene	179.8
Cyclohexane	224.3
Methylcyclo	89.2
2,2,4-Trimet	42.9
Toluene	44.5
Ethylbenzen	1.8
p-Xylene	8.2
H2O	59.0
MDEA	0.0
Piperazine	0.0
TEG	4.2
CHEMTHERM	0.0

Combustor Inlet Gas Analysis

Composition	Mass Flow (lb/hr)
Nitrogen	0.000
Methane	0.000
Carbon Diox	0.000
Ethane	0.000
Propane	0.070
Isobutane	0.362
n-Butane	2.943
Isopentane	6.719
n-Pentane	8.233
Cyclopentan	0.643
2-Methylper	0.000
3-Methylper	0.000
n-Hexane	10.844
Methylcyclo	0.000
Benzene	0.470
Cyclohexane	0.513
2-Methylhex	0.000
3-Methylhex	0.000
n-Heptane	0.169
Methylcyclo	0.215
Toluene	0.139
n-Octane	0.028
Ethylbenzen	0.006
n-Nonane	0.007
n-Decane	0.000
Undecane	0.000
Dodecane	0.000
Water	0.000
Hydrogen Su	0.000
2,2-Dimethyl	0.000
2,2-Dimethyl	0.000
2,3-Dimethyl	0.000
2,2,4-Trimetl	0.096
Tridecane	0.000
Tetradecane	0.000
Pentadecane	0.000
Hexadecane	0.000
Heptadecane	0.000
Octadecane	0.000
Nonadecane	0.000
Eicosane	0.000
Heneicosane	0.000
Docosane	0.000
Tricosane	0.000
Tetracosane	0.000
Pentacosane	0.000
Hexacosane	0.000
Heptacosane	0.000
Octacosane	0.000
Nonacosane	0.000
Triacontane	0.000
2,2,4-Trimetl	0.000
m-Xylene	0.000
o-Xylene	0.000
1,t-2-Dimeth	0.000
4,4-Dimethyl	0.000
p-Xylene	0.030
TEG	0.000
Piperazine	0.000
MDEA	0.000
O2	0.000

Thermal Oxidizer Inlet Gas Analysis

Composition	Mass Flow (lb/hr)
N2	0.24
C1	47.42
CO2	66397.73
C2	34.86
H2S	1.87
C3	36.89
iC4	6.04
nC4	24.97
iC5	10.67
nC5	13.49
C6	26.53
C7	0.52
C8	0.24
C9	0.20
C10	0.00
Cyclopentane	5.13
Benzene	37.54
Cyclohexane	3.55
Methylcyclohe	1.58
2,2,4-Trimeth	0.29
Toluene	12.20
Ethylbenzene	0.50
p-Xylene	2.42
H2O	2041.17
MDEA	0.00
Piperazine	0.00
TEG	0.00

Sour Water Tanks Head Space Analysis

Composition	lb/hr
Hydrogen Su	0.00
Nitrogen	0.06
Carbon Dioxi	0.00
Methane	0.03
Ethane	0.01
Propane	0.27
Isobutane	0.38
N-Butane	0.92
Isopentane	0.61
N-Pentane	0.43
Hexanes +	0.37

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Planned MSS Emissions

A) Enter information into the yellow boxes.

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

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) Make sure to answer the control device question.

EPN	2-EP-1t
Identifier	Train 2 - Blowdown SSM

Describe this MSS event in detail, include specifically what is being done and how it is being done.	Residue compressor blowdown emissions during maintenance activities. This train has 4 compressors, each with 470 acf of venting. 4 compressor blowdown volume = 470 x 4 = 1880 acf

Venting Emission Calculation

Warning: **This calculation should provide a conservatively high (potentially overestimated) result for emissions from venting when only gas is present in a unit. If liquids are present in the unit, this calculation could potentially significantly underestimate emissions because this calculation does not factor in emissions resulting from the evaporation of liquids present in the unit. If liquids are present or if you wish to use another calculation methodology, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).**

If emissions from this source are uncontrolled:

The formula is set up to do one calculation, which assumes that the entire volume of gas inside the unit is vented from the unit. The calculation of the mass of vented gas is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

If emissions from this source are controlled:

The formula is set up to do two calculations. To preface the explanation of the two calculations, it is understood that for a release from a pressurized vessel, initial venting due to depressurization could occur rapidly until the vapor inside the vessel is equal to the atmospheric pressure, then further venting of the vapor still left in the vessel at atmospheric conditions could occur at a slower rate. This calculation assumes that any releases at atmospheric pressure cannot be controlled.

In order to move the vapor present in the vessel at atmospheric conditions to a control device, a flare for example, some sort of extra operation is needed such as using air or nitrogen to move the vapor out, and if all of that vapor is routed to the control device, it may be diluted to the point where it would not have a sufficient heating value to combust, and if a supplemental fuel stream is added, there would be additional emissions associated with this.

If you do have a way to move the vapor present in the vessel at atmospheric conditions to a control device, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs). Also, please describe this MSS event in detail, include specifically what is being done, how it is being done, and how all of the vapor is controlled.

The first calculation of the mass of vented gas, which assumes that the entire volume of gas inside the unit is vented from the unit, is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

The second calculation is done the same as the first one except using the atmospheric pressure (instead of the pressure inside the unit before the venting occurs) and represents all of the mass vented from the vessel that is present at atmospheric conditions (after the vessel depressurization).

The final result is the first calculation plus the second calculation, with the control efficiency only applied to the first calculation (which uses the pressure inside the unit before venting and represents the entire volume of gas inside the unit being vented).

Actual Volume of the Vented Unit (acf - actual cubic feet)	1880
Pressure of Gas Inside the Unit Before Venting (psig)	241.304051
Final Pressure (psia)	14.7
Pressure of Gas Inside the Unit Before Venting (psia)	256.004051
Temperature of Gas Inside the Unit Before Venting (°F)	100.00
Temperature of Gas Inside the Unit Before Venting (°R)	559.67
Duration of Each Event (hours/event)	1
Frequency of Events (events/year)	8
Venting Gas Molecular Weight (lb/lb-mol)	16.82
VOC wt %	0.157304435
benzene wt%	0
H_2S wt%	0.006079097
Are planned MSS 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

Ideal Gas Constant, [(ft3*psia)/(R*lb-mol)]

10.73159

Gas Molecular Weight and Weight Percents From Analyses Tab:

Molecular Weight	22.7523
VOC wt %	21.3005
Benzene wt %	0.0488
H2S wt %	0.0003

Planned MSS Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC Results:	2.1201	0.0085
Benzene Results:	0.0000	0.0000
H_2S Results:	0.0819	0.0003

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Planned MSS Emissions

A) Enter information into the yellow boxes.

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

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) Make sure to answer the control device question.

EPN	3-EP-1t
Identifier	Train 3 - Blowdown SSM

Describe this MSS event in detail, include specifically what is being done and how it is being done.	Residue compressor blowdown emissions during maintenace activities. This train has 4 compressors, each with 470 acf of venting. 4 compressor blowdown volume = 470 x 4 = 1880 acf

Venting Emission Calculation

Warning: This calculation should provide a conservatively high (potentially overestimated) result for emissions from venting when only gas is present in a unit. If liquids are present in the unit, this calculation could potentially significantly underestimate emissions because this calculation does not factor in emissions resulting from the evaporation of liquids present in the unit. If liquids are present or if you wish to use another calculation methodology, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).

If emissions from this source are uncontrolled:

The formula is set up to do one calculation, which assumes that the entire volume of gas inside the unit is vented from the unit. The calculation of the mass of vented gas is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

If emissions from this source are controlled:

The formula is set up to do two calculations. To preface the explanation of the two calculations, it is understood that for a release from a pressurized vessel, initial venting due to depressurization could occur rapidly until the vapor inside the vessel is equal to the atmospheric pressure, then further venting of the vapor still left in the vessel at atmospheric conditions could occur at a slower rate. This calculation assumes that any releases at atmospheric pressure cannot be controlled.

In order to move the vapor present in the vessel at atmospheric conditions to a control device, a flare for example, some sort of extra operation is needed such as using air or nitrogen to move the vapor out, and if all of that vapor is routed to the control device, it may be diluted to the point where it would not have a sufficient heating value to combust, and if a supplemental fuel stream is added, there would be additional emissions associated with this.

If you do have a way to move the vapor present in the vessel at atmospheric conditions to a control device, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs). Also, please describe this MSS event in detail, include specifically what is being done, how it is being done, and how all of the vapor is controlled.

The first calculation of the mass of vented gas, which assumes that the entire volume of gas inside the unit is vented from the unit, is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

The second calculation is done the same as the first one except using the atmospheric pressure (instead of the pressure inside the unit before the venting occurs) and represents all of the mass vented from the vessel that is present at atmospheric conditions (after the vessel depressurization).

The final result is the first calculation plus the second calculation, with the control efficiency only applied to the first calculation (which uses the pressure inside the unit before venting and represents the entire volume of gas inside the unit being vented).

Actual Volume of the Vented Unit (acf - actual cubic feet)	1880
Pressure of Gas Inside the Unit Before Venting (psig)	241.304051
Final Pressure (psia)	14.7
Pressure of Gas Inside the Unit Before Venting (psia)	256.004051
Temperature of Gas Inside the Unit Before Venting (°F)	100.00
Temperature of Gas Inside the Unit Before Venting (°R)	559.67
Duration of Each Event (hours/event)	1
Frequency of Events (events/year)	8
Venting Gas Molecular Weight (lb/lb-mol)	16.81921558
VOC wt %	0.157304435
benzene wt%	0
H_2S wt%	0.006079097
Are planned MSS 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

Ideal Gas Constant, [(ft3*psia)/(R*lb-mol)]

10.73159

Gas Molecular Weight and Weight Percents From Analyses Tab:

Molecular Weight	22.7523
VOC wt %	21.3005
Benzene wt %	0.0488
H2S wt %	0.0003

Planned MSS Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC Results:	2.1201	0.0085
Benzene Results:	0.0000	0.0000
H_2S Results:	0.0819	0.0003

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Planned MSS Emissions

A) Enter information into the yellow boxes.

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

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) Make sure to answer the control device question.

EPN	4-EP-1t
Identifier	Train 4 - Blowdown SSM

Describe this MSS event in detail, include specifically what is being done and how it is being done.	Residue compressor blowdown emissions during maintenace activities. This train has 4 compressors, each with 470 acf of venting. 4 compressor blowdown volume = 470 x 4 = 1880 acf

Venting Emission Calculation

Warning: This calculation should provide a conservatively high (potentially overestimated) result for emissions from venting when only gas is present in a unit. If liquids are present in the unit, this calculation could potentially significantly underestimate emissions because this calculation does not factor in emissions resulting from the evaporation of liquids present in the unit. If liquids are present or if you wish to use another calculation methodology, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).

If emissions from this source are uncontrolled:

The formula is set up to do one calculation, which assumes that the entire volume of gas inside the unit is vented from the unit. The calculation of the mass of vented gas is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

If emissions from this source are controlled:

The formula is set up to do two calculations. To preface the explanation of the two calculations, it is understood that for a release from a pressurized vessel, initial venting due to depressurization could occur rapidly until the vapor inside the vessel is equal to the atmospheric pressure, then further venting of the vapor still left in the vessel at atmospheric conditions could occur at a slower rate. This calculation assumes that any releases at atmospheric pressure cannot be controlled.

In order to move the vapor present in the vessel at atmospheric conditions to a control device, a flare for example, some sort of extra operation is needed such as using air or nitrogen to move the vapor out, and if all of that vapor is routed to the control device, it may be diluted to the point where it would not have a sufficient heating value to combust, and if a supplemental fuel stream is added, there would be additional emissions associated with this.

If you do have a way to move the vapor present in the vessel at atmospheric conditions to a control device, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs). Also, please describe this MSS event in detail, include specifically what is being done, how it is being done, and how all of the vapor is controlled.

The first calculation of the mass of vented gas, which assumes that the entire volume of gas inside the unit is vented from the unit, is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

The second calculation is done the same as the first one except using the atmospheric pressure (instead of the pressure inside the unit before the venting occurs) and represents all of the mass vented from the vessel that is present at atmospheric conditions (after the vessel depressurization).

The final result is the first calculation plus the second calculation, with the control efficiency only applied to the first calculation (which uses the pressure inside the unit before venting and represents the entire volume of gas inside the unit being vented).

Actual Volume of the Vented Unit (acf - actual cubic feet)	1880
Pressure of Gas Inside the Unit Before Venting (psig)	241.304051
Final Pressure (psia)	14.7
Pressure of Gas Inside the Unit Before Venting (psia)	256.004051
Temperature of Gas Inside the Unit Before Venting (°F)	100.00
Temperature of Gas Inside the Unit Before Venting (°R)	559.67
Duration of Each Event (hours/event)	1
Frequency of Events (events/year)	8
Venting Gas Molecular Weight (lb/lb-mol)	16.81921558
VOC wt %	0.157304435
benzene wt%	0
H_2S wt%	0.006079097
Are planned MSS 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

Ideal Gas Constant, [(ft3*psia)/(R*lb-mol)]

10.73159

Gas Molecular Weight and Weight Percents From Analyses Tab:

Molecular Weight	22.7523
VOC wt %	21.3005
Benzene wt %	0.0488
H2S wt %	0.0003

Planned MSS Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC Results:	2.1201	0.0085
Benzene Results:	0.0000	0.0000
H_2S Results:	0.0819	0.0003

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Planned MSS Emissions

A) Enter information into the yellow boxes.

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

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) Make sure to answer the control device question.

EPN	5-EP-1t
Identifier	Train 5 - Blowdown SSM

Describe this MSS event in detail, include specifically what is being done and how it is being done.	Residue compressor blowdown emissions during maintenace activities. This train has 4 compressors, each with 470 acf of venting. 4 compressor blowdown volume = 470 x 4 = 1880 acf

Venting Emission Calculation

Warning: This calculation should provide a conservatively high (potentially overestimated) result for emissions from venting when only gas is present in a unit. If liquids are present in the unit, this calculation could potentially significantly underestimate emissions because this calculation does not factor in emissions resulting from the evaporation of liquids present in the unit. If liquids are present or if you wish to use another calculation methodology, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).

If emissions from this source are uncontrolled:

The formula is set up to do one calculation, which assumes that the entire volume of gas inside the unit is vented from the unit. The calculation of the mass of vented gas is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

If emissions from this source are controlled:

The formula is set up to do two calculations. To preface the explanation of the two calculations, it is understood that for a release from a pressurized vessel, initial venting due to depressurization could occur rapidly until the vapor inside the vessel is equal to the atmospheric pressure, then further venting of the vapor still left in the vessel at atmospheric conditions could occur at a slower rate. This calculation assumes that any releases at atmospheric pressure cannot be controlled.

In order to move the vapor present in the vessel at atmospheric conditions to a control device, a flare for example, some sort of extra operation is needed such as using air or nitrogen to move the vapor out, and if all of that vapor is routed to the control device, it may be diluted to the point where it would not have a sufficient heating value to combust, and if a supplemental fuel stream is added, there would be additional emissions associated with this.

If you do have a way to move the vapor present in the vessel at atmospheric conditions to a control device, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs). Also, please describe this MSS event in detail, include specifically what is being done, how it is being done, and how all of the vapor is controlled.

The first calculation of the mass of vented gas, which assumes that the entire volume of gas inside the unit is vented from the unit, is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

The second calculation is done the same as the first one except using the atmospheric pressure (instead of the pressure inside the unit before the venting occurs) and represents all of the mass vented from the vessel that is present at atmospheric conditions (after the vessel depressurization).

The final result is the first calculation plus the second calculation, with the control efficiency only applied to the first calculation (which uses the pressure inside the unit before venting and represents the entire volume of gas inside the unit being vented).

Actual Volume of the Vented Unit (acf - actual cubic feet)	1880
Pressure of Gas Inside the Unit Before Venting (psig)	241.304051
Final Pressure (psia)	14.7
Pressure of Gas Inside the Unit Before Venting (psia)	256.004051
Temperature of Gas Inside the Unit Before Venting (°F)	100.00
Temperature of Gas Inside the Unit Before Venting (°R)	559.67
Duration of Each Event (hours/event)	1
Frequency of Events (events/year)	8
Venting Gas Molecular Weight (lb/lb-mol)	16.81921558
VOC wt %	0.157304435
benzene wt%	0
H_2S wt%	0.006079097
Are planned MSS 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

Ideal Gas Constant, [(ft3*psia)/(R*lb-mol)]

10.73159

Gas Molecular Weight and Weight Percents From Analyses Tab:

Molecular Weight	22.7523
VOC wt %	21.3005
Benzene wt %	0.0488
H2S wt %	0.0003

Planned MSS Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC Results:	2.1201	0.0085
Benzene Results:	0.0000	0.0000
H_2S Results:	0.0819	0.0003

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Planned MSS Emissions

A) Enter information into the yellow boxes.

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

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) Make sure to answer the control device question.

EPN	6-EP-1t
Identifier	Train 6 - Blowdown SSM

Describe this MSS event in detail, include specifically what is being done and how it is being done.	Residue compressor blowdown emissions during maintenace activities. This train has 4 compressors, each with 470 acf of venting. 4 compressor blowdown volume = 470 x 4 = 1880 acf

Venting Emission Calculation

Warning: **This calculation should provide a conservatively high (potentially overestimated) result for emissions from venting when only gas is present in a unit. If liquids are present in the unit, this calculation could potentially significantly underestimate emissions because this calculation does not factor in emissions resulting from the evaporation of liquids present in the unit. If liquids are present or if you wish to use another calculation methodology, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).**

If emissions from this source are uncontrolled:

The formula is set up to do one calculation, which assumes that the entire volume of gas inside the unit is vented from the unit. The calculation of the mass of vented gas is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

If emissions from this source are controlled:

The formula is set up to do two calculations. To preface the explanation of the two calculations, it is understood that for a release from a pressurized vessel, initial venting due to depressurization could occur rapidly until the vapor inside the vessel is equal to the atmospheric pressure, then further venting of the vapor still left in the vessel at atmospheric conditions could occur at a slower rate. This calculation assumes that any releases at atmospheric pressure cannot be controlled.

In order to move the vapor present in the vessel at atmospheric conditions to a control device, a flare for example, some sort of extra operation is needed such as using air or nitrogen to move the vapor out, and if all of that vapor is routed to the control device, it may be diluted to the point where it would not have a sufficient heating value to combust, and if a supplemental fuel stream is added, there would be additional emissions associated with this.

If you do have a way to move the vapor present in the vessel at atmospheric conditions to a control device, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs). Also, please describe this MSS event in detail, include specifically what is being done, how it is being done, and how all of the vapor is controlled.

The first calculation of the mass of vented gas, which assumes that the entire volume of gas inside the unit is vented from the unit, is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

The second calculation is done the same as the first one except using the atmospheric pressure (instead of the pressure inside the unit before the venting occurs) and represents all of the mass vented from the vessel that is present at atmospheric conditions (after the vessel depressurization).

The final result is the first calculation plus the second calculation, with the control efficiency only applied to the first calculation (which uses the pressure inside the unit before venting and represents the entire volume of gas inside the unit being vented).

Ideal Gas Constant, [(ft3*psia)/(R*lb-mol)]

10.73159

Actual Volume of the Vented Unit (acf - actual cubic feet)	1880
Pressure of Gas Inside the Unit Before Venting (psig)	241.304051
Final Pressure (psia)	14.7
Pressure of Gas Inside the Unit Before Venting (psia)	256.004051
Temperature of Gas Inside the Unit Before Venting (°F)	100.00
Temperature of Gas Inside the Unit Before Venting (°R)	559.67
Duration of Each Event (hours/event)	1
Frequency of Events (events/year)	8
Venting Gas Molecular Weight (lb/lb-mol)	16.81921558
VOC wt %	0.157304435
benzene wt%	0
H_2S wt%	0.006079097
Are planned MSS 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

Gas Molecular Weight and Weight Percents From Analyses Tab:

Molecular Weight	22.7523
VOC wt %	21.3005
Benzene wt %	0.0488
H2S wt %	0.0003

<u>Planned MSS Emissions</u>

	Hourly Emissions (lb/hr)	**Annual Emissions (tpy)**
VOC Results:	2.1201	0.0085
Benzene Results:	0.0000	0.0000
H_2S Results:	0.0819	0.0003

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Planned MSS Emissions

A) Enter information into the yellow boxes.

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

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) Make sure to answer the control device question.

EPN	7-EP-1t
Identifier	Train 7 - Blowdown SSM

Describe this MSS event in detail, include specifically what is being done and how it is being done.	Residue compressor blowdown emissions during maintenace activities. This train has 4 compressors, each with 470 acf of venting. 4 compressor blowdown volume = 470 x 4 = 1880 acf

Venting Emission Calculation

Warning: This calculation should provide a conservatively high (potentially overestimated) result for emissions from venting when only gas is present in a unit. If liquids are present in the unit, this calculation could potentially significantly underestimate emissions because this calculation does not factor in emissions resulting from the evaporation of liquids present in the unit. If liquids are present or if you wish to use another calculation methodology, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs).

If emissions from this source are uncontrolled:

The formula is set up to do one calculation, which assumes that the entire volume of gas inside the unit is vented from the unit. The calculation of the mass of vented gas is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

If emissions from this source are controlled:

The formula is set up to do two calculations. To preface the explanation of the two calculations, it is understood that for a release from a pressurized vessel, initial venting due to depressurization could occur rapidly until the vapor inside the vessel is equal to the atmospheric pressure, then further venting of the vapor still left in the vessel at atmospheric conditions could occur at a slower rate. This calculation assumes that any releases at atmospheric pressure cannot be controlled.

In order to move the vapor present in the vessel at atmospheric conditions to a control device, a flare for example, some sort of extra operation is needed such as using air or nitrogen to move the vapor out, and if all of that vapor is routed to the control device, it may be diluted to the point where it would not have a sufficient heating value to combust, and if a supplemental fuel stream is added, there would be additional emissions associated with this.

If you do have a way to move the vapor present in the vessel at atmospheric conditions to a control device, do not use this calculation tab. Instead, use the calculation tab for "Other" and make sure to provide a separate detailed calculation for these emissions and also include any necessary supplemental information and notes (such as the source/justification for any calculation inputs). Also, please describe this MSS event in detail, include specifically what is being done, how it is being done, and how all of the vapor is controlled.

The first calculation of the mass of vented gas, which assumes that the entire volume of gas inside the unit is vented from the unit, is done based on the volume of the unit vented, which is assumed to be saturated with vapor, and the temperature and pressure inside the unit before the venting occurs.

The second calculation is done the same as the first one except using the atmospheric pressure (instead of the pressure inside the unit before the venting occurs) and represents all of the mass vented from the vessel that is present at atmospheric conditions (after the vessel depressurization).

The final result is the first calculation plus the second calculation, with the control efficiency only applied to the first calculation (which uses the pressure inside the unit before venting and represents the entire volume of gas inside the unit being vented).

Actual Volume of the Vented Unit (acf - actual cubic feet)	1880
Pressure of Gas Inside the Unit Before Venting (psig)	241.304051
Final Pressure (psia)	14.7
Pressure of Gas Inside the Unit Before Venting (psia)	256.004051
Temperature of Gas Inside the Unit Before Venting (°F)	100.00
Temperature of Gas Inside the Unit Before Venting (°R)	559.67
Duration of Each Event (hours/event)	1
Frequency of Events (events/year)	8
Venting Gas Molecular Weight (lb/lb-mol)	16.81921558
VOC wt %	0.157304435
benzene wt%	0
H_2S wt%	0.006079097
Are planned MSS 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

Ideal Gas Constant, [(ft3*psia)/(R*lb-mol)]

10.73159

Gas Molecular Weight and Weight Percents From Analyses Tab:

Molecular Weight	22.7523
VOC wt %	21.3005
Benzene wt %	0.0488
H2S wt %	0.0003

Planned MSS Emissions

	Hourly Emissions (lb/hr)	Annual Emissions (tpy)
VOC Results:	2.1201	0.0085
Benzene Results:	0.0000	0.0000
H_2S Results:	0.0819	0.0003

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Haul Road Emissions

General Information	
Unit Name:	Haul emissions
Unit EPN:	HAUL1
What kind of device is this? Enter a short description of the device type.	Unpaved haul road emissions from trucking operations for condensate tanks - Exempt under NMAC 20.2.72.202.B.5

Empty vehicle weight (tons)	16.00
Density of liquid loaded (lb/gal)	5.38
Load weight (tons)	20.34
Loaded vehicle (tons)	36.34
Mean vehicle weight (tons)	26.11
Round-trip distance (mile/trip)	0.32
Annual Throughput (bbl/yr)	1143180.00
Trip frequency (trips/hr)	2.00
Trip frequency (trips/yr)	6276.28
Surface silt content (%)	4.80
Annual wet days (days/yr)	70.00
Vehicle miles traveled (mile/hr)	0.60
Control	Base course and watering
Control Efficiency (%)	80%

Controlled Emissions		
Hourly (lb/hr)		
PM_{30}	PM_{10}	$PM_{2.5}$
0.820	0.209	0.021
Annual (tpy)		
1.109	0.283	0.028

Emission Factors and Constants

Parameter	PM_{30}	PM_{10}	$PM_{2.5}$	
k, lb/VMT	4.90	1.50	0.15	
a, lb/VMT	0.70	0.90	0.90	Table 13.2.2-2,
b, lb/VMT	0.45	0.45	0.45	Industrial Roads
Hourly EF, lb/VMT	6.83	1.74	0.17	
				AP-42 13.2.2,
Annual EF, lb/VMT	5.52	1.41	0.14	Equation 1a & 2

Empty vehicle weight includes driver and occupants and full fuel load.

Cargo, transported materials, etc. (6.8 lb/gal Oil *7560 gal truck/ 2000lb/ton)

Loaded vehicle weight = Empty + Load Size

Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2

AP-42 Table 13.2.2-1 - Silt Content 4.8 %

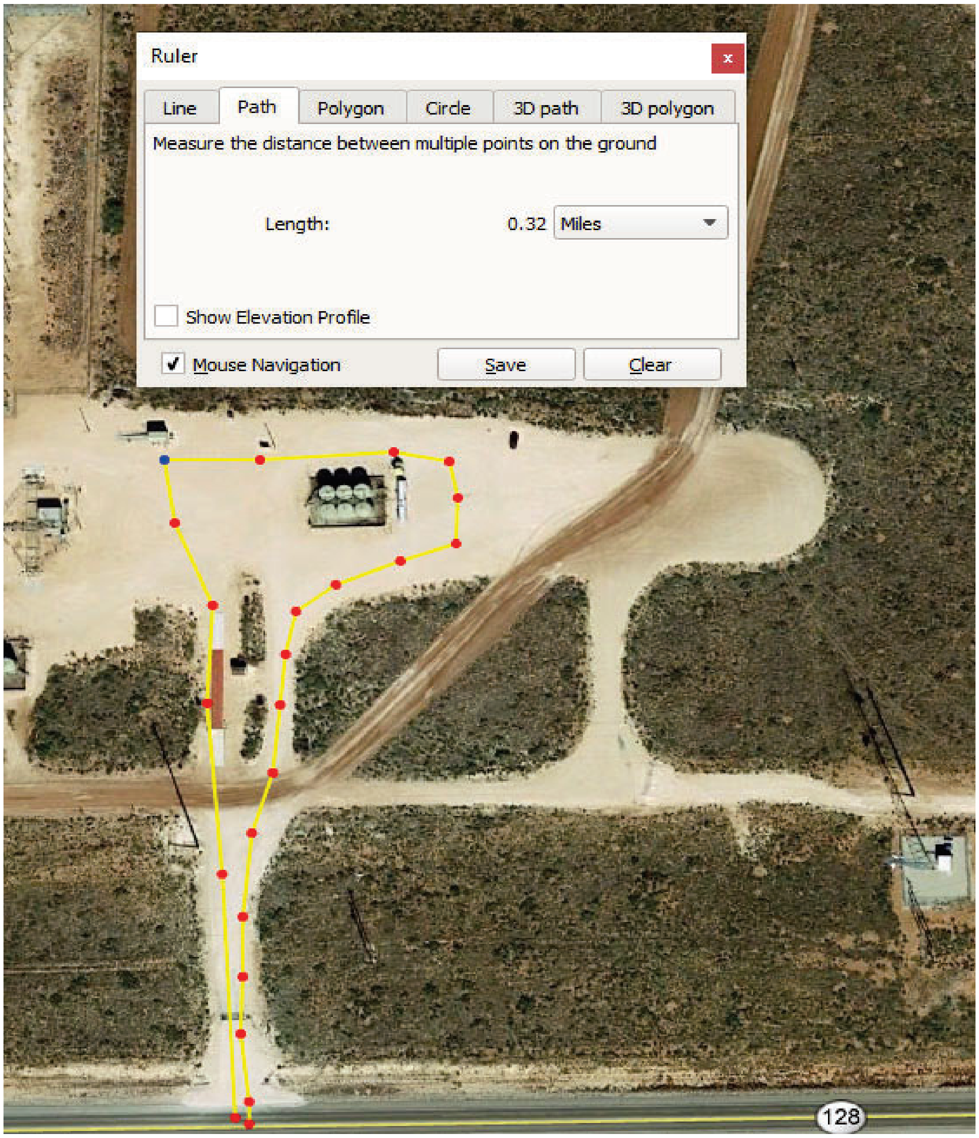
AP-42 Figure 13.2.2-1 - Annual wet days

VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length
Control Efficiency - NMED Guidance Document - Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions

Table 13.2.2-2, Industrial Roads for values of k, a, and b.
AP-42 13.2.2, Equation 1a & AP-42 13.2.2, Equation 2 for Hourly and Annual EF calculations.

lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr) * (1-control efficiency)

ton/yr =Annual EF (lb/VMT) * VMT (mile/Trip) * Trips per year (Trip/yr) / 2000 (lb/tpy) * (1-control efficiency)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128

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Haul Road Emissions

General Information	
Unit Name:	Haul emissions
Unit EPN:	HAUL2
What kind of device is this? Enter a short description of the device type.	Unpaved haul road emissions from trucking operations for sour water tanks - Exempt under NMAC 20.2.72.202.B.5

Empty vehicle weight (tons)	16.00
Density of liquid loaded (lb/gal)	5.38
Load weight (tons)	20.34
Loaded vehicle (tons)	36.34
Mean vehicle weight (tons)	26.11
Round-trip distance (mile/trip)	0.75
Annual Throughput (bbl/yr)	31755.00
Trip frequency (trips/hr)	2.00
Trip frequency (trips/yr)	174.34
Surface silt content (%)	4.80
Annual wet days (days/yr)	70.00
Vehicle miles traveled (mile/hr)	0.60
Control	Base course and watering
Control Efficiency (%)	80%

Controlled Emissions		
Hourly (lb/hr)		
PM_{30}	PM_{10}	$PM_{2.5}$
0.820	0.209	0.021
Annual (tpy)		
0.072	0.018	0.002

Emission Factors and Constants

Parameter	PM_{30}	PM_{10}	$PM_{2.5}$	
k, lb/VMT	4.90	1.50	0.15	Table 13.2.2-2, Industrial Roads
a, lb/VMT	0.70	0.90	0.90	
b, lb/VMT	0.45	0.45	0.45	
Hourly EF, lb/VMT	6.83	1.74	0.17	AP-42 13.2.2, Equation 1a & 2
Annual EF, lb/VMT	5.52	1.41	0.14	

Empty vehicle weight includes driver and occupants and full fuel load.

Cargo, transported materials, etc. (6.8 lb/gal Oil *7560 gal truck/ 2000lb/ton)

Loaded vehicle weight = Empty + Load Size

Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2

AP-42 Table 13.2.2-1 - Silt Content 4.8 %

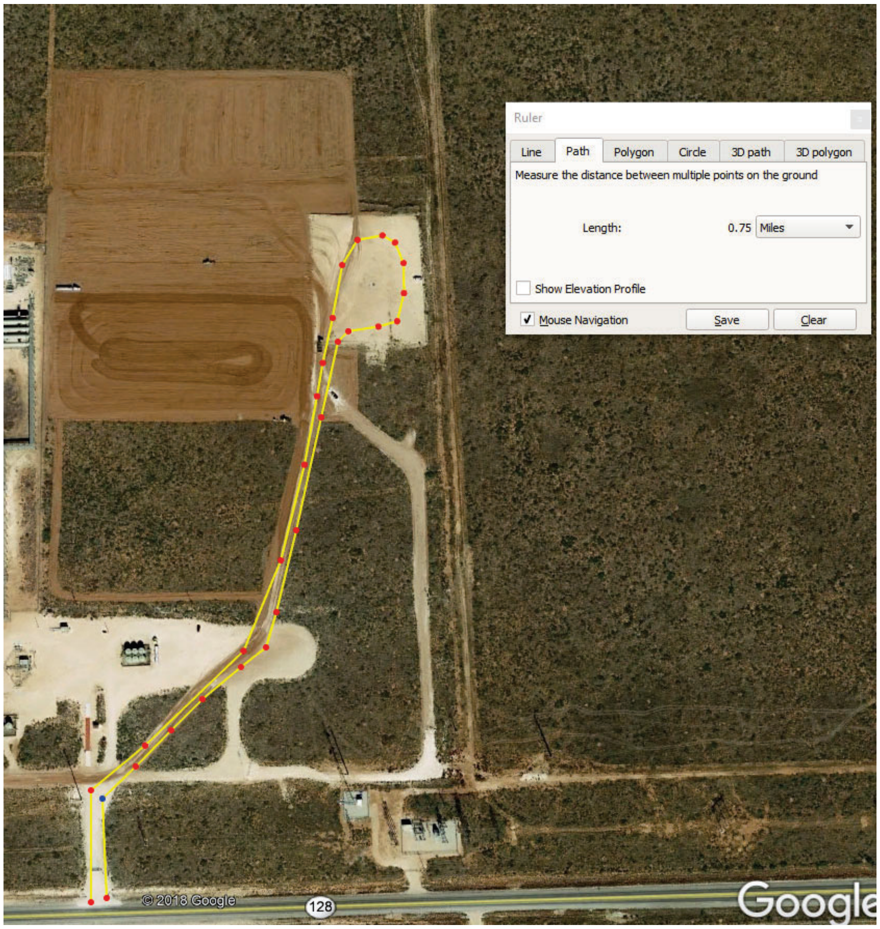
AP-42 Figure 13.2.2-1 - Annual wet days

VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length
Control Efficiency - NMED Guidance Document - Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions

Table 13.2.2-2, Industrial Roads for values of k, a, and b.
AP-42 13.2.2, Equation 1a & AP-42 13.2.2, Equation 2 for Hourly and Annual EF calculations.

lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr) * (1-control efficiency)

ton/yr =Annual EF (lb/VMT) * VMT (mile/Trip) * Trips per year (Trip/yr) / 2000 (lb/tpy) * (1-control efficiency)



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Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Haul Road Emissions

General Information	
Unit Name:	Haul emissions
Unit EPN:	HAUL3
What kind of device is this? Enter a short description of the device type.	Unpaved haul road emissions from trucking operations for slop tanks - Exempt under NMAC 20.2.72.202.B.5

Empty vehicle weight (tons)	16.00
Density of liquid loaded (lb/gal)	5.38
Load weight (tons)	20.34
Loaded vehicle (tons)	36.34
Mean vehicle weight (tons)	26.11
Round-trip distance (mile/trip)	1.58
Annual Throughput (bbl/yr)	88330.00
Trip frequency (trips/hr)	2.00
Trip frequency (trips/yr)	484.95
Surface silt content (%)	4.80
Annual wet days (days/yr)	70.00
Vehicle miles traveled (mile/hr)	0.60
Control	Base course and watering
Control Efficiency (%)	80%

Controlled Emissions		
Hourly (lb/hr)		
PM_{30}	PM_{10}	$PM_{2.5}$
0.820	0.209	0.021
Annual (tpy)		
0.423	0.108	0.011

Emission Factors and Constants

Parameter	PM_{30}	PM_{10}	$PM_{2.5}$	
k, lb/VMT	4.90	1.50	0.15	
a, lb/VMT	0.70	0.90	0.90	Table 13.2.2-2,
b, lb/VMT	0.45	0.45	0.45	Industrial Roads
Hourly EF, lb/VMT	6.83	1.74	0.17	
				AP-42 13.2.2,
Annual EF, lb/VMT	5.52	1.41	0.14	Equation 1a & 2

Empty vehicle weight includes driver and occupants and full fuel load.

Cargo, transported materials, etc. (6.8 lb/gal Oil *7560 gal truck/ 2000lb/ton)

Loaded vehicle weight = Empty + Load Size

Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2

AP-42 Table 13.2.2-1 - Silt Content 4.8 %

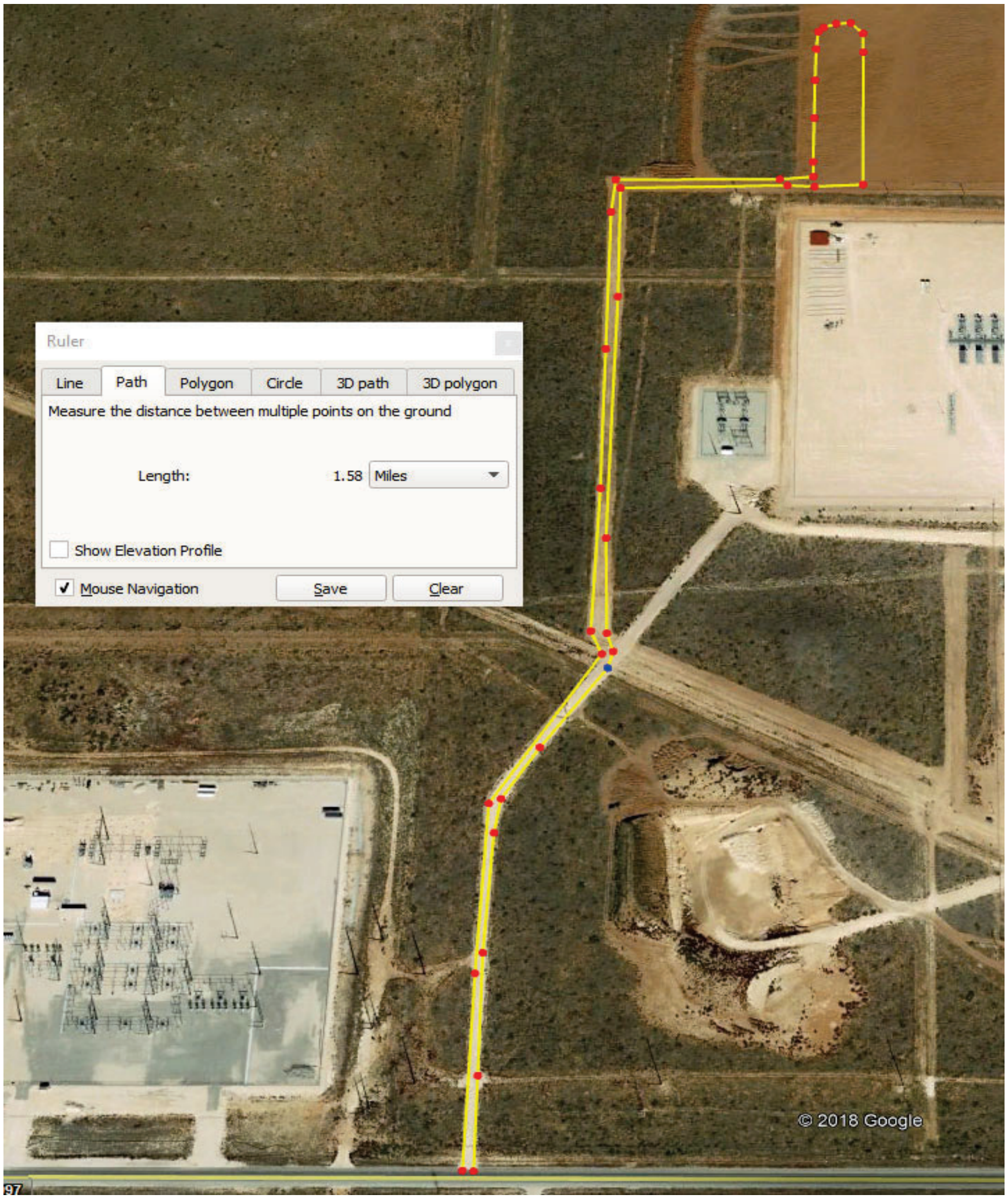
AP-42 Figure 13.2.2-1 - Annual wet days

VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length
Control Efficiency - NMED Guidance Document - Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions

Table 13.2.2-2, Industrial Roads for values of k, a, and b.
AP-42 13.2.2, Equation 1a & AP-42 13.2.2, Equation 2 for Hourly and Annual EF calculations.

lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr) * (1-control efficiency)

ton/yr =Annual EF (lb/VMT) * VMT (mile/Trip) * Trips per year (Trip/yr) / 2000 (lb/tpy) * (1-control efficiency)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Measure the distance between multiple points on the ground
Length:
1.58
Miles
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Default VOC emissions for Miscellaneous MSS activities

Company Name	Lucid Energy Delaware, LLC
Site Name	Red Hills Gas Processing Plant

Source Name	Miscellaneous Startup, Shutdown and Maintenance
EPN	SSM/M

Date of MSS activity	**Varies**
Default VOC emissions (tpy) associated with miscellaneous MSS activities	**0.250**
Add default VOC emissions from miscellaneous MSS activities to the emissions summary	No

#	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	41	0.506
			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)	12	Total (lbs/yr/engine)	24.678			
			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	41	2.87189E-05
			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)	12	Total (lbs/yr/engine)	0.0014			
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	41	0.000010
			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)	4	Total (lbs/yr/engine)	0.0005			

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	0.000085
			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					
			Ideal gas constant (psia-ft3/lb-mol-°R)	10.73					
			Number of activities per year	4	Total (lbs/yr/unit)	0.0854			
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	0.000336
			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	4	Total (lbs/yr/unit)	0.3360			
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	11	0.096
			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	2	Total (lbs/yr/unit)	17.3827			
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	**0.732**	**0.167**

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

Emission Type: (pick from list)
Low Pressure Periodic

Equations used:

1. Loading loss equation: Reference AP-42 Loading equation:

$$L_L = 12.46\ \frac{SPM}{T}$$

L_L = Loading loss (lb/1000 gal of liquid loaded)
S = Saturation factor from AP-42, Table 5.2-1
P = True vapor pressure of liquid loaded (psia)
M = Molecular weight of vapors (lb/lb-mol)
T = Temperature of bulk liquid loaded (deg R)

2. Ideal Gas Law: n = PV/RT

Total Emissions = (PV/RT) * M_W * Concentration
P = vapor pressure of material stored pressure (psia) at t
V = vessel volume (ft^3)
MW = molecular weight (lb/lb-mole)
R = (10.73 psia-ft3/lb-mol-R)
T = 460 + t (deg R)
t = 95° F or actual, whichever is higher

3. Evaporative loss equation: Reference:Ajay Kumar, N.S. Vatcha, and John Schmelzle, "Estimate Emissions from Atmospheric Releases of Hazardous Substances," Environmental Engineering World, November-December 1996.

$$L_E = 4.14 * 10^{-5} U_S^{0.78} P_V\ M_W^{0.67}\ A_p^{0.94}\ t$$

L_E = Evaporation loss (lb/activity)
U is wind speed in m/s
P_v = VOC vapor pressure, Pa
M_w = VOC vapor molecular weight
A_p = liquid surface area, m^2
t = time, hrs

4. Clingage loss equation: AP-42 (2-23) constrained by an upper limit equal to filling loss for IFR with liquid heel.

$L_{SL\ max}$ = 0.60 (PV_v / RT) M_v
P = vapor pressure of material stored pressure (psia) at t
V_v = vessel volume (ft^3)
M_v = molecular weight (lb/lb-mole)
R = (10.73 psia-ft3/lb-mol-R)
T = 460 + t (deg R)
t = Temperature (R)

References

(a) Engine Oil SAE 10 W: MSDS
(b) Caterpillar G3516B LE engine specifications sheet
(c) AP101 Apeizon grease MSDS
(d) Mono ethylene glycol (MEG) MSDS
(e) Mono ethanol amine (MEA)
(f) WD-40 Aerosol libricant MSDS

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 1, 2, 2.5, 3, and 4 Amine Vents

Emission Unit: 1-EP-4, 2-EP-4, 2.5-EP-4, 3-EP-4, 4-EP-4
Source Description: Amine Vent Uncontrolled Emissions
Manufacturer:

Train 1 - Unit 1-EP-4[1]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		Hexane		Xylene		H_2S		CO_2	CH_4
Emissions	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**tpy**	**tpy**
Uncontrolled	10.12	44.33	7.25	31.77	5.10	22.33	1.62	7.08	0.068	0.30	0.023	0.100	0.45	1.96	1.77	7.74	73,505.69	36.21

Train 2 - Unit 2-EP-4[2]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		Hexane		Xylene		H_2S		CO_2	CH_4
Emissions	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**tpy**	**tpy**
Uncontrolled	66.22	290.07	46.290	202.75	31.23	136.79	11.07	48.49	0.49	2.13	0.22	0.96	3.28	14.38	5.26	23.03	220,136.43	193.32

Train 2.5 - Unit 2.5-EP-4[3]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		Hexane		Xylene		H_2S		CO_2	CH_4
Emissions	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**tpy**	**tpy**
Uncontrolled	10.65	46.66	0.26	1.16	-	-	-	-	-	-	0.26	1.16	-	-	612.94	2,684.68	13,027.29	66.01

Train 3 - Unit 3-EP-4[4]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		Hexane		Xylene		H_2S		CO_2	CH_4
Emissions	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**tpy**	**tpy**
Uncontrolled	72.35	316.90	51.285	224.63	34.23	149.91	12.44	54.49	0.55	2.40	0.24	1.05	3.83	16.77	5.03	22.04	210,715.39	199.46

Train 4 - Unit 4-EP-4[4]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		Hexane		Xylene		H_2S		CO_2	CH_4
Emissions	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**tpy**	**tpy**
Uncontrolled	68.61	300.52	48.734	213.45	32.71	143.25	11.74	51.41	0.51	2.25	0.22	0.96	3.56	15.59	5.29	23.17	220,458.53	193.10

Notes:

All emissions calculated using ProMax.
1. Emissions from 1-EP-4 are controlled by the thermal oxidizer unit EP-5. Controlled emissions are represented under unit EP-5.
2. Emissions from 2-EP-4 are controlled by the thermal oxidizer unit EP-5. Controlled emissions are represented under unit EP-5.
3. Emissions from unit 2.5-EP-4 are controlled by the Acid Gas Injection Well (AGI). During AGI compressor downtime the controlled emissions are represented under the Emergency AGI Flare, unit 2.5-EP-5.
4. Emissions from unit 3-EP-4 and 4-EP-4 are routed to the thermal oxidizer units EP-6 and EP-8 respectively. Controlled emissions are represented under unit EP-6 and EP-8.

Lucid Energy Group - Red Hills Gas Processing Plant
Emergency AGI Flare

Emission Unit: 2.5-EP-5

Fuel Data

Flare Pilot	12	scf/hr	Max design
	0.000012	MMscf/hr	
	1050.00	Btu/scf	Pipeline Gas, HHV
	0.013	MMBtu/hr	
Purge Gas	0.084	Mscf/day	Design
	0.0035	Mscf/hr	Mscf/d / 24 hr/day
	3.50E-06	MMscf/hr	Mscf/hr / 1000
	1050.00	Btu/scf	Pipeline Gas, HHV
	0.0037	MMBtu/hr	MMscf/hr * Btu/scf
Assist Gas			
	149.67	Btu/scf	Heating value of Pilot + Purge gas + Flared gas
	925.0	Btu/scf	target heat content
	1,050.0	Btu/scf	Assist gas-assumed sweet
	0.2228	MMscf/hr	Assist gas volume
	234.0	MMBtu/hr	Assist gas heat input
*Assist gas - Annual**	33.4	MMscf/yr	Estimated Maximum annual SSM flow rate. Not a requested limit; for calculation only.

Ratio for assist gas/flared gas fuel usage		
	MMscf/hr	Ratio
Assist gas	0.2228	0.8612
Flared gas	0.036	0.1388
	0.259	1.0000

Note: Flared gas annual/ ratio of assist gas: flared gas hourly usage ex: 10.5 MMscf/yr / (1-.8054)

Flared Gas - Short Term [1]	0.036	MMscf/hr	Effective hourly flowrate
	149	Btu/scf	ProMax
	5	MMBtu/hr	Hourly heat rate = Heating value * Effective hourly flow rate.
Flared Gas - Annual [1]	4.63	MMscf/yr	Estimated Maximum annual SSM flow rate. Not a requested limit; for calculation only.
Total	**239.4**	**MMBtu/hr**	**Pilot + Purge gas + Flared gas + Assist gas**

Hours of flaring per year = 129

Note: [1] Flared gas is Unit 2.5-EP-4 amine vent gas

Lucid Energy Group - Red Hills Gas Processing Plant
Emergency AGI Flare
Emission Unit: 2.5-EP-5

Emission Rates

Pilot+ Purge Gas

NOx	CO	VOC	H_2S	SO_2	Total HAP	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Units	
0.0680	0.3100										lb/MMBtu	AP-42 Tables 13.5-1 and 13.5-2
			3.57E-04								lb H_2S/Mscf	Purchased sweet natural gas fuel, 0.25 gr H_2S/100scf
			5.53E-06								lb H_2S/hr	H_2S rate * fuel usage
				7.14E-03							lb S/Mscf	Purchased sweet natural gas fuel, 5 gr S/100scf
				1.11E-04							lb SO_2/hr	SO_2 rate * fuel usage
		0.00%			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	mol%	Assumed content in purchased fuel (methane)
100%	100%		100%	100%							%	Safety Factor
0.1360	0.6200										lb/MMBtu	Unit emission rate with Safety Factor
0.002	**0.010**										lb/hr	lb/MMBtu * MMBtu/hr
		-	**2.2E-07**	**2.2E-04**	-	-	-	-	-	-	lb/hr	98% combustion H_2S; 100% conversion to SO_2
0.010	**0.044**	-	**9.7E-07**	**9.7E-04**	-	-	-	-	-	-	tpy	8760 hrs/yr

Assist gas

NOx	CO	VOC	H_2S	SO_2	Total HAP	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Units	
0.0680	0.3100										lb/MMBtu	AP-42 Tables 13.5-1 and 13.5-2
			3.57E-04								lb H_2S/Mscf	Purchased sweet natural gas fuel, 0.25 gr H_2S/100scf
			7.96E-02								lb H_2S/hr	H_2S rate * fuel usage
				7.14E-03							lb S/Mscf	Purchased sweet natural gas fuel, 5 gr S/100scf
				1.59E+00							lb SO_2/hr	SO_2 rate * fuel usage
		0.00%			0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	mol%	Assumed content in purchased fuel (methane)
15.91	**72.53**										lb/hr	lb/MMBtu * MMBtu/hr
		-	**1.6E-03**	**1.595**	-	-	-	-	-	-	lb/hr	98% combustion H_2S; 100% conversion to SO_2
1.19	**5.43**	-	**1.19E-04**	**0.119**	-	-	-	-	-	-	tpy	

Flared Gas [1]

NOx	CO	VOC	H_2S	SO_2	Total HAP	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Units	
0.0680	0.3100										lb/MMBtu	AP-42 Tables 13.5-1 and 13.5-2
		10.6	612.9		0.26	-	-	-	-	0.26	lb/hr	ProMax
0.36	1.66										lb/hr	lb/MMBtu * MMBtu/hr
0.36	**1.66**	**0.21**	**12.3**	**1,153.8**	**0.0053**	-	-	-	-	**0.0053**	**lb/hr**	98% combustion H_2S; 100% conversion to SO_2
0.024	**0.11**	**0.014**	**0.79**	**74.4**	**0.00034**	-	-	-	-	**0.00034**	**tpy**	

Acid Gas Flare	NOx	CO	VOC	H_2S	SO_2	Total HAP	Benzene	Toluene	Ethylbenzene	Xylenes	n-Hexane	Units
Pilot + Flared + Assist Gas	**16.28**	**74.2**	**0.21**	**12.3**	**1,155.4**	**0.0053**	-	-	-	-	**5.28E-03**	lb/hr
	1.22	**5.6**	**0.014**	**0.79**	**74.5**	**0.00034**	-	-	-	-	**3.41E-04**	tpy
Pilot + Assist Gas					**1.6**							lb/hr
					0.1							

Lucid Energy Group - Red Hills Gas Processing Plant
Emergency AGI Flare

Emission Unit:	2.5-EP-5			
Stack Parameters				
	1000	˚C	Exhaust temperature	Per NMAQB guidelines
	20	m/sec	Exhaust velocity	Per NMAQB guidelines
	100.0	ft	Flare height	
Pilot+ Purge Gas only				
	16.04	g/mol	Pilot & Purge gas molecular weight	Mol. wt. of methane, the dominant species
	1,139	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	920		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	0.0303	m	Effective stack diameter (D)	$D = (10^{-6} q_n)^{1/2}$
Flared Gas MW				
	39.80	g/mol	MW flare gas	
	16.04	g/mol	MW assist gas, flare gas, purge gas	
Flaring Volumes	0.036	MMscf/hr	vol flare gas	
	925.0000	MMscf/hr	vol assist gas	
4-EP-2a	Flare (SSM)			
	0.2228	MMscf/hr	vol assist gas	
	0.000015	MMscf/hr	vol pilot + purge gas	
	5.53	g/mol	vol. weighted % flare gas	
	13.81	g/mol	vol. weighted % assist gas	
	9.60E-04	g/mol	vol. weighted % pilot + purge gas	
Pilot+Flared Gas+ Assist gas	19.34	g/mol	weighted-averaged Flared gas molecular weight	
	1.68E+07	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	1.32E+07		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	3.6357	m	Effective stack diameter (D)	$D = (10^{-6} q_n)^{1/2}$

Lucid Energy Group - Red Hills Gas Processing Plant
Emergency AGI Flare

§98.233(n) Flare stack GHG emissions.

Pilot & Purge Gas

Step 1. Calculate contribution of un-combusted CH_4 emissions

$E_{a,CH4}$ (un-combusted) = $V_a * (1- \eta) * X_{CH4}$ *(Equation W-39B)*

where:

$E_{a,CH4}$ = contribution of annual un-combusted CH_4 emissions from regenerator in cubic feet under actual conditions.

V_a = volume of gas sent to combustion unit during the year (cf)

η = Fraction of gas combusted by a burning flare (or regenerator), default value from Subpart W = 0.98

For gas sent to an unlit flare, η is zero.

X_{CH4} = Mole fraction of CH_4 in gas to the flare = 0.9921 Gas Analysis 1.0 pilot +Purge gas+ Assist gas [1]

Step 2. Calculate contribution of un-combusted CO_2 emissions

$E_{a,CO2} = V_a * X_{CO2}$ *(Equation W-20)*

where:

$E_{a,CO2}$ = contribution of annual un-combusted CO_2 emissions from regenerator in cubic feet under actual conditions.

V_a = volume of gas sent to combustion unit during the year (cf)

X_{CO2} = Mole fraction of CO_2 in gas to the flare = 71.655 Gas Analysis 0 pilot +Purge gas+ Assist gas [1]

Step 3. Calculate contribution of combusted CO_2 emissions

$E_{a,CO2}$ (combusted) = $\sum (\eta * V_a * Y_j * R_j)$ *(Equation W-21)*

where:

η = Fraction of gas combusted by a burning flare (or regenerator) = 0.98

For gas sent to an unlit flare, η is zero.

V_a = volume of gas sent to combustion unit during the year (cf)

Y_j = mole fraction of gas hydrocarbon constituents j:

Constituent j, Methane =	0.9921	Gas Analysis
Constituent j, Ethane =	0.4525	
Constituent j, Propane =	0.1442	
Constituent j, Butane =	0.05305	
Constituent j, Pentanes Plus =	1.09E-02	

R_j = number of carbon atoms in the gas hydrocarbon constituent j:

Constituent j, Methane =	1
Constituent j, Ethane =	2
Constituent j, Propane =	3
Constituent j, Butane =	4
Constituent j, Pentanes Plus =	5

Step 4. Calculate GHG volumetric emissions at standard conditions (scf).

$$E_{s,n} = \frac{E_{a,n} * (459.67 + T_s) * P_a}{(459.67 + T_a) * P_s}$$ *(Equation W-33)*

where:

$E_{s,n}$ = GHG i volumetric emissions at standard temperature and pressure (STP) in cubic feet
$E_{a,n}$ = GHG i volumetric emissions at actual conditions (cf)

T_s = Temperature at standard conditions (F) =	60	F	
T_a = Temperature at actual conditions (F) =	76	F	(Based on Annual Avg Max Temperature for Hobbs, NM from Western Regional Climate Center)
P_s = Absolute pressure at standard conditions (psia) =	14.7	psia	
P_a = Absolute pressure at actual conditions (psia) =	14.7	psia	(Assumption)

Constant = 459.67 (temperature conversion from F to R)

Step 5. Calculate annual CH_4 and CO_2 mass emissions (ton).

$Mass_{s,i} = E_{s,i} * \rho_i * 0.0011023$ *(Equation W-36)*

where:

$Mass_{s,i}$ = GHG i (CO_2, CH_4, or N_2O) mass emissions at standard conditions in tons (tpy)
$E_{s,i}$ = GHG i (CO_2, CH_4, or N_2O) volumetric emissions at standard conditions (cf)
ρ_i = Density of GHG i. Use:

CH_4:	0.0192	kg/ft^3 (at 60F and 14.7 psia)
CO_2:	0.0526	kg/ft^3 (at 60F and 14.7 psia)

Step 6. Calculate annual N_2O emissions from portable or stationary fuel combustion sources under actual conditions (cf) using Equation W-40 .

$Mass_{N2O} = 0.0011023 * Fuel * HHV * EF$ *(Equation W-40)*

where:

$Mass_{N2O}$ = annual N_2O emissions from combustion of a particular type of fuel (tons).
Fuel = mass or volume of the fuel combusted
HHV = high heat value of the fuel

Pilot & Purge & assist gas HHV =	0.0011	MMBtu/scf
Acid Gas HHV =	0.00015	MMBtu/scf
EF =	1.00E-04	kg N_2O/MMBtu

10^{-3} = conversion factor from kg to metric tons.

Step 7. Calculate total annual emission from flare by summing Equations W-40, W-19, W-20, and W-21.

Gas Sent to Flare	Gas Sent to Flare (cf/yr)	CH_4 Un-Combusted, $E_{a,CH4}$ (cf)	CO_2 Un-Combusted, $E_{a,CO2}$ (cf)	CO_2 Combusted, $E_{a,CO2}$ (cf)	CH_4 Un-Combusted, $E_{a,CH4}$ (scf)	CO_2 Un-Combusted, $E_{a,CO2}$ (scf)	CO_2 Combusted, $E_{a,CO2}$ (scf)	CH_4 Un-Combusted, $E_{a,CH4}$ (tpy)	CO_2 Un-Combusted, $E_{a,CO2}$ (tpy)	CO_2 Combusted, $E_{a,CO2}$ (tpy)	N_2O Mass Emissions (tpy)	CO2e (tpy)
Pilot & Purge& Assist[1]	33,516,185	665060	0	32,845,862	644,834	0	31,846,948	13.65	0.00	1,846.52	0.00388	2188.9
SSM	4,634,487	91962	332,082,346	11,793,183	89,165	321,983,008	11,434,527	1.89	18,668.89	662.99	0.00008	19379.1

	CO_2	CH_4	N_2O
GWP	1	25	298

Note: [1] Pilot + purge + assist gas is pipeline quality and assumed to be methane.

Lucid Energy Group - Red Hills Gas Processing Plant

Trains 1, 2, 3, and 4 Glycol Dehydrators

Emission Unit: 1-EP-3, 2a-EP-3, 3-EP-3, 4-EP-3
Source Description: 75 MMscf/d (1-EP-3) and three 120 MMscf/d glycol dehydrators (2a-EP-3, 3-EP-3, and 4-EP-3)
Manufacturer:

Train 1 - Unit 1-EP-3[1]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		n-Hexane		2,2,4-Trimethylpentane		Styrene		Xylene		H_2S		CO_2	CH_4
Emissions	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy	tpy
Uncontrolled	110.07	482.10	38.84	170.11	17.12	75.00	7.35	32.20	0.34	1.48	12.45	54.51	-	-	-	-	1.58	6.92	9.81E-06	4.30E-05	0.14	17.16

Train 2 - Unit 2a-EP-3[3]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		n-Hexane		2,2,4-Trimethylpentane		Styrene		Xylene		H_2S		CO_2	CH_4
Emissions	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy	tpy
Uncontrolled	109.47	479.49	39.79	174.28	17.98	78.74	8.01	35.10	0.37	1.61	4.19	18.37	-	-	-	-	1.66	7.25	1.10E-05	4.80E-05	0.29	18.37

Train 3 - Unit 3-EP-3[4]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		n-Hexane		2,2,4-Trimethylpentane		Styrene		Xylene		H_2S		CO_2	CH_4
Emissions	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy	tpy
Uncontrolled	109.41	479.20	39.50	173.03	17.69	77.49	7.94	34.78	0.37	1.62	11.85	51.89	-	-	-	-	1.65	7.23	9.52E-06	4.17E-05	0.00033	18.31

Train 4 - Unit 4-EP-3[4]

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		n-Hexane		2,2,4-Trimethylpentane		Styrene		Xylene		H_2S		CO_2	CH_4
Emissions	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	tpy	tpy
Uncontrolled	109.16	478.13	39.61	173.48	17.85	78.18	7.98	34.96	0.37	1.61	11.76	51.49	-	-	-	-	1.65	7.24	1.02E-05	4.45E-05	0.00	18.37

Notes

1 Unit 1-EP-3 incondensables are sent to thermal oxidizer unit EP-5 and flash tank emissions are routed to the facility fuel system. Controlled emissions are shown under unit EP-5
2 Unit 2a-EP-3 incondensables are sent to thermal oxidizer unit EP-5 and flash tank emissions are routed to the facility fuel system. Controlled emissions are shown under unit EP-5
3 Unit 3-EP-3 incondensables are sent to thermal oxidizer unit EP-6 and flash tank emissions are routed to the facility fuel system. Controlled emissions are shown under unit EP-6
4 Unit 4-EP-3 incondensables are sent to thermal oxidizer unit EP-8 and flash tank emissions are routed to the facility fuel system. Controlled emissions are shown under unit EP-8

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2, 3, and 4 Amine Reboiler

Emission Units: 2a-EP-1d, 2-EP-1h, 3-EP-1d, 3-EP-1h, 4-EP-1d, 4-EP-1h
Source Description: Natural gas-fired amine reboiler
Manufacturer:

Fuel Consumption

Input heat rate	55.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	52381.0	scf/hr	Input heat rate / Fuel heat value

Emission Rates

Potential Emission Rate

NOx[2]	CO[2]	VOC	SO_2	PM	Total HAP[1]	Benzene[1]	Toluene[1]	Units	
30	100							ppmvd	mfg data
46	28							Molecular Weight	
100	84	5.5		7.6				lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
		0.0054		0.0075				lb/MMBtu	lb/MMScf /1020 BTU/scf
			0.002					gr S/scf	Pipeline specification
1.018	2.065	0.30	0.030	0.410	0.79	0.041	0.056	lb/hr	lb/MMscf *scf/hr/1e6
4.459	9.047	1.30	0.131	1.79	3.47	0.18	0.24	tpy	lb/hr * 8760 hrs/yr / 2000lb/ton

2,24-Trimethyl pentane[1]	Ethylbenzene[1]	Styrene[1]	n-Hexane[1]	Xylenes[1]	CO_2	CH_4	N_2O	Units	
					53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
0.16	0.116	0.114	0.077	0.073				lb/hr	
0.68	0.51	0.50	0.34	0.32				tpy	GRI-HAPCalc
					25,564	0.48	0.048	metric tons	1x10-3 x Fuel x HHV x EF
					28,180	0.53	0.053	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using GRI-HAPCalc

[2]PV= nRT = n = PV/RT

P=	1.0	ATM				
Gas Constant, R=	1.314	(atm*ft3)/(lb-mole*K)				
T=	624	°F =	328.89	°C =	602.04	K

Exhaust Parameters

	55000	MBtu/hr	
Exhaust temp (Tstk):	624	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	9725.83	scfm	Calculated from F factor and heat rate
Exhaust flow:	23141.53	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	1	ft	Estimated - typical
Stack height:	15	ft	Estimated - typical
Exhaust velocity:	491.08	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Train 2.5 Amine Reboiler

Emission Unit:	2.5-EP-1d
Source Description:	Natural gas-fired amine reboiler
Manufacturer:	

Fuel Consumption

Input heat rate	20.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	19047.6	scf/hr	Input heat rate / Fuel heat value

Emission Rates

Potential Emission Rate

NOx	CO	VOC	SO_2	PM	Total HAP[1]	Benzene[1]	Toluene[1]	Units	
100	84	5.5		7.6				lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
0.098	0.082	0.0054		0.0075				lb/MMBtu	lb/MMScf /1020 BTU/scf
			0.002					gr S/scf	Pipeline specification
1.96	1.65	0.11	0.011	0.149	0.29	0.015	0.020	lb/hr	lb/MMscf *scf/hr/1e6
8.59	7.21	0.47	0.048	0.65	1.26	0.07	0.09	tpy	lb/hr * 8760 hrs/yr / 2000lb/ton

2,24-Trimethyl pentane[1]	Ethylbenzene[1]	Styrene[1]	n-Hexane[1]	Xylenes[1]	CO_2	CH_4	N_2O	Units	
					53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
0.06	0.042	0.042	0.028	0.026				lb/hr	
0.25	0.19	0.18	0.12	0.12				tpy	GRI-HAPCalc
					9,296	0.18	0.018	metric tons	1x10-3 x Fuel x HHV x EF
					10,247	0.19	0.019	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using GRI-HAPCalc

Exhaust Parameters

	20000	MBtu/hr	
Exhaust temp (Tstk):	624	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21333	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	3536.667	scfm	Calculated from F factor and heat rate
Exhaust flow:	8415.103	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	1	ft	Estimated - typical
Stack height:	15	ft	Estimated - typical
Exhaust velocity:	178.574	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2a, 3, and 4 Glycol Reboilers

Emission Unit: 2-EP-1e, 3-EP-1e, 4-EP-1e
Source Description: Natural gas-fired hot oil heaters
Manufacturer:

Fuel Consumption

Input heat rate	3.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	2857.1	scf/hr	Input heat rate / Fuel heat value

Emission Rates

Potential Emission Rate

NOx	CO	VOC	SO_2	PM	Total HAP[1]	Benzene[1]	Toluene[1]	Units	
100	84	5.5		7.6				lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
0.098	0.082	0.0054		0.0075				lb/MMBtu	lb/MMScf /1020 BTU/scf
			0.002					gr S/scf	Pipeline specification
0.29	0.25	0.016	0.0016	0.022	0.0433	0.0022	0.0031	lb/hr	lb/MMscf *scf/hr/1e6
1.29	1.08	0.071	0.0072	0.098	0.190	0.0098	0.0134	tpy	lb/hr * 8760 hrs/yr / 2000lb/ton

2,24-Trimethylpentane[1]	Ethylbenzene[1]	Styrene[1]	n-Hexane[1]	Xylenes[1]	CO_2	CH_4	N_2O	Units	
					53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
8.52E-03	6.35E-03	6.23E-03	4.22E-03	3.97E-03				lb/hr	
0.037	0.028	0.027	0.019	0.017				tpy	GRI-HAPCalc
					1,394	0.026	0.0026	metric tons	1x10-3 x Fuel x HHV x EF
					1,537	0.029	0.0029	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using GRI-HAPCalc

Exhaust Parameters

	3000	MBtu/hr	
Exhaust temp (Tstk):	624	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	530.50	scfm	Calculated from F factor and heat rate
Exhaust flow:	1262.27	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	0.67	ft	Estimated - typical
Stack height:	20	ft	Estimated - typical
Exhaust velocity:	59.67	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Train 3 Stabilizer Heater

Emission Unit:	1.5-EP-1g, 4-EP-1g
Source Description:	Natural gas-fired stabilizer heater
Manufacturer:	

Fuel Consumption

Input heat rate	18.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	17142.9	scf/hr	Input heat rate / Fuel heat value

Emission Rates

Potential Emission Rate

NOx	CO	VOC	SO_2	PM	Total HAP[1]	Benzene[1]	Toluene[1]	Units	
100	84	5.5		7.6				lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
0.098	0.082	0.0054		0.0075				lb/MMBtu	lb/MMScf /1020 BTU/scf
			0.002					gr S/scf	Pipeline specification
1.76	1.48	0.10	0.0098	0.134	0.26	0.0135	0.018	lb/hr	lb/MMscf *scf/hr/1e6
7.73	6.49	0.43	0.043	0.59	1.14	0.059	0.080	tpy	lb/hr * 8760 hrs/yr / 2000lb/ton

2,24-Trimethyl pentane[1]	Ethylbenzene[1]	Styrene[1]	n-Hexane[1]	Xylenes[1]	CO_2	CH_4	N_2O	Units	
					53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
0.05	0.038	0.037	0.025	0.024				lb/hr	
0.22	0.17	0.16	0.111	0.104				tpy	GRI-HAPCalc
					8,367	0.16	0.016	metric tons	1x10-3 x Fuel x HHV x EF
					9,222	0.17	0.017	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using GRI-HAPCalc

Exhaust Parameters

	18000	MBtu/hr	
Exhaust temp (Tstk):	624	°F	
Site Elevation:	3589.00	ft MSL	
Ambient pressure (Pstk):	26	in. Hg	Calculated based on elevation
F factor:	10610.0	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	3183.0	scfm	Calculated from F factor and heat rate
Exhaust flow:	7573.59	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	1.0	ft	Estimated - typical
Stack height:	20.0	ft	Estimated - typical
Exhaust velocity:	160.7	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2, 3, and 4 Flares

Emission Unit:	2-EP-2a, 3-EP-2a, 4-EP-2a
Source Description:	Flare SSM
Manufacturer:	

Destruction Efficiency: 98% Manufacturer guaranteed DRE for C3+ & H_2S

Fuel Data

Flare Pilot

Flow Rate	500.0	scf/hr	Design
Flow Rate	0.00050	MMscf/hr	
Fuel heat value	1,050.00	Btu/scf	Estimated pipeline gas, HHV
Fuel usage	0.53	MMBtu/hr	
Flow Rate	4.38	MMscf/yr	

Purge Gas

Flow Rate	2,000.00	scf/hr	Eng Estimate
Flow Rate	0.0020	MMscf/hr	scf/hr / 10^6
Fuel heat value	1050.00	Btu/scf	Estimated pipeline gas, HHV
Fuel usage	2.1	MMBtu/hr	MMscf/hr * Btu/scf
Flow Rate	17.5	MMscf/yr	

Flare SSM

Flow Rate	200.00	MMscf/d	Engineering estimate
Flow Rate	8,333.33	Mscf/hr	
Flow Rate	8,333,333.33	scf/hr	Input flow rate (MMscf/day) * (1 day/24 hr) * (10^6 scf/MMscf)
Flow Rate	100,000.00	Mscf/yr	
Fuel heat value	1,204.95	Btu/scf	ProMax, Inlet Gas
Fuel usage	10,041.25	MMBtu/hr	(scf/hr) * (Btu/scf) * (MMBtu/10^6 Btu)

Flare SSM Events

Flaring Time	6.0	hours/event
Events Per Year	2.0	

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2, 3, and 4 Flares

Emission Unit: 2-EP-2a, 3-EP-2a, 4-EP-2a
Source Description: Flare SSM
Manufacturer:

Inlet Gas Analysis[4]

Composition[1]	Mol%	MW[1]	MW*Mol%	Spec. Volume (scf/lb)[1]	Heating Value (Btu/scf)[1]	Mass Flow (lb/hr)[2]	Mass Flow (lb/yr)[3]
Carbon Dioxide	6.009%	44.01	2.645	8.623	0.0	58072.2	696866.3
Nitrogen	2.305%	28.013	0.646	13.547	0.0	14176.9	170122.9
Hydrogen Sulfide	0.0012%	34.076	0.000	11.136	637.0	9.0	107.8
Methane	70.694%	16.043	11.341	23.65	1009.7	249098.3	2989180.0
Ethane	11.117%	30.07	3.343	12.62	1768.7	73407.4	880888.3
Propane	5.881%	44.097	2.593	8.606	2517.2	56949.2	683390.7
i-Butane	0.744%	58.123	0.432	6.529	3252.6	9495.3	113944.0
n-Butane	1.818%	58.123	1.057	6.529	3262	23203.5	278442.4
i-Pentane	0.450%	72.15	0.325	5.26	3999.7	7134.6	85615.4
n-Pentane	0.464%	72.15	0.335	5.26	4008.7	7355.4	88264.5
Hexanes	0.286%	86.178	0.246	4.4	4756.1	5414.7	64976.2
Heptanes	0.143%	100.205	0.143	3.787	5502.8	3146.7	37760.0
Benzene	0.024%	78.114	0.019	4.858	3741.9	412.4	4948.3
Toluene	0.011%	92.141	0.010	4.119	4474.8	212.8	2553.3
Xylene	0.004%	106.16	0.005	3.574	4957	102.8	1233.1
Ethylbenzene	0.001%	106.17	0.001	3.574	4970.6	21.0	252.3
Octane	0.048%	114.23	0.054	3.322	5796.1	1194.9	14338.6
VOC Total	**9.9%**		**5.22**			**114,643.2**	**1,375,718.7**
Total	**100%**		**23.20**			**509,407.0**	**6,112,884.0**

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2, 3, and 4 Flares

Emission Unit:	2-EP-2a, 3-EP-2a, 4-EP-2a
Source Description:	Flare SSM
Manufacturer:	

Emission Rates

Pilot+ Purge Gas

NOx	CO	VOC	H_2S	SO_2	Units	
0.0680	0.31				lb/MMBtu	Table 13.5-1; AP-42 Section 13
			3.57E-04		lb H_2S/Mscf	Purchased sweet natural gas fuel, 0.25 gr H_2S/100scf
			8.93E-04		lb H_2S/hr	H_2S rate * fuel usage
				7.14E-03	lb S/Mscf	Purchased sweet natural gas fuel, 5 gr S/100scf
				1.79E-02	lb SO_2/hr	SO_2 rate * fuel usage
		0.00%			mol%	Assume no VOC content in purchased fuel (methane)
		23.7			ft^3/lb	Specific volume
		0.00			lb/hr	vol. Gas * mole fraction / specific volume
				98%	%	Estimated conversion of combusted H_2S to SO_2
0.18	0.81	0.00E+00	1.79E-05	0.0016	lb/hr	
0.78	3.56	0.0	7.82E-05	0.0072	tpy	

Potential SSM Emission Rate

NOx	CO	VOC	H_2S	SO_2	Units	
0.068	0.31				lb/MMBtu	AP-42 Table 13.5 Emission Factors
				98%	%	Estimated conversion of combusted H_2S to SO_2
682.8	**3,112.8**	**2,292.9**	**0.180**	**16.6**	lb/hr	lb/MMBtu * MMBtu/hr
4.1	**18.7**	**13.8**	**0.00108**	**0.099**	tpy	lb/hr * hrs/event * events/yr * 1 ton/2000 lb

n-Hexane	Benzene	Toluene	Xylene	Ethylbenzene	Total HAPs	
108.3	**8.2**	**4.3**	**2.1**	**0.4**	**123.3**	**lb/hr**
0.65	**0.049**	**0.026**	**0.0123**	**0.00252**	**0.74**	**tons/yr**

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2, 3, and 4 Flares

Emission Unit:	2-EP-2a, 3-EP-2a, 4-EP-2a
Source Description:	Flare SSM
Manufacturer:	

Notes

[1] From "Physical Properties of Hydrocarbons"
[2] Flow (lb/hr) = Volume (Mscf/event) / Duration (hr/event) * 1000cf/Mscf / Sp. Vol. (scf/lb) * Mol%

4-EP-2a
Flare (SSM)
[2] Flow (lb/hr) = Volume (Mscf/event) / Duration (hr/event) * 1000cf/Mscf / Sp. Vol. (scf/lb) * Mol%
[3] Flow (tons/yr) = Volume (Mscf/yr) * 1000scf/Mscf / Sp. Vol. (scf/lb) * Mol%
[4] Inlet analysis form ProMax

Fuel gas molecular weight:	23.2	g/mol	Mol. wt. of the gas being burned - Assumed to be methane
Heat release (q):	7.03E+08	cal/sec	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
$q_{n:}$	5.41E+08		$q_n = q(1-0.048(MW)^{1/2})$
Effective stack diameter (D):	23.249	m	$D = (10^{-6}q_n)^{1/2}$

Lucid Energy Group - Red Hills Gas Processing Plant
Sour Slop Tank Control Flare

Unit(s):	EP-9		
Description:	Sour Slop Tank Control Flare		
Flow Rates to ECD			
Sour Slop Tanks Flash Flow Rate	0.0633	MMscf/day	ProMax output
Loading Flow Rate	0.00005	MMscf/day	ProMax output
Total Flow Rate	2640.6	scf/hr	Oil Tank Flash Flow Rate (MMscf/day) * (10^6 scf/MMscf) * (1 day/24 hours)
Total Flow Rate With 100% Safety Factor	5281.3	scf/hr	Safety factor applied to account for variations in vapor flow into Flare.
	46.3	MMscf/yr	
Fuel Data			
Flare Pilot			
Flow Rate	12.0	scf/hr	
Flow Rate	0.00001	MMscf/hr	
Fuel heat value	1,050.00	Btu/scf	
Fuel usage	0.01	MMBtu/hr	
Flow Rate	0.10512	MMscf/yr	
Heating Values			
Gas Heating Value	998.053	Btu/ft^3	ProMax net ideal gas heating value for W&B and Loading emissions
Total Heating Rate	5.27	MMBtu/hr	Gas heating value (Btu/ft^3) * Flash gas mass flow (scf/hr) * (MMBtu/10^6 Btu)
Max Heating Rate	6.00	MMBtu/hr	Max heat rate capcity base on mfg data
Constituent Mass Flow Rates			
Loading VOC	32.91	tpy	loading losses emissions
Storage Tank VOC	529.80	tpy	ProMax Flash tank emissions
Loading Total HAP	0.00	tpy	loading losses emissions
Storage Tank Total HAP	0.00	tpy	ProMax Flash tank emissions
Loading Benzene	0.00	tpy	loading losses emissions
Storage Tank Benzene	0.00	tpy	ProMax Flash tank emissions
Loading Toluene	0.00	tpy	ProMax loading losses emissions
Storage Tank Toluene	0.00	tpy	ProMax Working and breathing tank emissions
Loading Ethylbenzene	0.00	tpy	ProMax loading losses emissions
Storage Tank Ethylbenzene	0.00	tpy	ProMax Working and breathing tank emissions
Loading 2,2,4-Trimethylpentane	0.00	tpy	ProMax loading losses emissions
Storage Tank 2,2,4-Trimethylpentane	0.000	tpy	ProMax Working and breathing tank emissions
Loading Xylene	0.000	tpy	ProMax loading losses emissions
Storage Tank Xylene	0.000	tpy	ProMax Working and breathing tank emissions
Loading H2S	0.007	tpy	loading losses emissions
Storage Tank H2S	0.261	tpy	ProMax Flash tank emissions

Emission Rates

Pilot+ Purge Gas

NOx	CO	VOC	H_2S	SO_2	Units	
0.0680	0.31				lb/MMBtu	Table 13.5-1; AP-42 Section 13
			3.57E-04		lb H_2S/Mscf	Purchased sweet natural gas fuel, 0.25 gr H_2S/100scf
			4.29E-06		lb H_2S/hr	H_2S rate * fuel usage
				7.14E-03	lb S/Mscf	Purchased sweet natural gas fuel, 5 gr S/100scf
				8.57E-05	lb SO_2/hr	SO_2 rate * fuel usage
		0.00%			mol%	Assume no VOC content in purchased fuel (methane)
		12.0			ft^3/lb	Specific volume
		0.00			lb/hr	vol. Gas * mole fraction / specific volume
				98%	%	Estimated conversion of combusted H_2S to SO_2
0.00086	0.0039	0.00E+00	4.01E-06	0.000008	lb/hr	
0.0038	0.017	0.0	1.76E-05	0.00003	tpy	

Sour Slop Tank FWB and Loading Losses

NOx	CO	VOC	SO_2	H_2S		
0.068	0.31				lb/MMBTU	Table 13.5-1; AP-42 Section 13
				0.05	% H_2S	From combusted gas composition
			0.00		% SO_2	From combusted gas composition
		32.9		0.01	tpy	Mass flow rate from loading
		529.796		0.261	tpy	Mass flow rate from tanks
		95%		95%	%	Estimated control efficiency [3]
0.36	1.63				lb/hr	Short term MMBtu/hr * lb/MMBtu
1.57	7.16				tpy	Long term MMBtu/hr * lb/MMBtu
		6.42	0.12	0.00	lb/hr	ton/yr * 2000 lb/ton * 1 yr/8760 hrs
		28.14	0.50	0.01	tpy	Mass flow rate * (1 - % control efficiency)
			-	-	lb/hr	From combusted gas composition
0.36	**1.63**	**6.42**	**0.12**	**0.003**	**lb/hr**	
1.57	**7.16**	**28.14**	**0.50**	**0.013**	**tpy**	8760 hr/yr

Benzene	Toluene	Ethylbenzene	-Trimethylper	Xylene	Total HAPs		
0.00	0.00	0.0000	0.00	0.000	0.00	tpy	Mass flow rate from loading
0.0	0.00	0.0000	0.00	0.000	0.00	tpy	Mass flow rate from tanks
95%	95%	95%	95%	95%	95%	%	Estimated control efficiency
0.0000	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.000**	**lb/hr**	
0.000	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.000**	**tpy**	8760 hr/yr

CO_2	CH_4	N_2O	Units	
53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
2,450	0.046	0.0046	metric tons	1x10-3 x Fuel x HHV x EF
2,701	0.05	0.005	tons	1.1023 metric tons/short ton

Notes:

[1] Assumes TSP = PM_{10} = $PM_{2.5}$

[2]Adjusted EF, per footnote a in Tables 1.4-1 and 1.4-2. EF (lb/MMBtu) = EF (lb/MMscf) / (1020Btu/scf)

[3] Assumed DRE of 95%

EP-9	Flare (SSM)		
Fuel gas molecular weight:	23.2	g/mol	Mol. wt. of the gas being burned - Assumed to be methane
Heat release (q):	4.20E+05	cal/sec	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
$q_{n:}$	3.23E+05		$q_n = q(1-0.048(MW)^{1/2})$
Effective stack diameter (D):	0.568	m	$D = (10^{-6} q_n)^{1/2}$

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 2, 3, and 4 Emergency Flares

Emission Units: 2-EP-2a, 3-EP-2a, 4-EP-2a
§98.233(n) Flare stack GHG emissions.

Pilot & Purge Gas & SSM

Step 1. Calculate contribution of un-combusted CH_4 emissions

$E_{a,CH4}$ (un-combusted) = $V_a * (1- \eta) * X_{CH4}$ *(Equation W-39B)*

where:

$E_{a,CH4}$ = contribution of annual un-combusted CH_4 emissions from regenerator in cubic feet under actual conditions.

V_a = volume of gas sent to combustion unit during the year (cf)

η = Fraction of gas combusted by a burning flare (or regenerator), default value from Subpart W = 0.98

For gas sent to an unlit flare, η is zero.

X_{CH4} = Mole fraction of CH_4 in gas to the flare = 0.7069 Inlet Gas Analysis 1.0 pilot +Purge gas[1]

Step 2. Calculate contribution of un-combusted CO_2 emissions

$E_{a,CO2} = V_a * X_{CO2}$ *(Equation W-20)*

where:

$E_{a,CO2}$ = contribution of annual un-combusted CO_2 emissions from regenerator in cubic feet under actual conditions.

V_a = volume of gas sent to combustion unit during the year (cf)

X_{CO2} = Mole fraction of CO_2 in gas to the flare = 0.060 Inlet Gas Analysis 0.0 pilot +Purge gas[1]

Step 3. Calculate contribution of combusted CO_2 emissions

$E_{a,CO2}$ (combusted) = $\sum (\eta * V_a * Y_j * R_j)$ *(Equation W-21)*

where:

η = Fraction of gas combusted by a burning flare (or regenerator) = 0.98

For gas sent to an unlit flare, η is zero.

V_a = volume of gas sent to combustion unit during the year (cf)

Y_j = mole fraction of gas hydrocarbon constituents j:

Constituent j, Methane =	0.7069	Gas Analysis
Constituent j, Ethane =	0.1112	
Constituent j, Propane =	0.0588	
Constituent j, Butane =	0.02562	
Constituent j, Pentanes Plus	0.0143	

R_j = number of carbon atoms in the gas hydrocarbon constituent j:

Constituent j, Methane =	1
Constituent j, Ethane =	2
Constituent j, Propane =	3
Constituent j, Butane =	4
Constituent j, Pentanes Plus	5

Step 4. Calculate GHG volumetric emissions at standard conditions (scf).

$$E_{s,n} = \frac{E_{a,n} * (459.67 + T_s) * P_a}{(459.67 + T_a) * P_s}$$ *(Equation W-33)*

where:

$E_{s,n}$ = GHG i volumetric emissions at standard temperature and pressure (STP) in cubic feet
$E_{a,n}$ = GHG i volumetric emissions at actual conditions (cf)
T_s = Temperature at standard conditions (F) = 60 F
T_a = Temperature at actual conditions (F) = 76 F (Based on Annual Avg Max Temperature for Hobbs, NM
P_s = Absolute pressure at standard conditions (psia) = 14.7 psia
P_a = Absolute pressure at actual conditions (psia) = 14.7 psia (Assumption)
Constant = 459.67 (temperature conversion from F to R)

Step 5. Calculate annual CH_4 and CO_2 mass emissions (ton).

$Mass_{s,i} = E_{s,i} * \rho_i * 0.0011023$ *(Equation W-36)*

where:

$Mass_{s,i}$ = GHG i (CO_2, CH_4, or N_2O) mass emissions at standard conditions in tons (tpy)
$E_{s,i}$ = GHG i (CO_2, CH_4, or N_2O) volumetric emissions at standard conditions (cf)
ρ_i = Density of GHG i. Use:

CH_4:	0.0192	kg/ft^3 (at 60F and 14.7 psia)
CO_2:	0.0526	kg/ft^3 (at 60F and 14.7 psia)

Step 6. Calculate annual N_2O emissions from portable or stationary fuel combustion sources under actual conditions (cf) using Equation W-40 .

$Mass_{N2O} = 0.0011023 * Fuel * HHV * EF$ *(Equation W-40)*

where:

$Mass_{N2O}$ = annual N_2O emissions from combustion of a particular type of fuel (tons).
Fuel = mass or volume of the fuel combusted
HHV = high heat value of the fuel
Pilot & Purge gas HHV = 0.0011 MMBtu/scf
Inlet Gas HHV = 0.0012 MMBtu/scf
EF = 1.00E-04 kg N_2O/MMBtu
10^{-3} = conversion factor from kg to metric tons.

Step 7. Calculate total annual emission from flare by summing Equations W-40, W-19, W-20, and W-21.

Gas Sent to Flare	Gas Sent to Flare (cf/yr)	CH_4 Un-Combusted, $E_{a,CH4}$ (cf)	CO_2 Un-Combusted, $E_{a,CO2}$ (cf)	CO_2 Combusted, $E_{a,CO2}$ (cf)	CH_4 Un-Combusted, $E_{a,CH4}$ (scf)	CO_2 Un-Combusted, $E_{a,CO2}$ (scf)	CO_2 Combusted, $E_{a,CO2}$ (scf)	CH_4 Un-Combusted, $E_{a,CH4}$ (tpy)	CO_2 Un-Combusted, $E_{a,CO2}$ (tpy)	CO_2 Combusted, $E_{a,CO2}$ (tpy)	N_2O Mass Emissions (tpy)	CO2e (tpy)
Pilot & Purge[1]	21,900,000	438000	0	21,462,000	424,679	0	20,809,294	8.99	0.00	1,206.54	0.00253	1432.0
SSM	100,000,000	1413882	6,009,078	125,414,580	1,370,883	5,826,329	121,600,453	29.01	337.82	7,050.51	0.01328	8117.6

	CO_2	CH_4	N_2O
GWP	1	25	298

Note: [1] Pilot+purge fuel is pipeline quality and assumed to be methane.

Lucid Energy Group - Red Hills Gas Processing Plant
Trains 1, 2, and 2a Thermal Oxidizer

Emission Unit:	EP-5
Source Description:	RH2 Thermal Oxidizer
Manufacturer:	

Fuel Consumption

Input heat rate	28.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	26666.7	scf/hr	Input heat rate / Fuel heat value

Emissions Routed to EP-5

Controlled Unit	VOC (tpy)	Total HAP (tpy)	Benzene (tpy)	Toluene (tpy)	Ethylbenzene (tpy)	Hexane (tpy)	Xylene (tpy)	H_2S (tpy)
1-EP-4	44.33	31.77	22.33	7.08	0.30	0.099636639	1.96	7.74
1-EP-3	482.10	170.11	75.00	32.20	1.48	54.51	6.92	4.30E-05
2-EP-4	290.07	202.75	136.79	48.49	2.13	0.96	14.38	23.03
2a-EP-3	479.49	174.28	78.74	35.10	1.61	18.37	7.25	4.80E-05
Total Emissions	1295.99	578.91	312.86	122.87	5.52	73.94	30.51	30.77

Emission Rates

Potential Emission Rate

NOx	CO	VOC	SO_2	PM	H_2S	Total HAP[1]	Benzene[1]	Toluene[1]	Ethylbenzene[1]	Hexane[1]	Xylene[1]	Units	
100	84			7.6								lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
0.098	0.082			0.0075								lb/MMBtu	lb/MMScf /1020 BTU/scf
		1295.99			30.77	578.91	312.86	122.87	5.52	73.94	30.51	tpy	Emissions routed to EP-5
		98%			98%	98%	98%	98%	98%	98%	98%	%	Percent control
			57.91		0.62							tpy	98% combustion H_2S; 100% conversion to SO_2
2.75	2.31	5.92	13.22	0.21	0.14	2.64	1.43	0.56	0.025	0.34	0.14	lb/hr	ton/yr * 2000 lb/ton * 1 yr/8760 hr
12.02	10.10	25.92	57.91	0.91	0.62	11.58	6.26	2.46	0.110	1.48	0.61	tpy	Controlled emissions routed to EP-5

CO_2	CH_4	N_2O	Units	
53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
13,015	0.25	0.025	metric tons	1x10-3 x Fuel x HHV x EF
14,346	0.27	0.027	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using ProMax

Exhaust Parameters

	28000	MBtu/hr	
Exhaust temp (Tstk):	1500	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	4951.33	scfm	Calculated from F factor and heat rate
Exhaust flow:	21301.70068	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	7	ft	Estimated - typical
Stack height:	50	ft	Estimated - typical
Exhaust velocity:	9.2	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Train 3 Thermal Oxidizer

Emission Unit:	EP-6
Source Description:	RH3 Thermal Oxidizer
Manufacturer:	

Fuel Consumption

Input heat rate	28.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	26666.7	scf/hr	Input heat rate / Fuel heat value

Emissions Routed to RH3 TO

Controlled Unit	VOC (tpy)	Total HAP (tpy)	Benzene (tpy)	Toluene (tpy)	Ethylbenzene (tpy)	Hexane (tpy)	Xylene (tpy)	H_2S (tpy)
3-EP-4	316.90	224.63	149.91	54.49	2.40	1.05	16.77	22.04
3-EP-3	479.20	173.03	77.49	34.78	1.62	51.89	7.23	4.17E-05
Total Emissions	796.10	397.65	227.41	89.28	4.02	52.94	24.01	22.04

Emission Rates

Potential Emission Rate

NOx	CO	VOC	SO_2	PM	H_2S	Total HAP[1]	Benzene[1]	Toluene[1]	Ethylbenzene[1]	Hexane[1]	Xylene[1]	Units	
100	84			7.6								lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
0.098	0.082			0.0075								lb/MMBtu	lb/MMScf /1020 BTU/scf
		796.10			22.04	397.65	227.41	89.28	4.02	52.94	24.01	tpy	Emissions routed to EP-5
		98%		98%	98%	98%	98%	98%	98%	98%	98%	%	Percent control
			41.49		0.44							tpy	98% combustion H_2S; 100% conversion to SO_2
2.75	2.31	3.64	9.47	0.21	0.10	1.82	1.04	0.41	0.018	0.24	0.110	lb/hr	ton/yr * 2000 lb/ton * 1 yr/8760 hr
12.02	10.10	15.92	41.49	0.91	0.44	7.95	4.55	1.79	0.080	1.06	0.48	tpy	Controlled emissions routed to EP-5

CO_2	CH_4	N_2O	Units	
53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
13,015	0.25	0.025	metric tons	1x10-3 x Fuel x HHV x EF
14,346	0.27	0.027	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using ProMax

Exhaust Parameters

	28000	MBtu/hr	
Exhaust temp (Tstk):	1500	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	4951.33	scfm	Calculated from F factor and heat rate
Exhaust flow:	21301.7	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	7	ft	Estimated - typical
Stack height:	50	ft	Estimated - typical
Exhaust velocity:	9.2	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Enclosed Combustion Device

Unit(s):	EP-7
Description:	Enclosed combustion device

Flow Rates to ECD			
Oil Tanks W&B Flow Rate	0.0013	MMscf/day	ProMax output
Loading Flow Rate	0.00359	MMscf/day	ProMax output
Total Flow Rate	203.1	scf/hr	Oil Tank Flash Flow Rate (MMscf/day) * (10^6 scf/MMscf) * (1 day/24 hours)
Total Flow Rate With 100% Safety Factor	406.2	scf/hr	Safety factor applied to account for variations in vapor flow into ECD.
	3.6	MMscf/yr	
Heating Values			
Gas Heating Value	3828.27	Btu/ft^3	ProMax net ideal gas heating value for W&B and Loading emissions
Total Heating Rate	1.55	MMBtu/hr	Gas heating value (Btu/ft^3) * Flash gas mass flow (scf/hr) * (MMBtu/10^6 Btu)
Max Heating Rate	6.00	MMBtu/hr	Max heat rate capcity base on mfg data
Constituent Mass Flow Rates			
Loading VOC	129.2	tpy	ProMax loading losses emissions
Storage Tank VOC	46.0	tpy	ProMax Working and breathing tank emissions
Loading Total HAP	0.9	tpy	ProMax loading losses emissions
Storage Tank Total HAP	0.4	tpy	ProMax Working and breathing tank emissions
Loading Benzene	0.7	tpy	ProMax loading losses emissions
Storage Tank Benzene	0.3	tpy	ProMax Working and breathing tank emissions
Loading Toluene	0.14	tpy	ProMax loading losses emissions
Storage Tank Toluene	0.05	tpy	ProMax Working and breathing tank emissions
Loading Ethylbenzene	0.005	tpy	ProMax loading losses emissions
Storage Tank Ethylbenzene	0.0019	tpy	ProMax Working and breathing tank emissions
Loading 2,2,4-Trimethylpentane	0.170	tpy	ProMax loading losses emissions
Storage Tank 2,2,4-Trimethylpentane	0.06	tpy	ProMax Working and breathing tank emissions
Loading Xylene	0.023	tpy	ProMax loading losses emissions
Storage Tank Xylene	0.008	tpy	ProMax Working and breathing tank emissions

Lucid Energy Group - Red Hills Gas Processing Plant
Enclosed Combustion Device

Unit(s):	EP-7
Description:	Enclosed combustion device

Emission Rates

NOx	CO	VOC	SO_2	PM[1]	H_2S		
100	84			7.6		lb/MMscf	AP-42 Tables 1.4-1 and 1.4-2
0.098	0.082			0.0075		lb/MMBtu[2]	AP-42 Tables 1.4-1 and 1.4-2
					0.00	% H_2S	From combusted gas composition
			0.00			% SO_2	From combusted gas composition
		129.2				tpy	Mass flow rate from loading
		46.0				tpy	Mass flow rate from tanks
		98%				%	Estimated control efficiency
0.59	0.49			0.045		lb/hr	Short term MMBtu/hr * lb/MMBtu
2.6	2.16			0.20		tpy	Long term MMBtu/hr * lb/MMBtu
		0.80				lb/hr	ton/yr * 2000 lb/ton * 1 yr/8760 hrs
		3.50				tpy	Mass flow rate * (1 - % control efficiency)
			-		-	lb/hr	From combusted gas composition
0.59	**0.49**	**0.80**	**-**	**0.045**	**-**	**lb/hr**	
2.58	**2.16**	**3.5**	**-**	**0.20**	**-**	**tpy**	8760 hr/yr

Benzene	Toluene	Ethylbenzene	-Trimethylpen	Xylene	Total HAPs		
0.73	0.14	0.0052	0.17	0.023	0.90	tpy	Mass flow rate from loading
0.3	0.05	0.0019	0.06	0.008	0.38	tpy	Mass flow rate from tanks
98%	98%	98%	98%	98%	98%	%	Estimated control efficiency
0.0045	**8.66E-04**	**3.24E-05**	**1.05E-03**	**1.42E-04**	**0.006**	**lb/hr**	
0.020	**3.79E-03**	**1.42E-04**	**4.60E-03**	**6.21E-04**	**0.026**	**tpy**	8760 hr/yr

CO_2	CH_4	N_2O	Units	
53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
723	0.014	0.0014	metric tons	1x10-3 x Fuel x HHV x EF
797	0.02	0.002	tons	1.1023 metric tons/short ton

[1] Assumes TSP = PM_{10} = $PM_{2.5}$
[2] Adjusted EF, per footnote a in Tables 1.4-1 and 1.4-2. EF (lb/MMBtu) = EF (lb/MMscf) / (1020Btu/scf)
[3] Mfg DRE is rated at 99.9%; conservativley represented as 98% DRE

4-EP-2a Flare (SSM)

Lucid Energy Group - Red Hills Gas Processing Plant
Enclosed Combustion Device

Unit(s): EP-7
Description: Enclosed combustion device

Exhaust Parameters (F-factor method)

Parameters	Value	Unit	Notes
Heat Rate	6.00	MMBtu/hr	With short-term safety factor applied.
Exhaust temp (Tstk)	1400	°F	
Site Elevation	3680	ft MSL	
Ambient pressure (Pstk)	26.12	in. Hg	Calculated based on elevation
F factor	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	1061.0	scfm	Calculated from F factor and heat rate
Exhaust flow	4346.5	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter	1.6	ft	Eng. Estimate
Stack height	16	ft	Eng. Estimate
Exhaust velocity	36.8	ft/s	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Train 4 Thermal Oxidizer

Emission Unit:	EP-8
Source Description:	RH4 Thermal Oxidizer
Manufacturer:	

Fuel Consumption

Input heat rate	28.00	MMBtu/hr	engineering estimate
Fuel heat value	1050	Btu/scf	Nominal for natural gas
Annual fuel usage	26666.7	scf/hr	Input heat rate / Fuel heat value

Emissions Routed to RH3 TO

Controlled Unit	VOC (tpy)	Total HAP (tpy)	Benzene (tpy)	Toluene (tpy)	Ethylbenzene (tpy)	Hexane (tpy)	Xylene (tpy)	H_2S (tpy)
4-EP-4	300.52	213.45	143.25	51.41	2.25	0.96	15.59	23.17
4-EP-3	478.13	173.48	78.18	34.96	1.61	51.49	7.24	4.45E-05
Total Emissions	778.65	386.93	221.43	86.36	3.86	52.45	22.83	23.17

Emission Rates
Potential Emission Rate

NOx	CO	VOC	SO_2	PM	H_2S	Total HAP[1]	Benzene[1]	Toluene[1]	Ethylbenzene[1]	Hexane[1]	Xylene[1]	Units	
100	84			7.6								lb/MMscf	Unit emission rates from AP-42 Table 1.4-1 & 2
0.098	0.082			0.0075								lb/MMBtu	lb/MMScf /1020 BTU/scf
		778.65			23.17	386.93	221.43	86.36	3.86	52.45	22.83	tpy	Emissions routed to EP-5
		98%		98%	98%	98%	98%	98%	98%	98%	98%	%	Percent control
			43.61		0.46							tpy	98% combustion H_2S; 100% conversion to SO_2
2.75	2.31	3.56	9.96	0.21	0.11	1.77	1.01	0.39	0.018	0.24	0.104	lb/hr	ton/yr * 2000 lb/ton * 1 yr/8760 hr
12.02	10.10	15.57	43.61	0.91	0.46	7.74	4.43	1.73	0.077	1.05	0.46	tpy	Controlled emissions routed to EP-5

CO_2	CH_4	N_2O	Units	
53.06	0.001	0.0001	kg/MMBtu	40 CFR 98 Subpart C, Table C-1 and C-2
13,015	0.25	0.025	metric tons	1x10-3 x Fuel x HHV x EF
14,346	0.27	0.027	tons	1.1023 metric tons/short ton

Notes

[1] HAPs calculated using ProMax

Exhaust Parameters

	28000	MBtu/hr	
Exhaust temp (Tstk):	1500	°F	
Site Elevation:	3589	ft MSL	
Ambient pressure (Pstk):	26.21	in. Hg	Calculated based on elevation
F factor:	10610	wscf/MMBtu	40 CFR 60 Appx A Method 19
Exhaust flow	4951.33	scfm	Calculated from F factor and heat rate
Exhaust flow:	21301.70068	acfm	scfm * (Pstd/Pstk)*(Tstk/Tstd), Pstd = 29.92 "Hg, Tstd = 520 °R
Stack diameter:	7	ft	Estimated - typical
Stack height:	50	ft	Estimated - typical
Exhaust velocity:	9.2	ft/sec	Exhaust flow ÷ stack area

Lucid Energy Group - Red Hills Gas Processing Plant
Condensate Storage Tanks

Emission Unit: 1-T
Source Description: Six 500 bbl Condensate Storage Tanks
Manufacturer: N/A

Uncontrolled Emissions[1]

Unit	VOC tpy	Total HAP tpy	Benzene tpy	Toluene tpy	Ethylbenzene tpy	2,2,4-Trimethylpentane tpy	p-Xylene tpy	
1-T	46	0.380	0.260	0.050	0.0019	0.060	0.0082	ProMax

Controlled Emissions[2]

Unit	VOC tpy	Total HAP tpy	Benzene tpy	Toluene tpy	Ethylbenzene tpy	2,2,4-Trimethylpentane tpy	p-Xylene tpy
Emissions from units 1-T are routed to the enclosed combustion device, unit EP-7. Controlled emissions are represented under unit EP-7.							

Note:
1. There are no flashing losses associated with the tanks; all emissions are from working and breathing.
2. Tank emissions are controlled by a combustor with 98.00% destruction rate efficiency.

Lucid Energy Group - Red Hills Gas Processing Plant
H2S Sour Slop Tanks

Emission Unit: 2-T
Source Description: Two 500 bbl Sour Slop Tanks
Manufacturer: N/A

Uncontrolled Emissions[1]

Unit	VOC tpy	Total HAP tpy	Benzene tpy	Toluene tpy	Ethylbenzene tpy	2,2,4-Trimethylpentane tpy	p-Xylene tpy	H2S tpy	CO2 tpy	N2 tpy	
2-T	529.80	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.261	0.093	11.376	From Head Space Analysis

Controlled Emissions[2]

Unit	VOC tpy	Total HAP tpy	Benzene tpy	Toluene tpy	Ethylbenzene tpy	2,2,4-Trimethylpentane tpy	p-Xylene tpy
Emissions from units 2-T are routed to the sour slop tank control flare, unit EP-9. Controlled emissions are represented under unit EP-9.							

Note:
1. Tank emissions are controlled by a combustor with 95.00% destruction rate efficiency.

Analysis of Head Space from Sour Water Tanks

Composition	Mol%	MW	Mol% x MW	wt%	lb/hr	tpy
Hydrogen Sulfide	0.083%	34.076	0.03	0.05%	0.06	0.26
Nitrogen	4.397%	28.013	1.23	2.07%	2.60	11.38
Carbon Dioxide	0.023%	44.01	0.01	0.02%	0.02	0.09
Methane	4.015%	16.043	0.64	1.08%	1.36	5.95
Ethane	0.570%	30.07	0.17	0.29%	0.36	1.58
Propane	11.837%	44.097	5.22	8.78%	11.01	48.21
Isobutane	12.712%	58.123	7.39	12.43%	15.58	68.24
N-Butane	30.465%	58.123	17.71	29.79%	37.34	163.54
Isopentane	16.224%	72.15	11.71	19.69%	24.68	108.11
N-Pentane	11.506%	72.15	8.30	13.96%	17.51	76.67
Hexanes +	8.168%	86.178	7.04	11.84%	14.84	65.01
VOC Total	90.912%		59.45	96.49%	120.96	529.80
Total	100%			100.00%	125.36	549.06

*from ProMax Analysis

Lucid Energy Group - Red Hills Gas Processing Plant
Loading Emissions

Emission Unit: 1-Load, 2-Load
Source Description: Loading Operations
Manufacturer: N/A

Uncontrolled Emissions

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		2,2,4-Trimethylpentane		p-Xylene		H2S		CO2		CH4	
Unit	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
1-Load	63.5	129.2	0.44	0.90	0.36	0.73	0.069	0.14	0.0026	0.0052	0.083	0.17	0.011	0.023	-	-	-	-	-	-
2-Load	81.8	14.11	0.00	0.00	0.00	0.00	0.000	0.000	0.0000	0.0000	0.000	0.000	0.0000	0.000	0.04	0.01	0.01	0.01	0.92	0.53
Total	145.3	143.3	0.4	0.9	0.4	0.7	0.1	0.1	0.0	0.0	0.1	0.2	0.0	0.0			0.0	0.0	0.9	0.5

Controlled Emissions

	VOC		Total HAP		Benzene		Toluene		Ethylbenzene		2,2,4-Trimethylpentane		p-Xylene	
Unit	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
Emissions from units 1-Load and 2-Load are routed to the enclosed combustion device, unit EP-7 and sour slop tank control flare, EP-9 respectively. Controlled emissions are represented under unit EP-7 and unit EP-9.														

1. 1-Load - Loading emissions are controlled by a combustor with a 98% destruction rate efficiency.
2. 2-Load - Loading emissions are controlle by the control flare with a 95% dectruction rate efficiency.

TRUCK LOADING EMISSIONS
RED HILLS

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 =	18.27	True vapor pressure of liquid loaded (psia)
M =	41.52	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 =	10.22	Loading Loss (lb released/1000 gal liquid loaded)
	81.79	Uncontrolled Emissions (lb/hr)
Tank Vapor Weight Percents		
VOC	0.96	Tank Vapor VOC wt%
benzene	0.00	Tank Vapor Benzene wt%
H_2S	0.00	Tank Vapor H2S wt%
Produced Water Reduction		
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	81.79	Emissions Uncontrolled VOC (lb/hr)
benzene	0.00	Emissions Uncontrolled Benzene (lb/hr)
H_2S	0.04	Emissions Uncontrolled H_2S (lb/hr)
Collection Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	70.00	VOC Collection Efficiency (%)
H_2S	70.00	H_2S Collection Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	24.54	VOC Uncaptured Vapors (lb/hr)
benzene	0.00	benzene Uncaptured Vapors (lb/hr)
H_2S	0.01	H_2S Uncaptured Vapors (lb/hr)
Control Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	95.00	VOC Control Efficiency (%)
H_2S	95.00	H_2S Control Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	2.86	VOC Results (lb/hr)
benzene	0.00	Benzene Results (lb/hr)
H_2S	0.00	H_2S Results (lb/hr)

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

Enter Barrels of Liquid	Gallons of liquid:
600	25200

Enter gallons per year	Barrels per day:
9198000	600

Enter any notes here:

TRUCK LOADING EMISSIONS
RED HILLS

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 =	18.27	= True vapor pressure of liquid loaded (psia)
M =	41.52	= Molecular Weight of Vapors (lb/lb-mole)
T =	554.67	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	9198000	= Gallons Loaded per Year
L_L =	10.22	Loading Loss (lb VOC released/1000 gal liquid loaded)
	47.02	VOC Uncontrolled Emissions (ton/yr)
Tank Vapor Weight Percents		
VOC	0.96	Tank Vapor VOC wt%
benzene	0.00	Tank Vapor Benzene wt%
H_2S	0.00	Tank Vapor H2S wt%
Produced Water Reduction		
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	47.02	Emissions Uncontrolled VOC (ton/yr)
benzene	0.00	Emissions Uncontrolled Benzene (ton/yr)
H_2S	0.02	Emissions Uncontrolled H_2S (ton/yr)
Collection Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	70.00	VOC Collection Efficiency (%)
H_2S	70.00	H_2S Collection Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	14.11	VOC Uncaptured Vapors (ton/yr)
benzene	0.00	benzene Uncaptured Vapors (ton/yr)
H_2S	0.01	H_2S Uncaptured Vapors (ton/yr)
Control Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	95.00	VOC Control Efficiency (%)
H_2S	95.00	H_2S Control Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	1.65	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):
62.5	522.17

Enter Barrels of Liquid	Gallons of liquid:
20	840

Enter gallons per year	Barrels per day:
306600	20

Enter any notes here:

- Molecular weight and vapor pressure referenced from Promax simulation
- A representative hydrocarbon condensate analysis was used to calculate loading losses, actual liquids will be mostly water.

TRUCK LOADING EMISSIONS
RED HILLS

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 =	18.27	True vapor pressure of liquid loaded (psia)
M =	41.52	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 =	10.22	Loading Loss (lb VOC released/1000 gal liquid loaded)
	81.79	VOC Uncontrolled Emissions (lb/hr)
Tank Vapor Weight Percents		
VOC	0.96	Tank Vapor VOC wt%
CO2	0.00	Tank Vapor CO2 wt%
C1	0.01	Tank Vapor C1 wt%
Produced Water Reduction		
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	81.79	Emissions Uncontrolled VOC (lb/hr)
CO2	0.01	Emissions Uncontrolled CO2 (lb/hr)
C1	0.92	Emissions Uncontrolled C1 (lb/hr)
Collection Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	70.00	VOC Collection Efficiency (%)
C1	70.00	C1 Collection Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	24.54	VOC Uncaptured Vapors (lb/hr)
CO2	0.00	CO2 Uncaptured Vapors (lb/hr)
C1	0.28	C1 Uncaptured Vapors (lb/hr)
Control Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	95.00	VOC Control Efficiency (%)
C1	95.00	C1 Control Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	2.86	VOC Results (lb/hr)
CO2	0.00	CO2 Results (lb/hr)
C1	0.03	C1 Results (lb/hr)

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

Enter Barrels of Liquid	Gallons of liquid:
600	25200

Enter gallons per year	Barrels per day:
9198000	600

Enter any notes here:

TRUCK LOADING EMISSIONS
RED HILLS

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 =	18.27	= True vapor pressure of liquid loaded (psia)
M =	41.52	= Molecular Weight of Vapors (lb/lb-mole)
T =	554.67	= Temperature of bulk liquid loaded (in degrees Rankine)
Annual Loading Rate	9198000	= Gallons Loaded per Year
L_L =	10.22	Loading Loss (lb VOC released/1000 gal liquid loaded)
	47.02	VOC Uncontrolled Emissions (ton/yr)
Tank Vapor Weight Percents		
VOC	0.96	Tank Vapor VOC wt%
CO2	0.00	Tank Vapor CO2 wt%
C1	0.01	Tank Vapor C1 wt%
Produced Water Reduction		
		Percent Reduction for Produced Water Tank Calc. as Oil/Cond. (%)
Uncontrolled Emissions		
VOC	47.02	Emissions Uncontrolled VOC (ton/yr)
CO2	0.01	Emissions Uncontrolled CO2 (ton/yr)
C1	0.53	Emissions Uncontrolled C1 (ton/yr)
Collection Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	70.00	VOC Collection Efficiency (%)
C1	70.00	C1 Collection Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	14.11	VOC Uncaptured Vapors (ton/yr)
CO2	0.00	CO2 Uncaptured Vapors (ton/yr)
C1	0.16	C1 Uncaptured Vapors (ton/yr)
Control Efficiency (only fill out if loading vapors are routed to a control device)		
VOC	95.00	VOC Control Efficiency (%)
C1	95.00	C1 Control Efficiency (%)
Vapors Uncaptured by Control Device (only fill out if loading vapors are routed to a control device)		
VOC	1.65	VOC Results (ton/yr)
CO2	0.00	CO2 Results (ton/yr)
C1	0.02	C1 Results (ton/yr)

Enter temperature in Fahrenheit °F):	Temperature in Rankine (°R):
62.5	522.17

Enter Barrels of Liquid	Gallons of liquid:
20	840

Enter gallons per year	Barrels per day:
306600	20

Enter any notes here:

- Molecular weight and vapor pressure referenced from Promax simulation
- A representative hydrocarbon condensate analysis was used to calculate loading losses, actual liquids will be mostly water.

Lucid Energy Group - Red Hills Gas Processing Plant

Unpaved Haul Road Emissions - Exempt under 20.2.72.202.B.5 NMAC

Emission unit number(s): HAUL

Source description: Unpaved Haul Road Emissions

Input Data

Empty vehicle weight[1]	16	tons	
Density of liquid loaded	5.35	lb/gal	
Load weight[2]	20.2	tons	
Loaded vehicle[3]	36.2	tons	
Mean vehicle weight[4]	26.1	tons	
Round-trip distance	0.3	mile/trip	
Annual Throughput	762,449	bbl/yr	Facility-wide condensate throughput
Trip frequency	2.0	trips/hour	
Trip frequency	4,236	trips/yr	
Surface silt content[5]	4.8	%	
Annual wet days[6]	70	days/yr	
Vehicle miles traveled[7]	0.6	mile/hr	
Control	Base course and watering		
Control Efficiency[8]	80%	%	

Emission Factors and Constants

Parameter	PM_{30}	PM_{10}	$PM_{2.5}$
k, lb/VMT[9]	4.9	1.5	0.15
a, lb/VMT[9]	0.70	0.90	0.90
b, lb/VMT[9]	0.45	0.45	0.45
Hourly EF, lb/VMT[10]	6.83	1.74	0.174
Annual EF, lb/VMT[11]	5.52	1.41	0.141

Uncontrolled Emission Calculations

PM_{30}	PM_{10}	$PM_{2.5}$	
4.10	1.04	0.104	lb/hr[12]
3.51	0.89	0.089	ton/yr[13]

Controlled Emission Calculations

PM_{30}	PM_{10}	$PM_{2.5}$	
0.82	0.21	0.021	lb/hr
0.70	0.18	0.018	ton/yr

Notes

[1] Empty vehicle weight includes driver and occupants and full fuel load.

[2] Cargo, transported materials, etc. (6.8 lb/gal Oil *7560 gal truck/ 2000lb/ton)

[3] Loaded vehicle weight = Empty + Load Size

[4] Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2

[5] AP-42 Table 13.2.2-1 - Silt Content 4.8 %

[6] AP-42 Figure 13.2.2-1

[7] VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length

[8] NMED Guidance Document - Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions

[9] Table 13.2.2-2, Industrial Roads

[10] AP-42 13.2.2, Equation 1a

[11] AP-42 13.2.2, Equation 2

[12] lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr)

[13] ton/yr =Annual EF (lb/VMT) * VMT (mile/Trip) * Trips per year (Trip/yr) / 2000 (lb/tpy)

Lucid Energy Group - Red Hills Gas Processing Plant
Unpaved Haul Road Emissions - Exempt under 20.2.72.202.B.5 NMAC

Emission unit number(s): HAUL
Source description: Unpaved Haul Road Emissions

Input Data

Empty vehicle weight[1]	16	tons	
Density of liquid loaded	8.25	lb/gal	
Load weight[2]	31.2	tons	
Loaded vehicle[3]	47.2	tons	
Mean vehicle weight[4]	31.6	tons	
Round-trip distance	0.9	mile/trip	
Annual Throughput	219,000	bbl/yr	Facility-wide condensate throughput
Trip frequency	2.0	trips/hour	
Trip frequency	1,217	trips/yr	
Surface silt content[5]	4.8	%	
Annual wet days[6]	70	days/yr	
Vehicle miles traveled[7]	1.8	mile/hr	
Control	Base course and watering		
Control Efficiency[8]	80%	%	

Emission Factors and Constants

Parameter	PM_{30}	PM_{10}	$PM_{2.5}$
k, lb/VMT[9]	4.9	1.5	0.15
a, lb/VMT[9]	0.70	0.90	0.90
b, lb/VMT[9]	0.45	0.45	0.45
Hourly EF, lb/VMT[10]	7.44	1.90	0.190
Annual EF, lb/VMT[11]	6.01	1.53	0.153

Uncontrolled Emission Calculations

PM_{30}	PM_{10}	$PM_{2.5}$	
13.40	3.41	0.341	lb/hr[12]
3.29	0.84	0.084	ton/yr[13]

Controlled Emission Calculations

PM_{30}	PM_{10}	$PM_{2.5}$	
2.68	0.68	0.068	lb/hr
0.66	0.17	0.017	ton/yr

Notes

[1] Empty vehicle weight includes driver and occupants and full fuel load.
[2] Cargo, transported materials, etc. (6.8 lb/gal Oil *7560 gal truck/ 2000lb/ton)
[3] Loaded vehicle weight = Empty + Load Size
[4] Mean Vehicle weight = (Loaded Weight + Empty Weight) / 2
[5] AP-42 Table 13.2.2-1 - Silt Content 4.8 %
[6] AP-42 Figure 13.2.2-1
[7] VMT/hr = Vehicle Miles Traveled per hour= Trips per hour * Segment Length
[8] NMED Guidance Document - Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions
[9] Table 13.2.2-2, Industrial Roads
[10] AP-42 13.2.2, Equation 1a
[11] AP-42 13.2.2, Equation 2

[12] lb/hr = Hourly EF (lb/VMT) * VMT (mile/hr)
[13] ton/yr =Annual EF (lb/VMT) * VMT (mile/Trip) * Trips per year (Trip/yr) / 2000 (lb/tpy)

Section 6.a

Green House Gas Emissions

(Submitting under 20.2.70, 20.2.72 20.2.74 NMAC)

Title V (20.2.70 NMAC), Minor NSR (20.2.72 NMAC), and PSD (20.2.74 NMAC) applicants must estimate and report greenhouse gas (GHG) emissions to verify the emission rates reported in the public notice, determine applicability to 40 CFR 60 Subparts, and to evaluate Prevention of Significant Deterioration (PSD) applicability. GHG emissions that are subject to air permit regulations consist of the sum of an aggregate group of these six greenhouse gases: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Calculating GHG Emissions:

1. Calculate the ton per year (tpy) GHG mass emissions and GHG CO_2e emissions from your facility.
2. GHG mass emissions are the sum of the total annual tons of greenhouse gases without adjusting with the global warming potentials (GWPs). GHG CO_2e emissions are the sum of the mass emissions of each individual GHG multiplied by its GWP found in Table A-1 in 40 CFR 98 Mandatory Greenhouse Gas Reporting.
3. Emissions from routine or predictable start up, shut down, and maintenance must be included.
4. Report GHG mass and GHG CO_2e emissions in Table 2-P of this application. Emissions are reported in **short** tons per year and represent each emission unit's Potential to Emit (PTE).
5. All Title V major sources, PSD major sources, and all power plants, whether major or not, must calculate and report GHG mass and CO2e emissions for each unit in Table 2-P.
6. For minor source facilities that are not power plants, are not Title V, and are not PSD there are three options for reporting GHGs in Table 2-P: 1) report GHGs for each individual piece of equipment; 2) report all GHGs from a group of unit types, for example report all combustion source GHGs as a single unit and all venting GHGs as a second separate unit; 3) or check the following ☐ By checking this box, the applicant acknowledges the total CO2e emissions are less than 75,000 tons per year.

Sources for Calculating GHG Emissions:

- Manufacturer's Data
- AP-42 Compilation of Air Pollutant Emission Factors at http://www.epa.gov/ttn/chief/ap42/index.html
- EPA's Internet emission factor database WebFIRE at http://cfpub.epa.gov/webfire/
- 40 CFR 98 Mandatory Green House Gas Reporting except that tons should be reported in short tons rather than in metric tons for the purpose of PSD applicability.
- API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry. August 2009 or most recent version.
- Sources listed on EPA's NSR Resources for Estimating GHG Emissions at http://www.epa.gov/nsr/clean-air-act-permitting-greenhouse-gases:

Global Warming Potentials (GWP):
Applicants must use the Global Warming Potentials codified in Table A-1 of the most recent version of 40 CFR 98 Mandatory Greenhouse Gas Reporting. The GWP for a particular GHG is the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specified time period.

"Greenhouse gas" for the purpose of air permit regulations is defined as the aggregate group of the following six gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. **(20.2.70.7 NMAC, 20.2.74.7 NMAC).** You may also find GHGs defined in 40 CFR 86.1818-12(a).

Metric to Short Ton Conversion:
Short tons for GHGs and other regulated pollutants are the standard unit of measure for PSD and title V permitting programs. 40 CFR 98 Mandatory Greenhouse Reporting requires metric tons.
1 metric ton = 1.10231 short tons (per Table A-2 to Subpart A of Part 98 – Units of Measure Conversions)

Section 7

Information Used To Determine Emissions

Information Used to Determine Emissions shall include the following:

- ☑ If manufacturer data are used, include specifications for emissions units and control equipment, including control efficiencies specifications and sufficient engineering data for verification of control equipment operation, including design drawings, test reports, and design parameters that affect normal operation.
- ☐ If test data are used, include a copy of the complete test report. If the test data are for an emissions unit other than the one being permitted, the emission units must be identical. Test data may not be used if any difference in operating conditions of the unit being permitted and the unit represented in the test report significantly effect emission rates.
- ☑ If the most current copy of AP-42 is used, reference the section and date located at the bottom of the page. Include a copy of the page containing the emissions factors, and clearly mark the factors used in the calculations.
- ☐ If an older version of AP-42 is used, include a complete copy of the section.
- ☑ If an EPA document or other material is referenced, include a complete copy.
- ☐ Fuel specifications sheet.
- ☑ If computer models are used to estimate emissions, include an input summary (if available) and a detailed report, and a disk containing the input file(s) used to run the model. For tank-flashing emissions, include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., permit or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis.

Heaters (Units 1-EP-1, 1-EP-5, 1.5-EP-1f, 1.5-EP-1g, 2-EP-1a, 2-EP-1b, 3-EP-1a, and 3-EP-1b)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- GRI-HAPCalc 3.01
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

Heaters (Units 5-EP-1c, 5-EP-1d, 6-EP-1c, 6-EP-1d, 7-EP-1c, 7-EP-1d)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

Reboilers (Units 1.5-EP-1e, 2-EP-1e, 2-EP-1h, 2a-EP-1d, 2.5-EP 1d, 3-EP-1d, 3-EP-1e, and 3-EP-1h)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- GRI-HAPCalc 3.01
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

Reboilers (Units 4-EP-1d, 4-EP-1e, 4-EP-1h, 5-EP-1a, 5-EP-1b, 6-EP-1a, 6-EP-1b and 5.5-EP-1a)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- Manufacture spec sheet
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

Flares (Units 1-EP-2, 1.5-EP-2, 2-EP-2a, 2.5-EP-5, and 3-EP-2a)
- AP-42 Table 13.5-1
- ProMax Gas Analysis
- 40 CFR Part 98 methodology

Flare SSM (Units 5-EP-2 and 7-EP-2), AGI Flare SSM (Unit 5.5-EP-1b) and Sour Water Tanks Flare (EP-13)
- AP-42 Table 13.5-1
- ProMax

- 40 CFR Part 98 methodology

Amine Vents (Units 1-EP-4, 1.5-EP-4, 2-EP-4, 2.5-EP-4, 3-EP-4, 4-EP-4, 5-EP-1f, and 6-EP-1f)
- ProMax

Glycol Dehydrators (Units 1-EP-3, 1.5-EP-3, 2a-EP-3, 3-EP-3, 4-EP-3, 5-EP-1e, and 6-EP-1e))
- ProMax

Thermal Oxidizers (Units EP-5, EP-6, EP-8, and EP-10)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- ProMax streams for HAP and VOC
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

Enclosed Combustion Device (Unit EP-7, and EP-12)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

Condensate Storage Tank (Unit 1-T and 3-T)
- ProMax

Sour Water Tanks (Unit 4-T)
- Promax

Slop Tanks (Unit 5-T)
- Promax

Loading Emissions (Unit 1-Load, 3-Load, 4-Load, and 5-Load)
- ProMax

MSS Blowdowns (Units 2-EP-1t, 3-EP-1t, 4-EP-1t, 5-EP-1t, 6-EP-1t, 7-EP-1t)
- TCEQ spreadsheet

Fugitive Emissions (Unit FUG and FUG-1)
- Tables 2-4 and 5-2 of the EPA Protocol for Equipment Leak Emission Estimates, November 1995
- Inlet gas and liquid analyses from ProMax

Haul Road Emissions (Unit HAUL-1)
- Equations 1a and 2 of AP-42 Section 13.2.2 (11/06)
- AP-42 Table 13.2.2-1
- AP-42 Figure 13.2.2-1
- AP-42 Table 13.2.2-2, Industrial Roads
- NMED Guidance Document - Department Accepted Values For: Aggregate Handling, Storage Pile, and Haul Road Emissions
- Google Earth

GRI-HAPCalc ® 3.01
External Combustion Devices Report

Facility ID:	**RED HILLS GP**	**Notes:**
Operation Type:	**GAS PLANT**	
Facility Name:	**LUCID ENERGY - RED HILLS GAS**	
User Name:		
Units of Measure:	**U.S. STANDARD**	

***Note:** Emissions less than 5.00E-09 tons (or tonnes) per year are considered insignificant and are treated as zero. These emissions are indicated on the report with a "0". Emissions between 5.00E-09 and 5.00E-05 tons (or tonnes) per year are represented on the report with "0.0000".*

External Combustion Devices

Unit Name: 15.95 MMBT

Hours of Operation:	8,760 Yearly
Heat Input:	15.95 MMBtu/hr
Fuel Type:	NATURAL GAS
Device Type:	HEATER
Emission Factor Set:	FIELD > EPA > LITERATURE
Additional EF Set:	-NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0590	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0673	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0515	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0239	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0523	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0710	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.1476	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0923	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.1985	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.0983	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.1452	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field

Benz(a)anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170	lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700	lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500	lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0001	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
Total	1.0070			

Criteria Pollutants

VOC	0.3767	0.0053921569	lb/MMBtu	EPA
PM	0.5205	0.0074509804	lb/MMBtu	EPA
PM, Condensible	0.3904	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.1301	0.0018627451	lb/MMBtu	EPA
CO	2.2610	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.5959	0.0085294118	lb/MMBtu	EPA
NOx	6.7777	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0411	0.0005880000	lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0001	0.0000011765	lb/MMBtu	EPA
Methane	0.7350	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.9781	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0662	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.1838	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.1639	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0747	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.1023	0.0014640770	lb/MMBtu	GRI Field
Butane	0.0962	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0790	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.2422	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.0994	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.0642	0.0009183830	lb/MMBtu	GRI Field
Methylcyclohexane	0.1538	0.0022011420	lb/MMBtu	GRI Field
n-Octane	0.1994	0.0028538830	lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.2391	0.0034224540	lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.2391	0.0034224540	lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.2391	0.0034224540	lb/MMBtu	GRI Field
n-Nonane	0.2557	0.0036604170	lb/MMBtu	GRI Field
CO2	8,218.9412	117.6470588235	lb/MMBtu	EPA

Unit Name: 18 MMBTU

Hours of Operation:	8,760	Yearly
Heat Input:	18.00	MMBtu/hr
Fuel Type:	NATURAL GAS	
Device Type:	HEATER	
Emission Factor Set:	FIELD > EPA > LITERATURE	
Additional EF Set:	-NONE-	

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0665	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0760	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0582	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0270	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0590	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0801	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.1666	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.1041	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.2240	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.1109	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.1639	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0001	0.0000007600 lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600 lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200 lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030 lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902 lb/MMBtu	EPA
Total	1.1364		
Criteria Pollutants			
VOC	0.4251	0.0053921569 lb/MMBtu	EPA
PM	0.5874	0.0074509804 lb/MMBtu	EPA
PM, Condensible	0.4406	0.0055882353 lb/MMBtu	EPA

PM, Filterable	0.1469	0.0018627451 lb/MMBtu	EPA
CO	2.5515	0.0323636360 lb/MMBtu	GRI Field
NMHC	0.6725	0.0085294118 lb/MMBtu	EPA
NOx	7.6488	0.0970167730 lb/MMBtu	GRI Field
SO2	0.0464	0.0005880000 lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0001	0.0000011765 lb/MMBtu	EPA
Methane	0.8295	0.0105212610 lb/MMBtu	GRI Field
Acetylene	1.1038	0.0140000000 lb/MMBtu	GRI Field
Ethylene	0.0747	0.0009476310 lb/MMBtu	GRI Field
Ethane	0.2074	0.0026312210 lb/MMBtu	GRI Field
Propylene	0.1849	0.0023454550 lb/MMBtu	GRI Field
Propane	0.0843	0.0010686280 lb/MMBtu	GRI Field
Isobutane	0.1154	0.0014640770 lb/MMBtu	GRI Field
Butane	0.1085	0.0013766990 lb/MMBtu	GRI Field
Cyclopentane	0.0891	0.0011304940 lb/MMBtu	GRI Field
Pentane	0.2734	0.0034671850 lb/MMBtu	GRI Field
n-Pentane	0.1121	0.0014221310 lb/MMBtu	GRI Field
Cyclohexane	0.0724	0.0009183830 lb/MMBtu	GRI Field
Methylcyclohexane	0.1735	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.2250	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.2698	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.2698	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.2698	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.2886	0.0036604170 lb/MMBtu	GRI Field
CO2	9,275.2941	117.6470588235 lb/MMBtu	EPA

Unit Name: 20 MMBTUHR

Hours of Operation: 8,760 Yearly

Heat Input: 20.00 MMBtu/hr

Fuel Type: NATURAL GAS

Device Type: HEATER

Emission Factor Set: FIELD > EPA > LITERATURE

Additional EF Set: -NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0739	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0844	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0646	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0300	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0655	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0890	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.1851	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.1157	0.0013205140 lb/MMBtu	GRI Field

2,2,4-Trimethylpentane	0.2489	0.0028417580	lb/MMBtu	GRI Field
n-Hexane	0.1233	0.0014070660	lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070	lb/MMBtu	GRI Field
Styrene	0.1821	0.0020788960	lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100	lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470	lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670	lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730	lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800	lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600	lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830	lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170	lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700	lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500	lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0001	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
Total	1.2626			

Criteria Pollutants

VOC	0.4724	0.0053921569	lb/MMBtu	EPA
PM	0.6527	0.0074509804	lb/MMBtu	EPA
PM, Condensible	0.4895	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.1632	0.0018627451	lb/MMBtu	EPA
CO	2.8351	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.7472	0.0085294118	lb/MMBtu	EPA
NOx	8.4987	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0515	0.0005880000	lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0001	0.0000011765	lb/MMBtu	EPA
Methane	0.9217	0.0105212610	lb/MMBtu	GRI Field
Acetylene	1.2264	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0830	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.2305	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.2055	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0936	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.1283	0.0014640770	lb/MMBtu	GRI Field
Butane	0.1206	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0990	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.3037	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.1246	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.0805	0.0009183830	lb/MMBtu	GRI Field
Methylcyclohexane	0.1928	0.0022011420	lb/MMBtu	GRI Field
n-Octane	0.2500	0.0028538830	lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.2998	0.0034224540	lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.2998	0.0034224540	lb/MMBtu	GRI Field

1,3,5-Trimethylbenzene	0.2998	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.3207	0.0036604170 lb/MMBtu	GRI Field
CO2	10,305.8824	117.6470588235 lb/MMBtu	EPA

Unit Name: 3 MMBTU

Hours of Operation:	8,760	Yearly
Heat Input:	3.00	MMBtu/hr
Fuel Type:	NATURAL GAS	
Device Type:	HEATER	
Emission Factor Set:	FIELD > EPA > LITERATURE	
Additional EF Set:	-NONE-	

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0111	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0127	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0097	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0045	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0098	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0134	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.0278	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0174	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0373	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.0185	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.0273	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0000	0.0000007600 lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600 lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200 lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030 lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902 lb/MMBtu	EPA
Total	0.1895		

Criteria Pollutants

VOC	0.0709	0.0053921569 lb/MMBtu	EPA
PM	0.0979	0.0074509804 lb/MMBtu	EPA
PM, Condensible	0.0734	0.0055882353 lb/MMBtu	EPA
PM, Filterable	0.0245	0.0018627451 lb/MMBtu	EPA
CO	0.4253	0.0323636360 lb/MMBtu	GRI Field
NMHC	0.1121	0.0085294118 lb/MMBtu	EPA
NOx	1.2748	0.0970167730 lb/MMBtu	GRI Field
SO2	0.0077	0.0005880000 lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0000	0.0000011765 lb/MMBtu	EPA
Methane	0.1382	0.0105212610 lb/MMBtu	GRI Field
Acetylene	0.1840	0.0140000000 lb/MMBtu	GRI Field
Ethylene	0.0125	0.0009476310 lb/MMBtu	GRI Field
Ethane	0.0346	0.0026312210 lb/MMBtu	GRI Field
Propylene	0.0308	0.0023454550 lb/MMBtu	GRI Field
Propane	0.0140	0.0010686280 lb/MMBtu	GRI Field
Isobutane	0.0192	0.0014640770 lb/MMBtu	GRI Field
Butane	0.0181	0.0013766990 lb/MMBtu	GRI Field
Cyclopentane	0.0149	0.0011304940 lb/MMBtu	GRI Field
Pentane	0.0456	0.0034671850 lb/MMBtu	GRI Field
n-Pentane	0.0187	0.0014221310 lb/MMBtu	GRI Field
Cyclohexane	0.0121	0.0009183830 lb/MMBtu	GRI Field
Methylcyclohexane	0.0289	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.0375	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0450	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0450	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0450	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.0481	0.0036604170 lb/MMBtu	GRI Field
CO2	1,545.8824	117.6470588235 lb/MMBtu	EPA

Unit Name: 30 MMBTU

Hours of Operation:	8,760	Yearly
Heat Input:	30.00	MMBtu/hr
Fuel Type:	NATURAL GAS	
Device Type:	HEATER	
Emission Factor Set:	FIELD > EPA > LITERATURE	
Additional EF Set:	-NONE-	

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.1109	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.1266	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0969	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0450	0.0003423350 lb/MMBtu	GRI Field

Benzene	0.0983	0.0007480470	lb/MMBtu	GRI Field
Toluene	0.1335	0.0010163310	lb/MMBtu	GRI Field
Ethylbenzene	0.2776	0.0021128220	lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.1735	0.0013205140	lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.3734	0.0028417580	lb/MMBtu	GRI Field
n-Hexane	0.1849	0.0014070660	lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070	lb/MMBtu	GRI Field
Styrene	0.2732	0.0020788960	lb/MMBtu	GRI Field
Naphthalene	0.0001	0.0000005100	lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470	lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670	lb/MMBtu	GRI Field
Biphenyl	0.0001	0.0000004730	lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800	lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600	lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830	lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170	lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700	lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500	lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0001	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0001	0.0000004902	lb/MMBtu	EPA
Total	1.8942			

Criteria Pollutants

VOC	0.7085	0.0053921569	lb/MMBtu	EPA
PM	0.9791	0.0074509804	lb/MMBtu	EPA
PM, Condensible	0.7343	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.2448	0.0018627451	lb/MMBtu	EPA
CO	4.2526	0.0323636360	lb/MMBtu	GRI Field
NMHC	1.1208	0.0085294118	lb/MMBtu	EPA
NOx	12.7480	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0773	0.0005880000	lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0002	0.0000011765	lb/MMBtu	EPA
Methane	1.3825	0.0105212610	lb/MMBtu	GRI Field
Acetylene	1.8396	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.1245	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.3457	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.3082	0.0023454550	lb/MMBtu	GRI Field
Propane	0.1404	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.1924	0.0014640770	lb/MMBtu	GRI Field
Butane	0.1809	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.1485	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.4556	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.1869	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.1207	0.0009183830	lb/MMBtu	GRI Field

Methylcyclohexane	0.2892	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.3750	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.4497	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.4497	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.4497	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.4810	0.0036604170 lb/MMBtu	GRI Field
CO2	15,458.8235	117.6470588235 lb/MMBtu	EPA

Unit Name: 35.3 MMBTU

Hours of Operation: 8,760 Yearly

Heat Input: 35.30 MMBtu/hr

Fuel Type: NATURAL GAS

Device Type: HEATER

Emission Factor Set: FIELD > EPA > LITERATURE

Additional EF Set: -NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.1305	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.1490	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.1140	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0529	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.1157	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.1571	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.3267	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.2042	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.4394	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.2176	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.3214	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0001	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0001	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0001	0.0000007600 lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600 lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200 lb/MMBtu	GRI Field

Dibenz(a,h)anthracene	0.0000	0.0000001030 lb/MMBtu	GRI Field
Lead	0.0001	0.0000004902 lb/MMBtu	EPA
Total	2.2289		

Criteria Pollutants

VOC	0.8337	0.0053921569 lb/MMBtu	EPA
PM	1.1520	0.0074509804 lb/MMBtu	EPA
PM, Condensible	0.8640	0.0055882353 lb/MMBtu	EPA
PM, Filterable	0.2880	0.0018627451 lb/MMBtu	EPA
CO	5.0039	0.0323636360 lb/MMBtu	GRI Field
NMHC	1.3188	0.0085294118 lb/MMBtu	EPA
NOx	15.0002	0.0970167730 lb/MMBtu	GRI Field
SO2	0.0909	0.0005880000 lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0002	0.0000011765 lb/MMBtu	EPA
Methane	1.6267	0.0105212610 lb/MMBtu	GRI Field
Acetylene	2.1646	0.0140000000 lb/MMBtu	GRI Field
Ethylene	0.1465	0.0009476310 lb/MMBtu	GRI Field
Ethane	0.4068	0.0026312210 lb/MMBtu	GRI Field
Propylene	0.3626	0.0023454550 lb/MMBtu	GRI Field
Propane	0.1652	0.0010686280 lb/MMBtu	GRI Field
Isobutane	0.2264	0.0014640770 lb/MMBtu	GRI Field
Butane	0.2129	0.0013766990 lb/MMBtu	GRI Field
Cyclopentane	0.1748	0.0011304940 lb/MMBtu	GRI Field
Pentane	0.5361	0.0034671850 lb/MMBtu	GRI Field
n-Pentane	0.2199	0.0014221310 lb/MMBtu	GRI Field
Cyclohexane	0.1420	0.0009183830 lb/MMBtu	GRI Field
Methylcyclohexane	0.3403	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.4413	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.5292	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.5292	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.5292	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.5660	0.0036604170 lb/MMBtu	GRI Field
CO2	18,189.8824	117.6470588235 lb/MMBtu	EPA

Unit Name: 4.4 MMBTU

Hours of Operation: 8,760 Yearly

Heat Input: 4.40 MMBtu/hr

Fuel Type: NATURAL GAS

Device Type: HEATER

Emission Factor Set: FIELD > EPA > LITERATURE

Additional EF Set: -NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0163	0.0008440090 lb/MMBtu	GRI Field

Methanol	0.0186	0.0009636360	lb/MMBtu	GRI Field
Acetaldehyde	0.0142	0.0007375920	lb/MMBtu	GRI Field
1,3-Butadiene	0.0066	0.0003423350	lb/MMBtu	GRI Field
Benzene	0.0144	0.0007480470	lb/MMBtu	GRI Field
Toluene	0.0196	0.0010163310	lb/MMBtu	GRI Field
Ethylbenzene	0.0407	0.0021128220	lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0254	0.0013205140	lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0548	0.0028417580	lb/MMBtu	GRI Field
n-Hexane	0.0271	0.0014070660	lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070	lb/MMBtu	GRI Field
Styrene	0.0401	0.0020788960	lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100	lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470	lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670	lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730	lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800	lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600	lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830	lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170	lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700	lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500	lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0000	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
Total	0.2778			

Criteria Pollutants

VOC	0.1039	0.0053921569	lb/MMBtu	EPA
PM	0.1436	0.0074509804	lb/MMBtu	EPA
PM, Condensible	0.1077	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0359	0.0018627451	lb/MMBtu	EPA
CO	0.6237	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.1644	0.0085294118	lb/MMBtu	EPA
NOx	1.8697	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0113	0.0005880000	lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.2028	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.2698	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0183	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.0507	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.0452	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0206	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.0282	0.0014640770	lb/MMBtu	GRI Field
Butane	0.0265	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0218	0.0011304940	lb/MMBtu	GRI Field

Pentane	0.0668	0.0034671850 lb/MMBtu	GRI Field
n-Pentane	0.0274	0.0014221310 lb/MMBtu	GRI Field
Cyclohexane	0.0177	0.0009183830 lb/MMBtu	GRI Field
Methylcyclohexane	0.0424	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.0550	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0660	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0660	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0660	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.0705	0.0036604170 lb/MMBtu	GRI Field
CO2	2,267.2941	117.6470588235 lb/MMBtu	EPA

Unit Name: 4.98 MMBTU

Hours of Operation: 8,760 Yearly

Heat Input: 4.98 MMBtu/hr

Fuel Type: NATURAL GAS

Device Type: HEATER

Emission Factor Set: FIELD > EPA > LITERATURE

Additional EF Set: -NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.0184	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.0210	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.0161	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0075	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.0163	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.0222	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.0461	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0288	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0620	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.0307	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.0453	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field

Benzo(k)fluoranthene	0.0000	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
Total	0.3144			

Criteria Pollutants

VOC	0.1176	0.0053921569	lb/MMBtu	EPA
PM	0.1625	0.0074509804	lb/MMBtu	EPA
PM, Condensible	0.1219	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0406	0.0018627451	lb/MMBtu	EPA
CO	0.7059	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.1860	0.0085294118	lb/MMBtu	EPA
NOx	2.1162	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0128	0.0005880000	lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.2295	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.3054	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0207	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.0574	0.0026312210	lb/MMBtu	GRI Field
Propylene	0.0512	0.0023454550	lb/MMBtu	GRI Field
Propane	0.0233	0.0010686280	lb/MMBtu	GRI Field
Isobutane	0.0319	0.0014640770	lb/MMBtu	GRI Field
Butane	0.0300	0.0013766990	lb/MMBtu	GRI Field
Cyclopentane	0.0247	0.0011304940	lb/MMBtu	GRI Field
Pentane	0.0756	0.0034671850	lb/MMBtu	GRI Field
n-Pentane	0.0310	0.0014221310	lb/MMBtu	GRI Field
Cyclohexane	0.0200	0.0009183830	lb/MMBtu	GRI Field
Methylcyclohexane	0.0480	0.0022011420	lb/MMBtu	GRI Field
n-Octane	0.0623	0.0028538830	lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0747	0.0034224540	lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0747	0.0034224540	lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0747	0.0034224540	lb/MMBtu	GRI Field
n-Nonane	0.0798	0.0036604170	lb/MMBtu	GRI Field
CO2	2,566.1647	117.6470588235	lb/MMBtu	EPA

Unit Name: 5.6 MMBTU

Hours of Operation: 8,760 Yearly

Heat Input: 5.60 MMBtu/hr

Fuel Type: NATURAL GAS

Device Type: HEATER

Emission Factor Set: FIELD > EPA > LITERATURE

Additional EF Set: -NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set

HAPs

3-Methylcholanthrene	0.0000	0.0000000018	lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157	lb/MMBtu	EPA
Formaldehyde	0.0207	0.0008440090	lb/MMBtu	GRI Field
Methanol	0.0236	0.0009636360	lb/MMBtu	GRI Field
Acetaldehyde	0.0181	0.0007375920	lb/MMBtu	GRI Field
1,3-Butadiene	0.0084	0.0003423350	lb/MMBtu	GRI Field
Benzene	0.0183	0.0007480470	lb/MMBtu	GRI Field
Toluene	0.0249	0.0010163310	lb/MMBtu	GRI Field
Ethylbenzene	0.0518	0.0021128220	lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.0324	0.0013205140	lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.0697	0.0028417580	lb/MMBtu	GRI Field
n-Hexane	0.0345	0.0014070660	lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070	lb/MMBtu	GRI Field
Styrene	0.0510	0.0020788960	lb/MMBtu	GRI Field
Naphthalene	0.0000	0.0000005100	lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470	lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670	lb/MMBtu	GRI Field
Biphenyl	0.0000	0.0000004730	lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800	lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600	lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900	lb/MMBtu	GRI Field
Pyrene	0.0000	0.0000000830	lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870	lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170	lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700	lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500	lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0000	0.0000007600	lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0000	0.0000002600	lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200	lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030	lb/MMBtu	GRI Field
Lead	0.0000	0.0000004902	lb/MMBtu	EPA
Total	0.3534			

Criteria Pollutants

VOC	0.1323	0.0053921569	lb/MMBtu	EPA
PM	0.1828	0.0074509804	lb/MMBtu	EPA
PM, Condensible	0.1371	0.0055882353	lb/MMBtu	EPA
PM, Filterable	0.0457	0.0018627451	lb/MMBtu	EPA
CO	0.7938	0.0323636360	lb/MMBtu	GRI Field
NMHC	0.2092	0.0085294118	lb/MMBtu	EPA
NOx	2.3796	0.0970167730	lb/MMBtu	GRI Field
SO2	0.0144	0.0005880000	lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0000	0.0000011765	lb/MMBtu	EPA
Methane	0.2581	0.0105212610	lb/MMBtu	GRI Field
Acetylene	0.3434	0.0140000000	lb/MMBtu	GRI Field
Ethylene	0.0232	0.0009476310	lb/MMBtu	GRI Field
Ethane	0.0645	0.0026312210	lb/MMBtu	GRI Field

Propylene	0.0575	0.0023454550 lb/MMBtu	GRI Field
Propane	0.0262	0.0010686280 lb/MMBtu	GRI Field
Isobutane	0.0359	0.0014640770 lb/MMBtu	GRI Field
Butane	0.0338	0.0013766990 lb/MMBtu	GRI Field
Cyclopentane	0.0277	0.0011304940 lb/MMBtu	GRI Field
Pentane	0.0850	0.0034671850 lb/MMBtu	GRI Field
n-Pentane	0.0349	0.0014221310 lb/MMBtu	GRI Field
Cyclohexane	0.0225	0.0009183830 lb/MMBtu	GRI Field
Methylcyclohexane	0.0540	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.0700	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.0839	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.0839	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.0839	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.0898	0.0036604170 lb/MMBtu	GRI Field
CO2	2,885.6471	117.6470588235 lb/MMBtu	EPA

Unit Name: 55 MMBTU

Hours of Operation: 8,760 Yearly

Heat Input: 55.00 MMBtu/hr

Fuel Type: NATURAL GAS

Device Type: HEATER

Emission Factor Set: FIELD > EPA > LITERATURE

Additional EF Set: -NONE-

Calculated Emissions (ton/yr)

Chemical Name	Emissions	Emission Factor	Emission Factor Set
HAPs			
3-Methylcholanthrene	0.0000	0.0000000018 lb/MMBtu	EPA
7,12-Dimethylbenz(a)anthracene	0.0000	0.0000000157 lb/MMBtu	EPA
Formaldehyde	0.2033	0.0008440090 lb/MMBtu	GRI Field
Methanol	0.2321	0.0009636360 lb/MMBtu	GRI Field
Acetaldehyde	0.1777	0.0007375920 lb/MMBtu	GRI Field
1,3-Butadiene	0.0825	0.0003423350 lb/MMBtu	GRI Field
Benzene	0.1802	0.0007480470 lb/MMBtu	GRI Field
Toluene	0.2448	0.0010163310 lb/MMBtu	GRI Field
Ethylbenzene	0.5090	0.0021128220 lb/MMBtu	GRI Field
Xylenes(m,p,o)	0.3181	0.0013205140 lb/MMBtu	GRI Field
2,2,4-Trimethylpentane	0.6846	0.0028417580 lb/MMBtu	GRI Field
n-Hexane	0.3390	0.0014070660 lb/MMBtu	GRI Field
Phenol	0.0000	0.0000001070 lb/MMBtu	GRI Field
Styrene	0.5008	0.0020788960 lb/MMBtu	GRI Field
Naphthalene	0.0001	0.0000005100 lb/MMBtu	GRI Field
2-Methylnaphthalene	0.0000	0.0000001470 lb/MMBtu	GRI Field
Acenaphthylene	0.0000	0.0000000670 lb/MMBtu	GRI Field
Biphenyl	0.0001	0.0000004730 lb/MMBtu	GRI Field
Acenaphthene	0.0000	0.0000000900 lb/MMBtu	GRI Field
Fluorene	0.0000	0.0000000800 lb/MMBtu	GRI Field
Anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Phenanthrene	0.0000	0.0000000600 lb/MMBtu	GRI Field
Fluoranthene	0.0000	0.0000000900 lb/MMBtu	GRI Field

Pyrene	0.0000	0.0000000830 lb/MMBtu	GRI Field
Benz(a)anthracene	0.0000	0.0000000870 lb/MMBtu	GRI Field
Chrysene	0.0000	0.0000001170 lb/MMBtu	GRI Field
Benzo(a)pyrene	0.0000	0.0000000700 lb/MMBtu	GRI Field
Benzo(b)fluoranthene	0.0000	0.0000001500 lb/MMBtu	GRI Field
Benzo(k)fluoranthene	0.0002	0.0000007600 lb/MMBtu	GRI Field
Benzo(g,h,i)perylene	0.0001	0.0000002600 lb/MMBtu	GRI Field
Indeno(1,2,3-c,d)pyrene	0.0000	0.0000001200 lb/MMBtu	GRI Field
Dibenz(a,h)anthracene	0.0000	0.0000001030 lb/MMBtu	GRI Field
Lead	0.0001	0.0000004902 lb/MMBtu	EPA
Total	3.4727		

Criteria Pollutants

VOC	1.2990	0.0053921569 lb/MMBtu	EPA
PM	1.7949	0.0074509804 lb/MMBtu	EPA
PM, Condensible	1.3462	0.0055882353 lb/MMBtu	EPA
PM, Filterable	0.4487	0.0018627451 lb/MMBtu	EPA
CO	7.7964	0.0323636360 lb/MMBtu	GRI Field
NMHC	2.0547	0.0085294118 lb/MMBtu	EPA
NOx	23.3713	0.0970167730 lb/MMBtu	GRI Field
SO2	0.1416	0.0005880000 lb/MMBtu	EPA

Other Pollutants

Dichlorobenzene	0.0003	0.0000011765 lb/MMBtu	EPA
Methane	2.5346	0.0105212610 lb/MMBtu	GRI Field
Acetylene	3.3726	0.0140000000 lb/MMBtu	GRI Field
Ethylene	0.2283	0.0009476310 lb/MMBtu	GRI Field
Ethane	0.6339	0.0026312210 lb/MMBtu	GRI Field
Propylene	0.5650	0.0023454550 lb/MMBtu	GRI Field
Propane	0.2574	0.0010686280 lb/MMBtu	GRI Field
Isobutane	0.3527	0.0014640770 lb/MMBtu	GRI Field
Butane	0.3316	0.0013766990 lb/MMBtu	GRI Field
Cyclopentane	0.2723	0.0011304940 lb/MMBtu	GRI Field
Pentane	0.8352	0.0034671850 lb/MMBtu	GRI Field
n-Pentane	0.3426	0.0014221310 lb/MMBtu	GRI Field
Cyclohexane	0.2212	0.0009183830 lb/MMBtu	GRI Field
Methylcyclohexane	0.5303	0.0022011420 lb/MMBtu	GRI Field
n-Octane	0.6875	0.0028538830 lb/MMBtu	GRI Field
1,2,3-Trimethylbenzene	0.8245	0.0034224540 lb/MMBtu	GRI Field
1,2,4-Trimethylbenzene	0.8245	0.0034224540 lb/MMBtu	GRI Field
1,3,5-Trimethylbenzene	0.8245	0.0034224540 lb/MMBtu	GRI Field
n-Nonane	0.8818	0.0036604170 lb/MMBtu	GRI Field
CO2	28,341.1765	117.6470588235 lb/MMBtu	EPA

Bloomberg BNA Environment & Safety Resource Center™

Federal Environment and Safety Codified Regulations
TITLE 40—Protection of Environment
PART 98—MANDATORY GREENHOUSE GAS REPORTING
SUBPART C—General Stationary Fuel Combustion Sources

Table C-1 to Subpart C of Part 98 —Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel

Fuel type	Default high heat value	Default CO_2 emission factor
Coal and coke	mmBtu/short ton	kg CO_2/mmBtu
Anthracite	25.09	103.69
Bituminous	24.93	93.28
Subbituminous	17.25	97.17
Lignite	14.21	97.72
Coal Coke	24.80	113.67
Mixed (Commercial sector)	21.39	94.27
Mixed (Industrial coking)	26.28	93.90
Mixed (Industrial sector)	22.35	94.67
Mixed (Electric Power sector)	19.73	95.52
Natural gas	mmBtu/scf	kg CO_2/mmBtu
(Weighted U.S. Average)	1.026×10^{-3}	53.06
Petroleum products	mmBtu/gallon	kg CO_2/mmBtu
Distillate Fuel Oil No. 1	0.139	73.25
Distillate Fuel Oil No. 2	0.138	73.96
Distillate Fuel Oil No. 4	0.146	75.04
Residual Fuel Oil No. 5	0.140	72.93
Residual Fuel Oil No. 6	0.150	75.10
Used Oil	0.138	74.00
Kerosene	0.135	75.20
Liquefied petroleum gases (LPG) [1]	0.092	61.71
Propane [1]	0.091	62.87
Propylene [2]	0.091	67.77
Ethane [1]	0.068	59.60
Ethanol	0.084	68.44
Ethylene [2]	0.058	65.96
Isobutane [1]	0.099	64.94
Isobutylene [1]	0.103	68.86
Butane [1]	0.103	64.77
Butylene [1]	0.105	68.72

Naphtha (<401 deg F)	0.125	68.02
Natural Gasoline	0.110	66.88
Other Oil (>401 deg F)	0.139	76.22
Pentanes Plus	0.110	70.02
Petrochemical Feedstocks	0.125	71.02
Petroleum Coke	0.143	102.41
Special Naphtha	0.125	72.34
Unfinished Oils	0.139	74.54
Heavy Gas Oils	0.148	74.92
Lubricants	0.144	74.27
Motor Gasoline	0.125	70.22
Aviation Gasoline	0.120	69.25
Kerosene-Type Jet Fuel	0.135	72.22
Asphalt and Road Oil	0.158	75.36
Crude Oil	0.138	74.54
Other fuels—solid	mmBtu/short ton	kg CO_2/mmBtu
Municipal Solid Waste	9.95 [3]	90.7
Tires	28.00	85.97
Plastics	38.00	75.00
Petroleum Coke	30.00	102.41
Other fuels—gaseous	mmBtu/scf	kg CO_2/mmBtu
Blast Furnace Gas	0.092×10^{-3}	274.32
Coke Oven Gas	0.599×10^{-3}	46.85
Propane Gas	2.516×10^{-3}	61.46
Fuel Gas [4]	1.388×10^{-3}	59.00
Biomass fuels—solid	mmBtu/short ton	kg CO_2/mmBtu
Wood and Wood Residuals (dry basis) [5]	17.48	93.80
Agricultural Byproducts	8.25	118.17
Peat	8.00	111.84
Solid Byproducts	10.39	105.51
Biomass fuels—gaseous	mmBtu/scf	kg CO_2/mmBtu
Landfill Gas	0.485×10^{-3}	52.07
Other Biomass Gases	0.655×10^{-3}	52.07
Biomass Fuels—Liquid	mmBtu/gallon	kg CO_2/mmBtu
Ethanol	0.084	68.44
Biodiesel (100%)	0.128	73.84
Rendered Animal Fat	0.125	71.06
Vegetable Oil	0.120	81.55

[1] The HHV for components of LPG determined at 60 °F and saturation pressure with the exception of ethylene.

[2] Ethylene HHV determined at 41 °F (5 °C) and saturation pressure.

[3] Use of this default HHV is allowed only for: (a) Units that combust MSW, do not generate steam, and are

allowed to use Tier 1; (b) units that derive no more than 10 percent of their annual heat input from MSW and/or tires; and (c) small batch incinerators that combust no more than 1,000 tons of MSW per year.

[4] Reporters subject to subpart X of this part that are complying with § 98.243(d) or subpart Y of this part may only use the default HHV and the default CO_2 emission factor for fuel gas combustion under the conditions prescribed in § 98.243(d)(2)(i) and (d)(2)(ii) and § 98.252(a)(1) and (a)(2), respectively. Otherwise, reporters subject to subpart X or subpart Y shall use either Tier 3 (Equation C-5) or Tier 4.

[5] Use the following formula to calculate a wet basis HHV for use in Equation C-1: HHV_w = ((100 - M)/100)*HHV_d where HHV_w = wet basis HHV, M = moisture content (percent) and HHV_d = dry basis HHV from Table C-1.

[78 FR page 71950, Nov. 29, 2013]

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Bloomberg BNA Environment & Safety Resource Center™

Federal Environment and Safety Codified Regulations
TITLE 40—Protection of Environment
PART 98—MANDATORY GREENHOUSE GAS REPORTING
SUBPART C—General Stationary Fuel Combustion Sources

Table C-2 to Subpart C of Part 98 —Default CH_4 and N_2O Emission Factors for Various Types of Fuel

Fuel type	Default CH_4 emission factor (kg CH_4/mmBtu)	Default N_2O emission factor (kg N_2O/mmBtu)
Coal and Coke (All fuel types in Table C-1)	1.1×10^{-02}	1.6×10^{-03}
Natural Gas	1.0×10^{-03}	1.0×10^{-04}
Petroleum (All fuel types in Table C-1)	3.0×10^{-03}	6.0×10^{-04}
Fuel Gas	3.0×10^{-03}	6.0×10^{-04}
Municipal Solid Waste	3.2×10^{-02}	4.2×10^{-03}
Tires	3.2×10^{-02}	4.2×10^{-03}
Blast Furnace Gas	2.2×10^{-05}	1.0×10^{-04}
Coke Oven Gas	4.8×10^{-04}	1.0×10^{-04}
Biomass Fuels—Solid (All fuel types in Table C-1, except wood and wood residuals)	3.2×10^{-02}	4.2×10^{-03}
Wood and wood residuals	7.2×10^{-03}	3.6×10^{-03}
Biomass Fuels—Gaseous (All fuel types in Table C-1)	3.2×10^{-03}	6.3×10^{-04}
Biomass Fuels—Liquid (All fuel types in Table C-1)	1.1×10^{-03}	1.1×10^{-04}

Note: Those employing this table are assumed to fall under the IPCC definitions of the “Energy Industry” or “Manufacturing Industries and Construction”. In all fuels except for coal the values for these two categories are identical. For coal combustion, those who fall within the IPCC “Energy Industry” category may employ a value of 1g of CH_4/mmBtu.

[75 FR page 79154, Dec. 17, 2010; 78 FR page 71952, Nov. 29, 2013]

ISSN 2167-8065

Section 7.4-3 – EPA AP42 Table 13.5-1 for Flares

Since flares do not lend themselves to conventional emission testing techniques, only a few attempts have been made to characterize flare emissions. Recent EPA tests using propylene as flare gas indicated that efficiencies of 98 percent can be achieved when burning an offgas with at least 11,200 kJ/m^3 (300 Btu/ft^3). The tests conducted on steam-assisted flares at velocities as low as 39.6 meters per minute (m/min) (130 ft/min) to 1140 m/min (3750 ft/min), and on air-assisted flares at velocities of 180 m/min (617 ft/min) to 3960 m/min (13,087 ft/min) indicated that variations in incoming gas flow rates have no effect on the combustion efficiency. Flare gases with less than 16,770 kJ/m^3 (450 Btu/ft^3) do not smoke.

Table 13.5-1 presents flare emission factors, and Table 13.5-2 presents emission composition data obtained from the EPA tests.[1] Crude propylene was used as flare gas during the tests. Methane was a major fraction of hydrocarbons in the flare emissions, and acetylene was the dominant intermediate hydrocarbon species. Many other reports on flares indicate that acetylene is always formed as a stable intermediate product. The acetylene formed in the combustion reactions may react further with hydrocarbon radicals to form polyacetylenes followed by polycyclic hydrocarbons.[2]

In flaring waste gases containing no nitrogen compounds, NO is formed either by the fixation of atmospheric nitrogen (N) with oxygen (O) or by the reaction between the hydrocarbon radicals present in the combustion products and atmospheric nitrogen, by way of the intermediate stages, HCN, CN, and OCN.[2] Sulfur compounds contained in a flare gas stream are converted to SO_2 when burned. The amount of SO_2 emitted depends directly on the quantity of sulfur in the flared gases.

Table 13.5-1 (English Units). EMISSION FACTORS FOR FLARE OPERATIONS[a]

EMISSION FACTOR RATING: B

Component	Emission Factor ($lb/10^6$ Btu)
Total hydrocarbons[b]	0.14
Carbon monoxide	0.37
Nitrogen oxides	0.068
Soot[c]	0 - 274

[a] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.
[b] Measured as methane equivalent.
[c] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-453/R-95-017
November 1995

Air

EPA

Protocol for Equipment Leak Emission Estimates

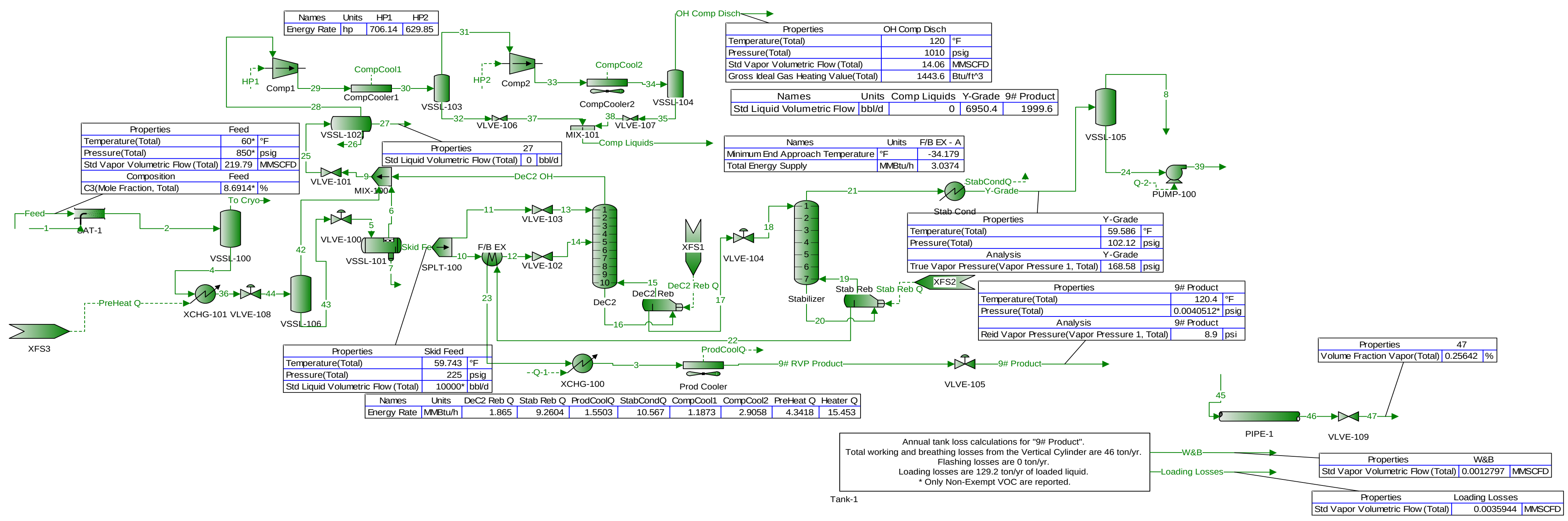
TABLE 2-4. OIL AND GAS PRODUCTION OPERATIONS AVERAGE EMISSION FACTORS (kg/hr/source)

Equipment Type	Service[a]	Emission Factor (kg/hr/source)[b]
Valves	Gas	4.5E-03
	Heavy Oil	8.4E-06
	Light Oil	2.5E-03
	Water/Oil	9.8E-05
Pump seals	Gas	2.4E-03
	Heavy Oil	NA
	Light Oil	1.3E-02
	Water/Oil	2.4E-05
Others[c]	Gas	8.8E-03
	Heavy Oil	3.2E-05
	Light Oil	7.5E-03
	Water/Oil	1.4E-02
Connectors	Gas	2.0E-04
	Heavy Oil	7.5E-06
	Light Oil	2.1E-04
	Water/Oil	1.1E-04
Flanges	Gas	3.9E-04
	Heavy Oil	3.9E-07
	Light Oil	1.1E-04
	Water/Oil	2.9E-06
Open-ended lines	Gas	2.0E-03
	Heavy Oil	1.4E-04
	Light Oil	1.4E-03
	Water/Oil	2.5E-04

[a]Water/Oil emission factors apply to water streams in oil service with a water content greater than 50%, from the point of origin to the point where the water content reaches 99%. For water streams with a water content greater than 99%, the emission rate is considered negligible.

[b]These factors are for total organic compound emission rates (including non-VOC's such as methane and ethane) and apply to light crude, heavy crude, gas plant, gas production, and off shore facilities. "NA" indicates that not enough data were available to develop the indicated emission factor.

[c]The "other" equipment type was derived from compressors, diaphrams, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents. This "other" equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps, or valves.



Names	Units	HP1	HP2
Energy Rate	hp	706.14	629.85

Properties	OH Comp Disch	
Temperature(Total)	120	°F
Pressure(Total)	1010	psig
Std Vapor Volumetric Flow (Total)	14.06	MMSCFD
Gross Ideal Gas Heating Value(Total)	1443.6	Btu/ft^3

Names	Units	Comp Liquids	Y-Grade	9# Product
Std Liquid Volumetric Flow	bbl/d	0	6950.4	1999.6

Properties	Feed	
Temperature(Total)	60*	°F
Pressure(Total)	850*	psig
Std Vapor Volumetric Flow (Total)	219.79	MMSCFD
Composition	Feed	
C3(Mole Fraction, Total)	8.6914*	%

Properties	27	
Std Liquid Volumetric Flow (Total)	0	bbl/d

Names	Units	F/B EX - A
Minimum End Approach Temperature	°F	-34.179
Total Energy Supply	MMBtu/h	3.0374

Properties	Y-Grade	
Temperature(Total)	59.586	°F
Pressure(Total)	102.12	psig
Analysis	Y-Grade	
True Vapor Pressure(Vapor Pressure 1, Total)	168.58	psig

Properties	9# Product	
Temperature(Total)	120.4	°F
Pressure(Total)	0.0040512*	psig
Analysis	9# Product	
Reid Vapor Pressure(Vapor Pressure 1, Total)	8.9	psi

Properties	Skid Feed	
Temperature(Total)	59.743	°F
Pressure(Total)	225	psig
Std Liquid Volumetric Flow (Total)	10000*	bbl/d

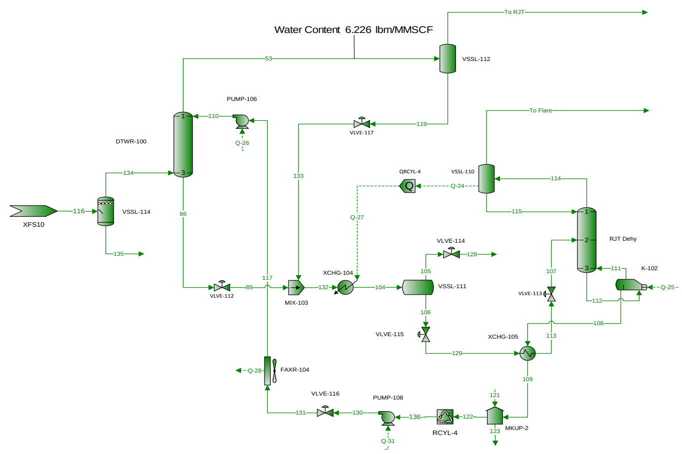
Names	Units	DeC2 Reb Q	Stab Reb Q	ProdCoolQ	StabCondQ	CompCool1	CompCool2	PreHeat Q	Heater Q
Energy Rate	MMBtu/h	1.865	9.2604	1.5503	10.567	1.1873	2.9058	4.3418	15.453

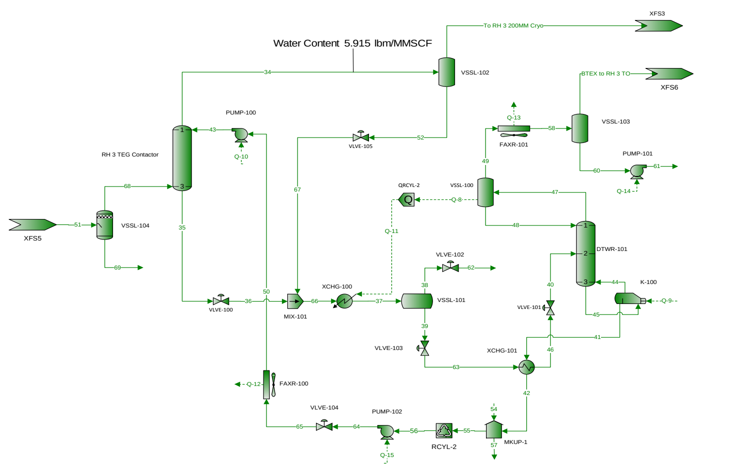
Properties	47	
Volume Fraction Vapor(Total)	0.25642	%

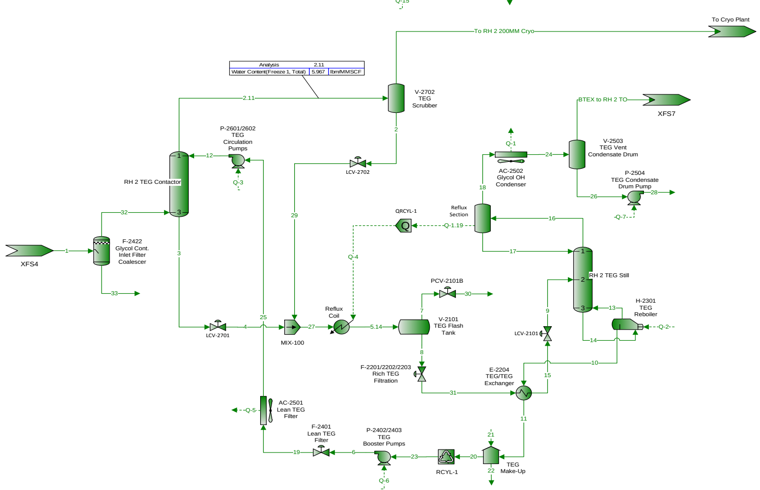
Annual tank loss calculations for "9# Product".
Total working and breathing losses from the Vertical Cylinder are 46 ton/yr.
Flashing losses are 0 ton/yr.
Loading losses are 129.2 ton/yr of loaded liquid.
* Only Non-Exempt VOC are reported.

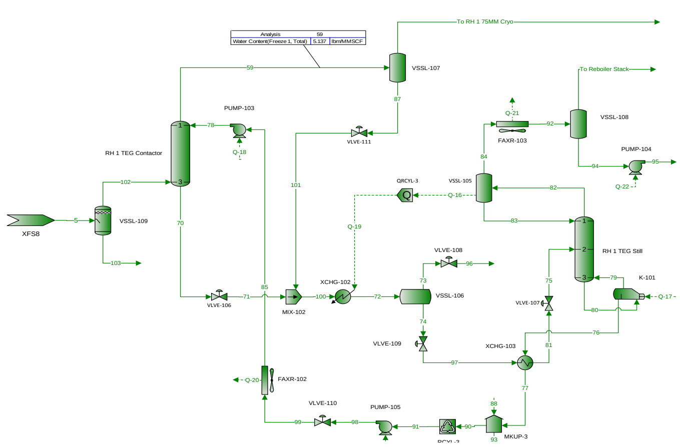
Properties	W&B	
Std Vapor Volumetric Flow (Total)	0.0012797	MMSCFD

Properties	Loading Losses	
Std Vapor Volumetric Flow (Total)	0.0035944	MMSCFD


Water Content 6.226 lbm/MMSCF
To RJT
VSSL-112
PUMP-106
DTWR-100
VLVE-117
To Flare
QRCYL-4
VSSL-110
XFS10
VSSL-114
RJT Dehy
K-102
VLVE-114
XCHG-104
VSSL-111
VLVE-112
MIX-103
VLVE-113
VLVE-115
XCHG-105
FAXR-104
VLVE-116
PUMP-108
RCYL-4
MKUP-2

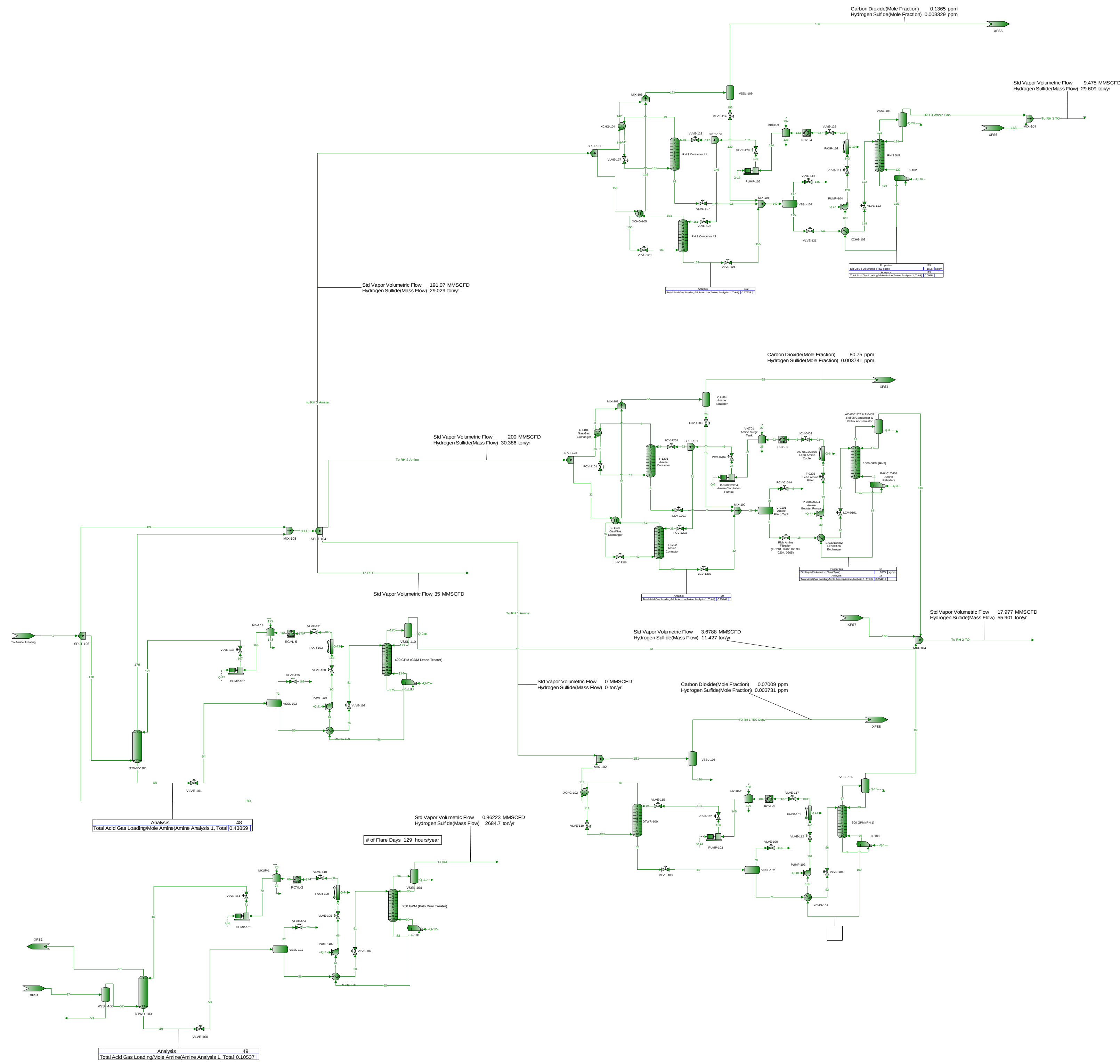

Water Content 5.915 lbm/MMSCF
To RH 3 200MM Cryo
XFS3
VSSL-102
BTEX to RH 3 TO
XFS6
PUMP-100
RH 3 TEG Contactor
VLVE-105
FAXR-101
VSSL-103
PUMP-101
QRCYL-2
VSSL-100
XFS5
VSSL-104
DTWR-101
VLVE-102
XCHG-100
K-100
VLVE-100
MIX-101
VSSL-101
VLVE-101
VLVE-103
XCHG-101
FAXR-100
VLVE-104
PUMP-102
RCYL-2
MKUP-1


To Cryo Plant
To RH 2 200MM Cryo
Analysis
Water Content(Freeze 1, Total)
5.967
lbm/MMSCF
V-2702
TEG
Scrubber
BTEX to RH 2 TO
XFS7
P-2601/2602
TEG
Circulation
Pumps
LCV-2702
AC-2502
Glycol OH
Condenser
V-2503
TEG Vent
Condensate Drum
P-2504
TEG Condensate
Drum Pump
RH 2 TEG Contactor
QRCYL-1
Reflux
Section
XFS4
F-2422
Glycol Cont.
Inlet Filter
Coalescer
RH 2 TEG Still
PCV-2101B
H-2301
TEG
Reboiler
Reflux
Coil
V-2101
TEG Flash
Tank
LCV-2701
MIX-100
LCV-2101
F-2201/2202/2203
Rich TEG
Filtration
E-2204
TEG/TEG
Exchanger
AC-2501
Lean TEG
Filter
F-2401
Lean TEG
Filter
P-2402/2403
TEG
Booster Pumps
RCYL-1
TEG
Make-Up


To RH 1 75MM Cryo
Analysis
Water Content(Freeze 1, Total)
5.137
lbm/MMSCF
VSSL-107
To Reboiler Stack
PUMP-103
VLVE-111
FAXR-103
VSSL-108
RH 1 TEG Contactor
PUMP-104
QRCYL-3
VSSL-105
XFS8
VSSL-109
RH 1 TEG Still
VLVE-108
K-101
XCHG-102
VLVE-106
MIX-102
VSSL-106
VLVE-107
VLVE-109
XCHG-103
FAXR-102
VLVE-110
PUMP-105
MKUP-3

Process Streams		BTEX to RH 2 TO	BTEX to RH 3 TO	To Flare	128
Composition	Status:	Solved	Solved	Solved	Solved
Phase: **Total**	From Block:	V-2503 TEG Vent Condensate Drum	VSSL-103	VSSL-110	VLVE-114
	To Block:	XFS7	XFS6	--	--
Mole Fraction		%	%	%	%
Carbon Dioxide		0.0578448	7.95569E-05	1.68618E-05	9.52128E-05
Hydrogen Sulfide		1.92954E-05	1.69302E-05	2.21777E-06	2.52450E-06
Nitrogen		0.0259748	0.0258737	0.00266312	0.543596
Methane		10.2968	10.2834	1.06668	54.8217
Ethane		13.0730	13.0823	1.37501	20.0620
Propane		17.6775	17.7136	1.88215	14.0712
i-Butane		2.53832	2.54454	0.273858	1.66256
n-Butane		10.7865	10.8073	1.16016	4.81897
i-Pentane		4.67515	4.68964	0.514659	1.19010
n-Pentane		5.97664	6.00684	0.671900	1.29733
Hexane		5.39423	5.43340	0.648093	0.675877
Heptane		3.26465	3.30563	0.463929	0.244630
Benzene		8.70055	8.58004	1.12925	0.0722846
Toluene		3.33364	3.31054	0.567977	0.0202883
o-Xylene		0	0	0	0
p-Xylene		0.608616	0.608520	0.172047	0.00438298
Octane		0.698046	0.714215	0.149944	0.0479261
Water		12.7152	12.7148	89.8389	0.463508
MDEA		0.0419228	0.0421129	0.0323400	5.70278E-05
Piperazine		3.28213E-07	4.57640E-07	0.0121129	0.00210821
TEG		2.68734E-10	2.77749E-10	2.46660E-05	0.000460862
Ethylbenzene		0.135487	0.137179	0.0383076	0.000945122
Mass Flow		lb/h	lb/h	lb/h	lb/h
Carbon Dioxide		0.0647596	8.88984E-05	5.94769E-05	8.68662E-05
Hydrogen Sulfide		1.67285E-05	1.46502E-05	6.05793E-06	1.78359E-06
Nitrogen		0.0185102	0.0184032	0.00597934	0.315683
Methane		4.20209	4.18867	1.37152	18.2319
Ethane		9.99970	9.98784	3.31376	12.5056
Propane		19.8294	19.8323	6.65190	12.8628
i-Butane		3.75303	3.75510	1.27575	2.00322
n-Butane		15.9483	15.9488	5.40452	5.80638
i-Pentane		8.58060	8.59089	2.97608	1.78000
n-Pentane		10.9693	11.0038	3.88535	1.94039
Hexane		11.8251	11.8884	4.47627	1.20743
Heptane		8.32159	8.41007	3.72584	0.508153
Benzene		17.2885	17.0167	7.06976	0.117050
Toluene		7.81364	7.74479	4.19438	0.0387521
o-Xylene		0	0	0	0
p-Xylene		1.64368	1.64031	1.46394	0.00964628
Octane		2.02839	2.07144	1.37277	0.113489
Water		5.82717	5.81594	129.718	0.173104
MDEA		0.127082	0.127416	0.308870	0.000140875
Piperazine		7.19170E-07	1.00087E-06	0.0836232	0.00376448
TEG		1.02661E-09	1.05904E-09	0.000296884	0.00143474
Ethylbenzene		0.365909	0.369776	0.325959	0.00208007

Process Streams		BTEX to RH 2 TO	BTEX to RH 3 TO	To Flare	128
Properties	Status:	Solved	Solved	Solved	Solved
Phase: Total	From Block:	V-2503 TEG Vent Condensate Drum	VSSL-103	VSSL-110	VLVE-114
	To Block:	XFS7	XFS6	--	--
Property	**Units**				
Temperature	°F	120	120	205.573	136.095
Pressure	psig	1	1	2	65
Mole Fraction Vapor	%	100	100	100	100
Mole Fraction Light Liquid	%	0	0	0	0
Mole Fraction Heavy Liquid	%	0	0	0	0
Molecular Weight	lb/lbmol	50.5558	50.5746	22.1619	27.7954
Mass Density	lb/ft^3	0.109778	0.109821	0.0447536	0.344685
Molar Flow	lbmol/h	2.54386	2.53904	8.01487	2.07305
Mass Flow	lb/h	128.607	128.411	177.625	57.6211
Vapor Volumetric Flow	ft^3/h	1171.52	1169.28	3968.96	167.170
Liquid Volumetric Flow	gpm	146.060	145.780	494.831	20.8420
Std Vapor Volumetric Flow	MMSCFD	0.0231686	0.0231247	0.0729966	0.0188806
Std Liquid Volumetric Flow	sgpm	0.431616	0.431241	0.416873	0.288193
Compressibility		0.984610	0.984591	0.991910	0.974968
Specific Gravity		1.74555	1.74620	0.765192	0.959698
API Gravity					
Enthalpy	Btu/h	-116975	-116965	-768609	-76403.0
Mass Enthalpy	Btu/lb	-909.557	-910.864	-4327.14	-1325.95
Mass Cp	Btu/(lb*°F)	0.403079	0.403516	0.454176	0.482867
Ideal Gas CpCv Ratio		1.10872	1.10855	1.24764	1.17762
Dynamic Viscosity	cP	0.00893913	0.00893283	0.0124527	0.0108720
Kinematic Viscosity	cSt	5.08348	5.07790	17.3705	1.96909
Thermal Conductivity	Btu/(h*ft*°F)	0.0112760	0.0112771	0.0147780	0.0175781
Surface Tension	lbf/ft				
Net Ideal Gas Heating Value	Btu/ft^3	2447.77	2450.62	300.319	1485.03
Net Liquid Heating Value	Btu/lb	18173.2	18187.9	4324.63	20165.4
Gross Ideal Gas Heating Value	Btu/ft^3	2642.56	2645.85	367.975	1626.50
Gross Liquid Heating Value	Btu/lb	19635.4	19652.7	5483.09	22096.9



Carbon Dioxide(Mole Fraction) 0.1365 ppm
Hydrogen Sulfide(Mole Fraction) 0.003329 ppm
XFS5
Std Vapor Volumetric Flow 9.475 MMSCFD
Hydrogen Sulfide(Mass Flow) 29.609 ton/yr
RH 3 Waste Gas
To RH 3 TO
RH 3 Contactor #1
RH 3 Contactor #2
RH 3 Still
Properties 125
Std Liquid Volumetric Flow(Total) 1606 sgpm
Analysis 125
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total) 0.0046
Analysis 152
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total) 0.27903
Std Vapor Volumetric Flow 191.07 MMSCFD
Hydrogen Sulfide(Mass Flow) 29.029 ton/yr
To RH 3 Amine
Carbon Dioxide(Mole Fraction) 80.75 ppm
Hydrogen Sulfide(Mole Fraction) 0.003741 ppm
XFS4
Std Vapor Volumetric Flow 200 MMSCFD
Hydrogen Sulfide(Mass Flow) 30.386 ton/yr
To RH 2 Amine
V-1203 Amine Scrubber
T-1201 Amine Contactor
T-1202 Amine Contactor
V-0701 Amine Surge Tank
V-0101 Amine Flash Tank
1600 GPM (RH2)
Properties 18
Std Liquid Volumetric Flow(Total) 1605 sgpm
Analysis 18
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total) 0.004711
Analysis 39
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total) 0.29148
To RJT
Std Vapor Volumetric Flow 35 MMSCFD
To RH 1 Amine
To Amine Treating
Std Vapor Volumetric Flow 17.977 MMSCFD
Hydrogen Sulfide(Mass Flow) 55.901 ton/yr
To RH 2 TO
Std Vapor Volumetric Flow 3.6788 MMSCFD
Hydrogen Sulfide(Mass Flow) 11.427 ton/yr
400 GPM (CDM Lease Treater)
Std Vapor Volumetric Flow 0 MMSCFD
Hydrogen Sulfide(Mass Flow) 0 ton/yr
Carbon Dioxide(Mole Fraction) 0.07009 ppm
Hydrogen Sulfide(Mole Fraction) 0.003731 ppm
TO RH 1 TEG Dehy
XFS8
500 GPM (RH 1)
Analysis 48
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total) 0.43859
Std Vapor Volumetric Flow 0.86223 MMSCFD
Hydrogen Sulfide(Mass Flow) 2684.7 ton/yr
# of Flare Days 129 hours/year
250 GPM (Palo Duro Treater)
Analysis 49
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total) 0.10537

Process Streams		RH 3 Waste Gas	To AGI	82	98	110
Composition	Status:	Solved	Solved	Solved	Solved	Solved
Phase: **Total**	From Block:	VSSL-108	VSSL-104	VSSL-110	VSSL-105	AC-0601/02 & T-0403 Reflux Condenser & Reflux Accumulator
	To Block:	MIX-107	--	MIX-104	MIX-104	MIX-104
Mole Fraction		%	%	%	%	%
Carbon Dioxide		92.1085	71.6546	92.0898	92.3863	91.0792
Hydrogen Sulfide		0.0191122	18.9974	0.0189524	0.0191587	0.0189431
Nitrogen		0.000820919	0.00250444	0.000482854	0.000475613	0.000772806
Methane		0.296378	0.992147	0.132718	0.145847	0.274590
Ethane		0.105738	0.452486	0.0366017	0.0436424	0.0963417
Propane		0.0332996	0.144230	0.0109680	0.0133941	0.0302758
i-Butane		0.00231976	0.0106931	0.000736494	0.000920285	0.00210360
n-Butane		0.0110228	0.0530502	0.00337086	0.00421996	0.00997136
i-Pentane		0.000616212	0.00454723	0.000151665	0.000195082	0.000549503
n-Pentane		0.00101388	0.00708069	0.000262550	0.000336708	0.000906409
Hexane		0.000351566	0.00323851	7.21823E-05	0.000100855	0.000310092
Heptane		3.52507E-05	0.000441199	6.87345E-06	9.64048E-06	3.09839E-05
Benzene		0.0462904	0	0.0171307	0.0211634	0.0406025
Toluene		0.0149111	0	0.00472437	0.00609788	0.0127951
o-Xylene		0	0	0	0	0
p-Xylene		0.00422008	0	0.00116436	0.00152072	0.00349029
Octane		9.84452E-06	0.000155762	1.95359E-06	2.82570E-06	8.67410E-06
Water		7.35477	7.67746	7.68271	7.35638	8.42860
MDEA		3.40590E-08	6.27615E-08	2.10880E-08	2.45018E-08	4.26691E-08
Piperazine		2.72749E-08	1.55697E-07	1.52232E-08	1.24656E-08	3.14707E-08
TEG		8.30947E-15	2.62947E-15	1.62856E-15	7.14734E-15	9.25926E-15
Ethylbenzene		0.000598943	0	0.000174133	0.000227274	0.000510708
Mass Flow		lb/h	lb/h	lb/h	lb/h	lb/h
Carbon Dioxide		42069.9	2985.44	16370.3	19147.0	43951.3
Hydrogen Sulfide		6.76001	612.945	2.60900	3.07484	7.07894
Nitrogen		0.238667	0.0664191	0.0546361	0.0627430	0.237379
Methane		49.3449	15.0683	8.60003	11.0183	48.3016
Ethane		32.9972	12.8808	4.44548	6.17979	31.7643
Propane		15.2391	6.02098	1.95354	2.78133	14.6385
i-Butane		1.39930	0.588386	0.172906	0.251889	1.34063
n-Butane		6.64903	2.91908	0.791371	1.15504	6.35481
i-Pentane		0.461408	0.310594	0.0441990	0.0662816	0.434715
n-Pentane		0.759174	0.483640	0.0765136	0.114401	0.717065
Hexane		0.314424	0.264208	0.0251253	0.0409286	0.293008
Heptane		0.0366580	0.0418531	0.00278195	0.00454905	0.0340423
Benzene		37.5261	0	5.40493	7.78482	34.7756
Toluene		14.2585	0	1.75826	2.64585	12.9268
o-Xylene		0	0	0	0	0
p-Xylene		4.64973	0	0.499306	0.760284	4.06302
Octane		0.0116706	0.0168443	0.000901374	0.00152001	0.0108644
Water		1375.10	130.941	559.054	624.095	1664.95
MDEA		4.21207E-05	7.08026E-06	1.01501E-05	1.37493E-05	5.57517E-05
Piperazine		2.43821E-05	1.26964E-05	5.29648E-06	5.05641E-06	2.97231E-05
TEG		1.29506E-11	3.73832E-13	9.87853E-13	5.05454E-12	1.52466E-11
Ethylbenzene		0.659922	0	0.0746724	0.113626	0.594511

Process Streams		RH 3 Waste Gas	To AGI	82	98	110
Properties	Status:	Solved	Solved	Solved	Solved	Solved
Phase: **Vapor**	From Block:	VSSL-108	VSSL-104	VSSL-110	VSSL-105	AC-0601/02 & T-0403 Reflux Condenser & Reflux Accumulator
	To Block:	MIX-107	--	MIX-104	MIX-104	MIX-104
Property	**Units**					
Temperature	°F	120	120	120	120	120
Pressure	psig	11	10	10	11	8
Mole Fraction Vapor	%	100	100	100	100	100
Mole Fraction Light Liquid	%	0	0	0	0	0
Mole Fraction Heavy Liquid	%	0	0	0	0	0
Molecular Weight	lb/lbmol	42.0265	39.8008	41.9779	42.0606	41.7511
Mass Density	lb/ft^3	0.158577	0.143735	0.151550	0.158705	0.137130
Molar Flow	lbmol/h	1037.83	94.6710	403.922	470.918	1096.49
Mass Flow	lb/h	43616.3	3767.98	16955.8	19807.1	45779.8
Vapor Volumetric Flow	ft^3/h	275049	26214.8	111883	124805	333841
Liquid Volumetric Flow	gpm	34291.8	3268.34	13949.0	15560.0	41621.8
Std Vapor Volumetric Flow	MMSCFD	9.45218	0.862230	3.67878	4.28896	9.98647
Std Liquid Volumetric Flow	sgpm	106.420	9.31119	41.2828	48.2458	111.574
Compressibility		0.992649	0.992636	0.992949	0.992650	0.993542
Specific Gravity		1.45106	1.37421	1.44938	1.45224	1.44155
API Gravity						
Enthalpy	Btu/h	-1.69430E+08	-1.24139E+07	-6.60343E+07	-7.70670E+07	-1.78308E+08
Mass Enthalpy	Btu/lb	-3884.56	-3294.58	-3894.49	-3890.88	-3894.91
Mass Cp	Btu/(lb*°F)	0.217519	0.225931	0.217325	0.217083	0.218432
Ideal Gas CpCv Ratio		1.28033	1.28624	1.28096	1.28077	1.28084
Dynamic Viscosity	cP	0.0161052	0.0156241	0.0161172	0.0161220	0.0160857
Kinematic Viscosity	cSt	6.34023	6.78596	6.63917	6.34173	7.32292
Thermal Conductivity	Btu/(h*ft*°F)	0.0107010	0.0107064	0.0106838	0.0106834	0.0107058
Surface Tension	lbf/ft					
Net Ideal Gas Heating Value	Btu/ft^3	8.30839	133.685	3.19065	3.74211	7.50518
Net Liquid Heating Value	Btu/lb	-31.0200	1144.78	-78.5020	-72.1592	-42.5728
Gross Ideal Gas Heating Value	Btu/ft^3	12.6946	149.284	7.32670	7.75574	12.3706
Gross Liquid Heating Value	Btu/lb	8.58515	1293.51	-41.1119	-35.9472	1.64943

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LIQUID ANALYSIS REPORT

Analysis For:	AGAVE ENERGY COMPANY	Run No:	2161110-12
Field Name:	RED HILLS	Date Run:	11/10/2016
Well Name:	RED HILLS GAS PLANT - SOUTH	Date Sampled:	11/10/2016
Station Number:		Producer:	AGAVE ENERGY
Purpose:	SPOT	County:	LEA
Sample Deg. F:	60	State:	NM
Volume/Day:		Sampled By:	CHANDLER M.
Formation:		Atmos Deg. F:	53
Line PSIG:	280.0		
Line PSIA:	293.2		

LIQUID COMPONENTS

		MOL%	LIQ%	WT%
Carbon Dioxide	C02:	0.0000	0.0000	0.0000
Nitrogen	N2:	0.0000	0.0000	0.0000
Methane	C1:	0.9547	0.5487	0.3177
Ethane	C2:	17.6370	15.9917	11.0022
Propane	C3:	48.6140	45.4084	44.4725
Iso-Butane	IC4:	8.6649	9.6132	10.4482
Nor-Butane	NC4:	13.7747	14.7234	16.6097
Iso-Pentane	IC5:	3.3756	4.1855	5.0527
Nor-Pentanes	NC5:	3.1975	3.9296	4.7860
Hexanes Plus	C6+:	3.7816	5.5995	7.3110
	TOTAL :	100.0000	100.0000	100.0000

Pressure Base:	14.73
Calc. Ideal Gravity:	0.5083
Calc. Real Gravity:	0.5195
Field Gravity:	
Pressure Base:	14.6960
Calc. Vapor Pres.:	295.2326
Reid Vapor Pres.:	
Z Factor:	0.9781
Avg. Mol Weight:	48.2020
Avg. CuFt/Gal:	34.5842

Analysis By: DON NORMAN

Remarks:

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GOVERNOR

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JC BORREGO
DEPUTY SECRETARY

DEPARTMENT ACCEPTED VALUES FOR:
AGGREGATE HANDLING, STORAGE PILE, and HAUL ROAD EMISSIONS

TO: Applicants and Air Quality Bureau Permitting Staff

SUBJECT: Department accepted default values for percent silt, wind speed, moisture content, and control efficiencies for haul road control measures

This guidance document provides the Department accepted default values for correction parameters in the emission calculation equations for aggregate handling and storage piles emissions in construction permit applications and notices of intent submitted under 20.2.72 and 20.2.73 NMAC; and the Department accepted control efficiencies for haul road control measures for applications submitted under 20.2.72 NMAC.

Aggregate Handling and Storage Pile Emission Calculations

Applicants should calculate the particulate matter emissions from aggregate handling and storage piles using the EPA's AP-42 Chapter 13.2.4.
http://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf

Equation 1 from Chapter 13.2.4 requires users to input values for two correction parameters, U and M, where U = mean wind speed and M = material moisture content. Below are the accepted values for U and M:

Default Values for Chapter 13.2.4, Equation 1:

Parameter	Default Value
U = Mean wind speed (miles per hour)	11 mph
M = Material moisture content (% water)	2%

Applicants must receive preapproval from the Department if they wish to assume a higher moisture content and/or a lower wind speed in these calculations. Higher moisture contents may require site specific testing either as a permit condition or submitted with the application. Applicants may assume higher wind speeds and lower percent moisture content in their calculations without prior approval from the Department.

Haul Road Emissions and Control Measure Efficiencies

Applicants should calculate the particulate matter emissions from unpaved haul roads using the EPA's AP-42 Chapter 13.2.2. http://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf

Equation 1(a) from Chapter 13.2.2 requires users to input values for two correction parameters, s and W, where s = surface material silt content (%) and W = mean vehicle weight (tons). The applicant should calculate the mean vehicle weight in accordance with the chapter's instructions. Below is the accepted value for the parameter s:

Default Values for Chapter 13.2.2, Equation 1(a):

Parameter	Default Value
s = surface material silt content (%)	4.8%

Applicants may use a higher silt content without prior approval from the Department. Use of a lower silt content requires prior approval from the Department and may require site specific testing in support of the request.

Equation 2 from Chapter 13.2.2 allows users to take credit for the number of days that receive precipitation in excess of 0.01 inches, in the annual emissions calculation, where P = number of days in a year with at least 0.01 inches of precipitation.

Default Values for Chapter 13.2.2, Equation 2:

Parameter	Default Value
P = number of days in a year with at least 0.01 inches of precipitation	70 days

Applications submitted under Part 72 may request to apply control measures to reduce the particulate matter emissions from facility haul roads. Applications submitted under Part 73 may not consider any emission reduction from control measures in the potential emission rate calculation, as registrations issued under Part 73 are not federally enforceable under the Clean Air Act or the New Mexico Air Quality Control Act. In order for those control measures to be federally enforceable, the controls must be a requirement in an air quality permit.

Below are the Department accepted control efficiencies for various haul road control measures:

Haul Road Control Measures and Control Efficiency:

Control Measure	Control Efficiency
None	0%
Base course **or** watering	60%
Base course **and** watering	80%
Base course **and** surfactant	90%
Paved **and** Swept	95%

13.2.2 Unpaved Roads

13.2.2.1 General

When a vehicle travels an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

The particulate emission factors presented in the previous draft version of this section of AP-42, dated October 2001, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material[25]. EPA included these sources in the emission factor equation for unpaved public roads (equation 1b in this section) since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the unpaved public road emission factor equation only estimates particulate emissions from resuspended road surface material [23, 26]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [24]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on unpaved public roads. It also incorporates the decrease in exhaust emissions that has occurred since the unpaved public road emission factor equation was developed. The previous version of the unpaved public road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.2.2 Emissions Calculation And Correction Parameters[1-6]

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Field investigations also have shown that emissions depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic. Characterization of these source parameters allow for "correction" of emission estimates to specific road and traffic conditions present on public and industrial roadways.

Dust emissions from unpaved roads have been found to vary directly with the fraction of silt (particles smaller than 75 micrometers [µm] in diameter) in the road surface materials.[1] The silt fraction is determined by measuring the proportion of loose dry surface dust that passes a 200-mesh screen, using the ASTM-C-136 method. A summary of this method is contained in Appendix C of AP-42. Table 13.2.2-1 summarizes measured silt values for industrial unpaved roads. Table 13.2.2-2 summarizes measured silt values for public unpaved roads. It should be noted that the ranges of silt content vary over two orders of magnitude. Therefore, the use of data from this table can potentially introduce considerable error. Use of this data is strongly discouraged when it is feasible to obtain locally gathered data.

Since the silt content of a rural dirt road will vary with geographic location, it should be measured for use in projecting emissions. As a conservative approximation, the silt content of the parent soil in the area can be used. Tests, however, show that road silt content is normally lower than in the surrounding parent soil, because the fines are continually removed by the vehicle traffic, leaving a higher percentage of coarse particles.

Other variables are important in addition to the silt content of the road surface material. For example, at industrial sites, where haul trucks and other heavy equipment are common, emissions are highly correlated with vehicle weight. On the other hand, there is far less variability in the weights of cars and pickup trucks that commonly travel publicly accessible unpaved roads throughout the United States. For those roads, the moisture content of the road surface material may be more dominant in determining differences in emission levels between, for example a hot, desert environment and a cool, moist location.

The PM-10 and TSP emission factors presented below are the outcomes from stepwise linear regressions of field emission test results of vehicles traveling over unpaved surfaces. Due to a limited amount of information available for PM-2.5, the expression for that particle size range has been scaled against the result for PM-10. Consequently, the quality rating for the PM-2.5 factor is lower than that for the PM-10 expression.

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL UNPAVED ROADS[a]

Industry	Road Use Or Surface Material	Plant Sites	No. Of Samples	Silt Content (%)	
				Range	Mean
Copper smelting	Plant road	1	3	16 - 19	17
Iron and steel production	Plant road	19	135	0.2 - 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 - 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 - 16	10
	Haul road to/from pit	4	20	5.0-15	8.3
Taconite mining and processing	Service road	1	8	2.4 - 7.1	4.3
	Haul road to/from pit	1	12	3.9 - 9.7	5.8
Western surface coal mining	Haul road to/from pit	3	21	2.8 - 18	8.4
	Plant road	2	2	4.9 - 5.3	5.1
	Scraper route	3	10	7.2 - 25	17
	Haul road (freshly graded)	2	5	18 - 29	24
Construction sites	Scraper routes	7	20	0.56-23	8.5
Lumber sawmills	Log yards	2	2	4.8-12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 - 21	6.4

[a]References 1,5-15.

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\ (s/12)^a (W/3)^b \qquad (1a)$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\ (s/12)^a (S/30)^d}{(M/0.5)^c} - C \qquad (1b)$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range as shown in Table 13.2.2-4

Table 13.2.2-4. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b] lb/VMT
$PM_{2.5}$	0.00036
PM_{10}	0.00047
PM_{30}[c]	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

It is important to note that the vehicle-related source conditions refer to the average weight, speed, and number of wheels for all vehicles traveling the road. For example, if 98 percent of traffic on the road are 2-ton cars and trucks while the remaining 2 percent consists of 20-ton trucks, then the mean weight is 2.4 tons. More specifically, Equations 1a and 1b are *not* intended to be used to calculate a separate emission factor for each vehicle class within a mix of traffic on a given unpaved road. That is, in the example, one should *not* determine one factor for the 2-ton vehicles and a second factor for the 20-ton trucks. Instead, only one emission factor should be calculated that represents the "fleet" average of 2.4 tons for all vehicles traveling the road.

Moreover, to retain the quality ratings when addressing a group of unpaved roads, it is necessary that reliable correction parameter values be determined for the road in question. The field and laboratory procedures for determining road surface silt and moisture contents are given in AP-42 Appendices C.1 and C.2. Vehicle-related parameters should be developed by recording visual observations of traffic. In some cases, vehicle parameters for industrial unpaved roads can be determined by reviewing maintenance records or other information sources at the facility.

In the event that site-specific values for correction parameters cannot be obtained, then default values may be used.In the absence of site-specific silt content information, an appropriate mean value from Table 13.2.2-1 may be used as a default value, but the quality rating of the equation is reduced by two letters. Because of significant differences found between different types of road surfaces and between different areas of the country, use of the default moisture content value of 0.5 percent in Equation 1b is discouraged. The quality rating should be downgraded two letters when the default moisture content value is used. (It is assumed that readers addressing industrial roads have access to the information needed to develop average vehicle information in Equation 1a for their facility.)

The effect of routine watering to control emissions from unpaved roads is discussed below in Section 13.2.2.3, “Controls”. However, all roads are subject to some natural mitigation because of rainfall and other precipitation. The Equation 1a and 1b emission factors can be extrapolated to annual average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \qquad (2)$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that <u>the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution</u> have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. <u>Vehicle restrictions</u> that limit the speed, weight or number of vehicles on the road;

2. Surface improvement, by measures such as (a) paving or (b) adding gravel or slag to a dirt road; and

3. Surface treatment, such as watering or treatment with chemical dust suppressants.

Available control options span broad ranges in terms of cost, efficiency, and applicability. For example, traffic controls provide moderate emission reductions (often at little cost) but are difficult to enforce. Although paving is highly effective, its high initial cost is often prohibitive. Furthermore, paving is not feasible for industrial roads subject to very heavy vehicles and/or spillage of material in transport. Watering and chemical suppressants, on the other hand, are potentially applicable to most industrial roads at moderate to low costs. However, these require frequent reapplication to maintain an acceptable level of control. Chemical suppressants are generally more cost-effective than water but not in cases of temporary roads (which are common at mines, landfills, and construction sites). In summary, then, one needs to consider not only the type and volume of traffic on the road but also how long the road will be in service when developing control plans.

Vehicle restrictions. These measures seek to limit the amount and type of traffic present on the road or to lower the mean vehicle speed. For example, many industrial plants have restricted employees from driving on plant property and have instead instituted bussing programs. This eliminates emissions due to employees traveling to/from their worksites. Although the heavier average vehicle weight of the busses increases the base emission factor, the decrease in vehicle-miles-traveled results in a lower overall emission rate.

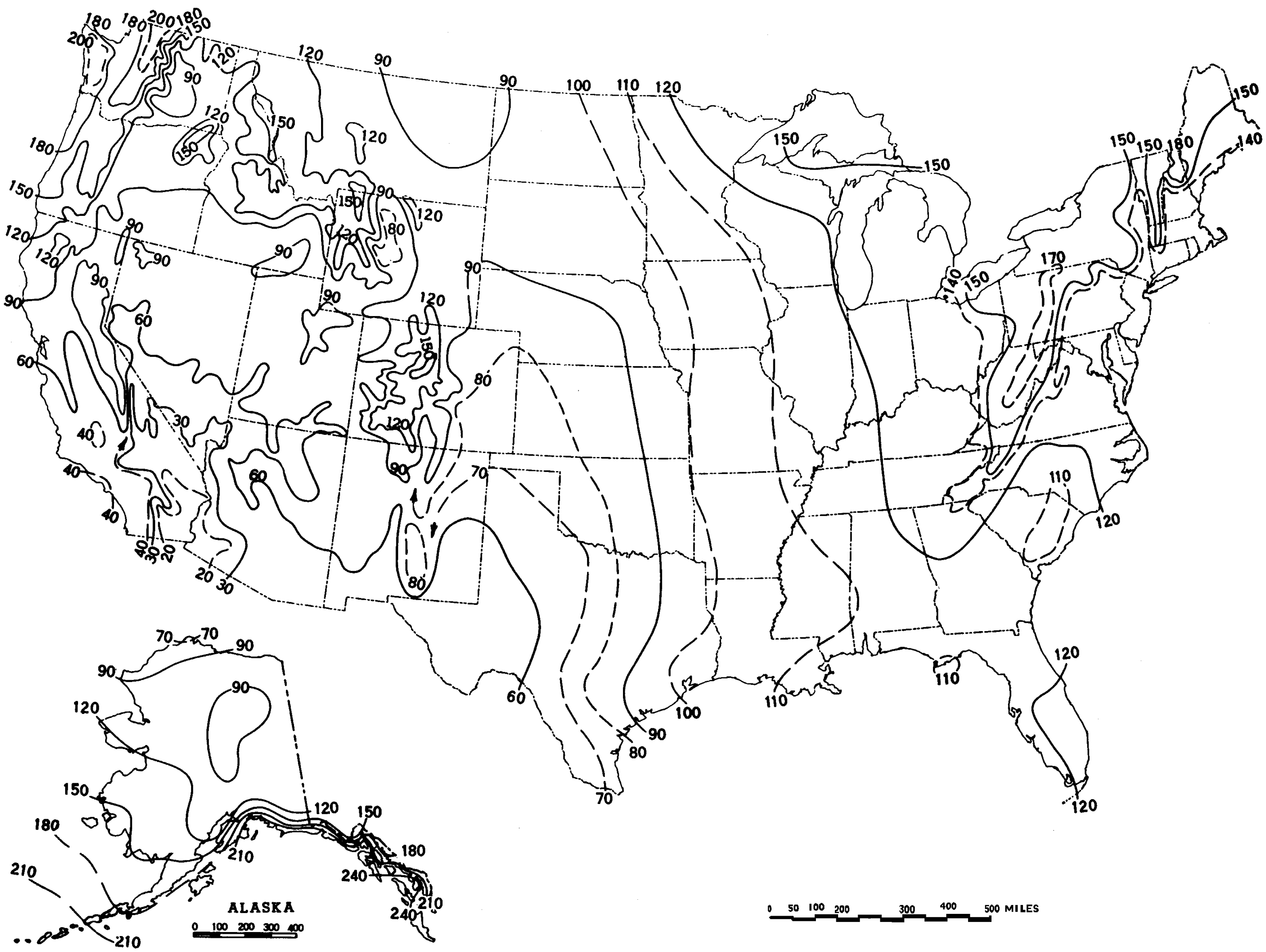
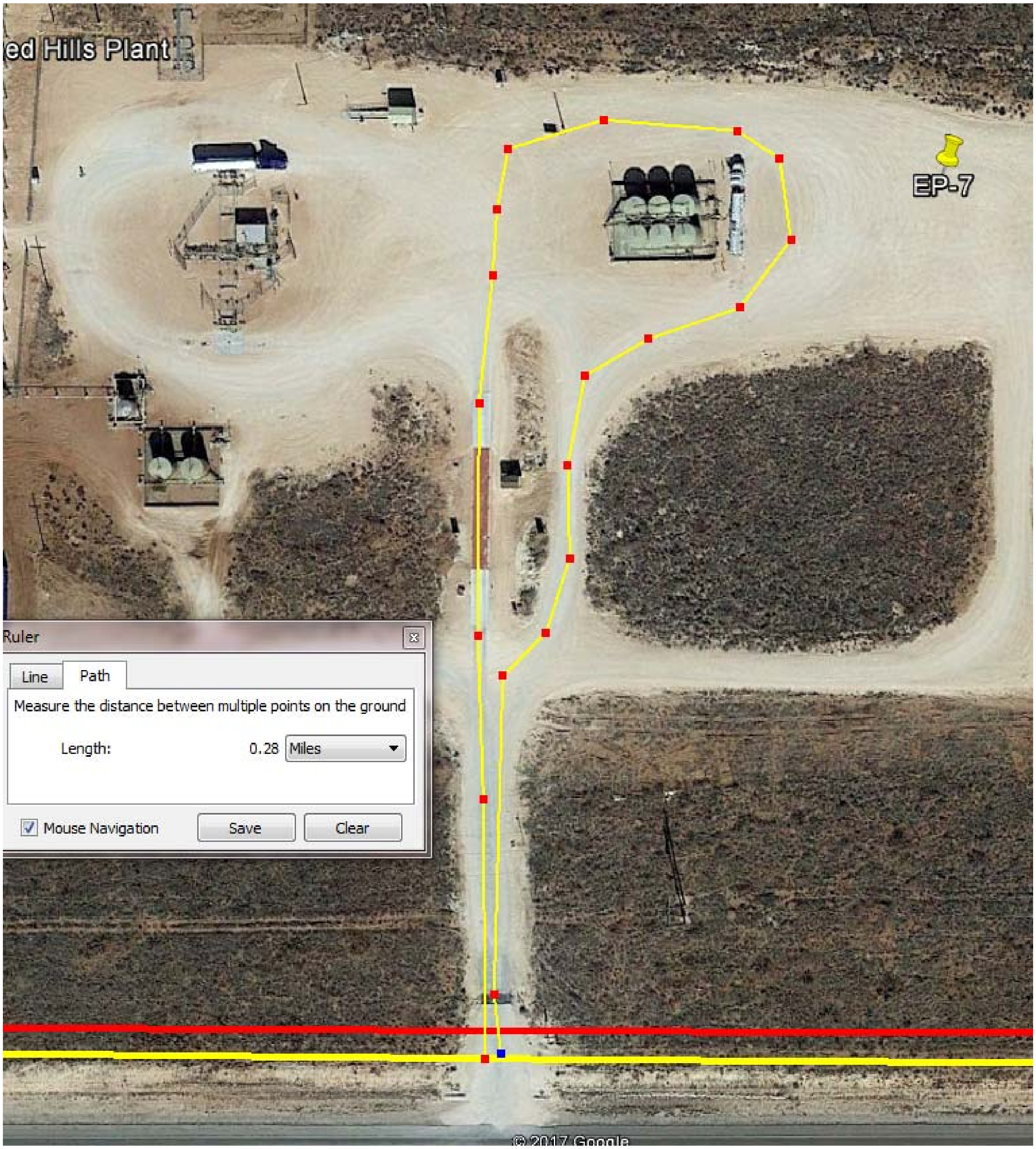


Figure 13.2.2-1. Mean number of days with 0.01 inch or more of precipitation in United States.


ed Hills Plant
EP-7
Ruler
Line
Path
Measure the distance between multiple points on the ground
Length:
0.28
Miles
Mouse Navigation
Save
Clear
© 2017 Google

Subpart C GHG Emissions

Tier 1

Facility Wide Subpart C GHG Emissions Calculated Yearly*

Red Hills Gas Processing Plant

Highest Maximum Rated Heat Input Capacity (MMBTUH): 112.00

Weighted Annual Average HHV (BTU/CF): 1,026

Group/Unit ID	Table C-1 Fuel Type	Fuel Use (MCF)	MMBtu/HR	MT CO_2	MT CH_4	MT N_2O	CH_4 MT CO_2e	N_2O MT CO_2e	Total CO_2e
EP-10	Natural Gas	956,257.3	112.0	52,058.2	0.98	0.098	24.53	29.237	52,112.0
6-EP-1d	Natural Gas	150,723.5	17.5	8,205.3	0.15	0.015	3.87	4.608	8,213.8
5.5-EP-1a	Natural Gas	601,176.5	70.0	32,727.8	0.62	0.062	15.42	18.381	32,761.6
7-EP-1d	Natural Gas	150,723.5	17.5	8,205.3	0.15	0.015	3.87	4.608	8,213.8
7-EP-1c	Natural Gas	62,608.2	7.3	3,408.4	0.06	0.006	1.61	1.914	3,411.9
6-EP-1b	Natural Gas	601,176.5	70.0	32,727.8	0.62	0.062	15.42	18.381	32,761.6
6-EP-1a	Natural Gas	601,176.5	70.0	32,727.8	0.62	0.062	15.42	18.381	32,761.6
6-EP-1c	Natural Gas	62,608.2	7.3	3,408.4	0.06	0.006	1.61	1.914	3,411.9
5-EP-1d	Natural Gas	150,723.5	17.5	8,205.3	0.15	0.015	3.87	4.608	8,213.8
5-EP-1c	Natural Gas	62,608.2	7.3	3,408.4	0.06	0.006	1.61	1.914	3,411.9
5-EP-1b	Natural Gas	601,176.5	70.0	32,727.8	0.62	0.062	15.42	18.381	32,761.6
5-EP-1a	Natural Gas	601,176.5	70.0	32,727.8	0.62	0.062	15.42	18.381	32,761.6
		4,602,135.0		**250,538.2**	**4.72**	**0.472**	**118.04**	**140.709**	**250,797.0**

**All Emissions Reported in Metric Tons Per Year*

Glycol Dehydrators with throughput greater than or equal to 0.4 MMscfd

Dehydrator's with throughput larger than or equal to 0.4 MMscfd GHG Emissions & Data

Year: 2019
Industry: Onshore Natural Gas Processing
Basin: **Permian Basin**
County: **LEA**
State: **NM**
Formation Type: **N/A**

Dehydrator's with throughput larger than or equal to 0.4 MMscfd GHG Emissions & Data

Site: **Red Hills Gas Processing Plant**

Unit ID/#: 5-EP-1e

Feed Natural Gas Flow Rate (MMscfd):	231.2
Feed NG Water Content (lbs/MMSCF):	112.19
Outlet NG Water Content (lbs/MMSCF):	6.1413
Absorbent Circulation Pump Type:	Electric
Dehydrator absorbent Circulation rate (GPM):	55.1804
Type of Absorbent:	Triethylene glycol (TEG)
Use of Stripper Gas (Yes if checked):	☐
Flash Tank Separator (Yes if checked):	☑
Operating Hours:	8,760.0
Temperature of Wet Natural Gas (ºF):	120.0
Pressure of Wet Natural Gas (psig):	851.0
Concentration of CH_4 in Wet Natural Gas:	0.7665
Concentration of CO_2 in Wet Natural Gas:	0.0002
Were any dehydrator emissions vented to a vapor recovery device:	No
ere any dehydrator emissions vented to a flare or regen firebox/tubes:	No
Total CO_2 Emissions from Flaring (mt CO_2):	1,839.3
Total CH_4 Emissions from Flaring (mt CH_4):	0.47
Total N_2O Emissions from Flaring (mt N_2O):	0.003
Were any dehydrator emissions vented to atmosphere:	Yes
Total CO_2 Emissions from Venting (mt CO_2):	0.3
Total CH_4 Emissions from Venting (mt CH_4):	23.3

Dehydrator's with throughput larger than or equal to 0.4 MMscfd GHG Emissions & Data

Unit ID/#: 6-EP-1e

Feed Natural Gas Flow Rate (MMscfd):	231.2
Feed NG Water Content (lbs/MMSCF):	112.19
Outlet NG Water Content (lbs/MMSCF):	6.1413
Absorbent Circulation Pump Type:	Electric
Dehydrator absorbent Circulation rate (GPM):	55.1804
Type of Absorbent:	Triethylene glycol (TEG)
Use of Stripper Gas (Yes if checked):	☐
Flash Tank Separator (Yes if checked):	☑
Operating Hours:	8,760.0
Temperature of Wet Natural Gas (ºF):	120.0
Pressure of Wet Natural Gas (psig):	851.0
Concentration of CH_4 in Wet Natural Gas:	0.7665
Concentration of CO_2 in Wet Natural Gas:	0.0002
Were any dehydrator emissions vented to a vapor recovery device:	No
ere any dehydrator emissions vented to a flare or regen firebox/tubes:	No
Total CO_2 Emissions from Flaring (mt CO_2):	1,839.3
Total CH_4 Emissions from Flaring (mt CH_4):	0.47
Total N_2O Emissions from Flaring (mt N_2O):	0.003
Were any dehydrator emissions vented to atmosphere:	Yes
Total CO_2 Emissions from Venting (mt CO_2):	0.3
Total CH_4 Emissions from Venting (mt CH_4):	23.3

Acid Gas Removal Units: Method 4 Modeling Software

Acid Gas Removal Units Using Modeling Software GHG Emissions & Data

Year: 2019
Industry: Onshore Natural Gas Processing
Basin: **Permian Basin**
County: LEA
State: NM
Formation Type: N/A
Site: Red Hills Gas Processing Plant
UNIT ID: 5-EP-1f

Total Feed Rate Entering the Unit (MMSCF/YR):	90,262.310
CO_2 transfered out of facility (mt CO_2):	0
Total CO_2 Emissions (mt CO_2):	5276.28591218103
Name of Simulation Software Package Used:	BR&E ProMax
Natural Gas Feed Temperature (°F):	0.0
Natural Gas Feed Pressure (psi):	0.0
Natural Gas Feed Flow Rate (SCF/Min):	0.0
Acid gas content of feed natural gas (mol %):	0.1
Acid gas content of outlet natural gas (mol %):	0.9
Unit operating hours:	8,760.0
Exit Temperature of the Natural Gas (°F):	0.0
Vent Type Information:	Vents To A Flare Or Engine
Solvent Pressure (psi):	0
Solvent Temperature (°F):	0
Solvent Circulation Rate (GPM):	0

UNIT ID: 6-EP-1f

Total Feed Rate Entering the Unit (MMSCF/YR):	90,262.310
CO_2 transfered out of facility (mt CO_2):	0
Total CO_2 Emissions (mt CO_2):	5276.28591218103
Name of Simulation Software Package Used:	BR&E ProMax
Natural Gas Feed Temperature (°F):	0.0
Natural Gas Feed Pressure (psi):	0.0
Natural Gas Feed Flow Rate (SCF/Min):	0.0
Acid gas content of feed natural gas (mol %):	0.1
Acid gas content of outlet natural gas (mol %):	0.9
Unit operating hours:	8,760.0
Exit Temperature of the Natural Gas (°F):	0.0
Vent Type Information:	Vents To A Flare Or Engine
Solvent Pressure (psi):	0
Solvent Temperature (°F):	0
Solvent Circulation Rate (GPM):	0

$$E_{s,CH4} = V_s * X_{CH4} * \left[(1-\eta) * Z_L + Z_U\right] \quad \text{(Eq. W-19)}$$

$$E_{s,CO2} = V_s * X_{CO2} + \sum_{j=1}^{5}\left(\eta * V_s * Y_j * R_j * Z_L\right) \quad \text{(Eq. W-20)}$$

Where:

$E_{s,CH4}$ = Annual CH_4 emissions from flare stack in cubic feet, at standard conditions.

$E_{s,CO2}$ = Annual CO_2 emissions from flare stack in cubic feet, at standard conditions.

V_s = Volume of gas sent to flare in standard cubic feet, during the year as determined in paragraph (n)(1) of this section.

η = Flare combustion efficiency, expressed as fraction of gas combusted by a burning flare (default is 0.98).

X_{CH4} = Mole fraction of CH_4 in the feed gas to the flare as determined in paragraph (n)(2) of this section.

X_{CO2} = Mole fraction of CO_2 in the feed gas to the flare as determined in paragraph (n)(2) of this section.

Z_U = Fraction of the feed gas sent to an un-lit flare determined by engineering estimate and process knowledge based on best available data and operating records.

Z_L = Fraction of the feed gas sent to a burning flare (equal to $1 - Z_U$).

Y_j = Mole fraction of hydrocarbon constituents j (such as methane, ethane, propane, butane, and pentanes-plus) in the feed gas to the flare as determined in paragraph (n)(1) of this section.

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

Flare Stack GHG Emissions

Flare Stack GHG Emissions Report

Year: 2019
Industry: Onshore Natural Gas Processing
Basin: **Permian Basin**
Site: Red Hills Gas Processing Plant

Flare Stack ID: **EP-13**

Were CEMS used to measure CO_2 emissions for the flare stack: ☐
Does the flare have a continuous flow monitor: ☐
Does the flare have a continuous gas analyzer: ☐
Volume of gas sent to flare (scf/yr): 3,973,972.2
Percent of gas sent to un-lit flare: 0.00
Flare combustion efficiency: 95.00%

Mole Fraction of CH_4 in the feed gas:	0.0402
Mole Fraction of CO_2 in the feed gas:	0.0000
If CEMS were used, CO_2 (mt CO_2):	0.0
CO_2 Emissions (mt CO_2):	932.3
CH_4 Emissions (mt CH_4):	2.92
N_2O Emissions (mt N_2O):	0.002

Flare Stack ID: **EP-12**

Were CEMS used to measure CO_2 emissions for the flare stack: ☐
Does the flare have a continuous flow monitor: ☐
Does the flare have a continuous gas analyzer: ☐
Volume of gas sent to flare (scf/yr): 1,395,205.0
Percent of gas sent to un-lit flare: 0.00
Flare combustion efficiency: 95.00%

Mole Fraction of CH_4 in the feed gas:	0.0000
Mole Fraction of CO_2 in the feed gas:	0.0000
If CEMS were used, CO_2 (mt CO_2):	0.0
CO_2 Emissions (mt CO_2):	360.3
CH_4 Emissions (mt CH_4):	0.51
N_2O Emissions (mt N_2O):	0.001

Flare Stack GHG Emissions Report

Flare Stack ID: 7-EP-2

Were CEMS used to measure CO_2 emissions for the flare stack: ☐

Does the flare have a continuous flow monitor: ☐

Does the flare have a continuous gas analyzer: ☐

Volume of gas sent to flare (scf/yr): 115,292,998.5

Percent of gas sent to un-lit flare: 0.00

Flare combustion efficiency: 98.00%

Mole Fraction of CH_4 in the feed gas:	0.7685
Mole Fraction of CO_2 in the feed gas:	0.0001
If CEMS were used, CO_2 (mt CO_2):	0.0
CO_2 Emissions (mt CO_2):	7,952.6
CH_4 Emissions (mt CH_4):	34.64
N_2O Emissions (mt N_2O):	0.014

Flare Stack ID: 5-EP-2

Were CEMS used to measure CO_2 emissions for the flare stack: ☐

Does the flare have a continuous flow monitor: ☐

Does the flare have a continuous gas analyzer: ☐

Volume of gas sent to flare (scf/yr): 115,292,998.5

Percent of gas sent to un-lit flare: 0.00

Flare combustion efficiency: 98.00%

Mole Fraction of CH_4 in the feed gas:	0.7685
Mole Fraction of CO_2 in the feed gas:	0.0001
If CEMS were used, CO_2 (mt CO_2):	0.0
CO_2 Emissions (mt CO_2):	7,952.6
CH_4 Emissions (mt CH_4):	34.64
N_2O Emissions (mt N_2O):	0.014

Flare Stack GHG Emissions Report

Flare Stack ID: 5.5-EP-1b

Were CEMS used to measure CO_2 emissions for the flare stack: ☐

Does the flare have a continuous flow monitor: ☐

Does the flare have a continuous gas analyzer: ☐

Volume of gas sent to flare (scf/yr): 17,525,531.8

Percent of gas sent to un-lit flare: 0.00

Flare combustion efficiency: 98.00%

Mole Fraction of CH_4 in the feed gas:	0.0009
Mole Fraction of CO_2 in the feed gas:	0.8019
If CEMS were used, CO_2 (mt CO_2):	0.0
CO_2 Emissions (mt CO_2):	911.7
CH_4 Emissions (mt CH_4):	1.21
N_2O Emissions (mt N_2O):	0.000

$$E_{s,n} = N * \left(V \left(\frac{(459.67 + T_s) P_a}{(459.67 + T_a) P_s Z_a} \right) - V * C \right) \qquad \text{(Eq. W-14A)}$$

Where:

Es,n = Annual natural gas emissions at standard conditions from each unique physical volume that is blown down, in cubic feet.

N = Number of occurrences of blowdowns for each unique physical volume in the calendar year.

V = Unique physical volume between isolation valves, in cubic feet, as calculated in paragraph (i)(1) of this section.

C = Purge factor is 1 if the unique physical volume is not purged, or 0 if the unique physical volume is purged using non-GHG gases.

Ts = Temperature at standard conditions (60 °F).

Ta = Temperature at actual conditions in the unique physical volume (°F). For emergency blowdowns at onshore petroleum and natural gas gathering and boosting facilities, engineering estimates based on best available information may be used to determine the temperature.

Ps = Absolute pressure at standard conditions (14.7 psia).

Pa = Absolute pressure at actual conditions in the unique physical volume (psia). For emergency blowdowns at onshore petroleum and natural gas gathering and boosting facilities, engineering estimates based on best available information may be used to determine the pressure.

Za = Compressibility factor at actual conditions for natural gas. You may use either a default compressibility factor of 1, or a site-specific compressibility factor based on actual temperature and pressure conditions

Source: 40 CFR 98.233

Blowdown Vent Stacks GHG Emissions

Blowdown Vent Stacks GHG Emissions & Data

Year: 2019
Industry: Onshore Natural Gas Processing
Facility/Pipeline: **Red Hills Gas Processing Plant**
Blowdown Vent Stack Emissions Type: Calculated by equipment or event type
Equipment Type: All other equipment with a physical volume greater than

Equipment Number:	EP-11
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	1
Volume Between Isolation Valves (Cu. Ft.) :	216,608,755
Temperature at Actual Conditions (F) :	119
Pressure at Actual Conditions (psia) :	14
Mol % CH4 :	0
Mol % CO2 :	1
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	9,158.8936109
Annual CH_4 Emissions (mt CH_4):	6.5497862

Blowdown Vent Stack Emissions Type: Calculated by equipment or event type

Equipment Type: Compressors

Equipment Number:	7-EP-1t
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	8
Volume Between Isolation Valves (Cu. Ft.) :	1,880
Temperature at Actual Conditions (F) :	100
Pressure at Actual Conditions (psia) :	255
Mol % CH4 :	1
Mol % CO2 :	0
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	0.0012742
Annual CH_4 Emissions (mt CH_4):	4.3744791

Blowdown Vent Stack Emissions Type: Calculated by equipment or event type

Equipment Type: Compressors

Equipment Number:	6-EP-1t
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	8
Volume Between Isolation Valves (Cu. Ft.) :	1,880
Temperature at Actual Conditions (F) :	100
Pressure at Actual Conditions (psia) :	255
Mol % CH4 :	1
Mol % CO2 :	0
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	0.0012742
Annual CH_4 Emissions (mt CH_4):	4.3744791

Blowdown Vent Stack Emissions Type: Calculated by equipment or event type

Equipment Type: Compressors

Equipment Number:	5-EP-1t
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	8
Volume Between Isolation Valves (Cu. Ft.) :	1,880
Temperature at Actual Conditions (F) :	100
Pressure at Actual Conditions (psia) :	255
Mol % CH4 :	1
Mol % CO2 :	0
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	0.0012742
Annual CH_4 Emissions (mt CH_4):	4.3744791

Blowdown Vent Stack Emissions Type: Calculated by equipment or event type

Equipment Type: Compressors

Equipment Number:	4-EP-1t
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	8
Volume Between Isolation Valves (Cu. Ft.) :	1,880
Temperature at Actual Conditions (F) :	100
Pressure at Actual Conditions (psia) :	255
Mol % CH4 :	1
Mol % CO2 :	0
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	0.0012742
Annual CH_4 Emissions (mt CH_4):	4.3744791

Blowdown Vent Stack Emissions Type: Calculated by equipment or event type

Equipment Type: Compressors

Equipment Number:	3-EP-1t
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	8
Volume Between Isolation Valves (Cu. Ft.) :	1,880
Temperature at Actual Conditions (F) :	100
Pressure at Actual Conditions (psia) :	255
Mol % CH4 :	1
Mol % CO2 :	0
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	0.0012742
Annual CH_4 Emissions (mt CH_4):	4.3744791

Blowdown Vent Stack Emissions Type: Calculated by equipment or event type

Equipment Type: Compressors

Equipment Number:	2-EP-1t
Method:	W-14A
Was the Volume Purged? :	Purged Using non-GHG Gases
For equipment or event type emissions,Total Number of blowdowns:	8
Volume Between Isolation Valves (Cu. Ft.) :	1,880
Temperature at Actual Conditions (F) :	100
Pressure at Actual Conditions (psia) :	255
Mol % CH4 :	1
Mol % CO2 :	0
Density CO2 (kg/ft^3) :	0.0526
Density CH4 (kg/ft^3) :	0.0192
Purge Factor (C) :	0
Compressibility factor (Za) :	1
Annual CO_2 Emissions (mt CO_2):	0.0012742
Annual CH_4 Emissions (mt CH_4):	4.3744791

$$E_{s,p,i} = GHG_i * EF_{s,p} * \sum_{z=1}^{x_p} T_{p,z} \qquad \text{(Eq. W-30)}$$

Where:

$E_{s,p,i}$ = Annual total volumetric emissions of GHG_i from specific component type "p" (in accordance with paragraphs (q)(1)(i) through (iv) of this section) in standard ("s") cubic feet, as specified in paragraphs (q)(2)(ii) through (x) of this section.

x_p = Total number of specific component type "p" detected as leaking in any leak survey during the year. A component found leaking in two or more surveys during the year is counted as one leaking component.

$EF_{s,p}$ = Leaker emission factor for specific component types listed in Tables W-1E, W-2, W-3A, W-4A, W-5A, W-6A, and W-7 to this subpart.

GHG_i = For onshore petroleum and natural gas production facilities and onshore petroleum and natural gas gathering and boosting facilities, concentration of GHG_i, CH_4, or CO_2, in produced natural gas as defined in paragraph (u)(2) of this section; for onshore natural gas processing facilities, concentration of GHG_i, CH_4 or CO_2, in the total hydrocarbon of the feed natural gas; for onshore natural gas transmission compression and underground natural gas storage, GHG_i equals 0.975 for CH_4 and 1.1×10^{-2} for CO_2; for LNG storage and LNG import and export equipment, GHG_i equals 1 for CH_4 and 0 for CO_2; and for natural gas distribution, GHG_i equals 1 for CH_4 and 1.1×10^{-2} CO_2.

$T_{p,z}$ = The total time the surveyed component "z," component type "p," was assumed to be leaking and operational, in hours. If one leak detection survey is conducted in the calendar year, assume the component was leaking for the entire calendar year. If multiple leak detection surveys are conducted in the calendar year, assume a component found leaking in the first survey was leaking since the beginning of the year until the date of the survey; assume a component found leaking in the last survey of the year was leaking from the preceding survey through the end of the year; assume a component found leaking in a survey between the first and last surveys of the year was leaking since the preceding survey until the date of the survey; and sum times for all leaking periods. For each leaking component, account for time the component was not operational (i.e., not operating under pressure) using an engineering estimate based on best available data.

Equipment Leaks Using Leak Detection Survey Report for Processing Facilities

Equipment Leaks using Leak Detection Surveys for Processing Facility's GHG Emissions Report

Year: 2019

Industry: Onshore Natural Gas Processing

Facility: **Red Hills Gas Processing Plant**

Number of complete equipment leak surveys performed: **2**

Component Type	Total number of leaking components	Average time components assumed to be leaking	CO_2 Emissions (mt CO_2)	CH_4 Emissions (mt CH_4)
Compressor Components, Gas Service - Valve	4,014	5,475.0	1,545.0	7,218.5
Compressor Components, Gas Service - Connector	16,338	5,475.0	2,368.9	11,067.4
Compressor Components, Gas Service - OEL	0	2,190.0	0.0	0.0
Compressor Components, Gas Service - PRV	30	5,475.0	30.9	144.2
Compressor Components, Gas Service - Meter	0	2,190.0	0.0	0.0
Non-Compressor Components, Gas Service - Valve	1,072	5,475.0	178.5	834.0
Non-Compressor Components, Gas Service - Connector	2,290	5,475.0	339.2	1,584.5
Non-Compressor Components, Gas Service - OEL	0	2,190.0	0.0	0.0
Non-Compressor Components, Gas Service - PRV	1	5,475.0	0.1	0.2
Non-Compressor Components, Gas Service - Meter	0	2,190.0	0.0	0.0

Table 13.5-1 (English Units). THC, NOx AND SOOT EMISSIONS FACTORS FOR FLARE OPERATIONS FOR CERTAIN CHEMICAL MANUFACTURING PROCESSES[a]

Pollutant	SCC[e]	Emissions Factor Value	Emissions Factor Units	Grade or Representativeness
THC, elevated flares[c]	30190099; 30119701; 30119705; 30119709; 30119741	0.14[b,f]	lb/10^6 Btu	B
THC, enclosed ground flares[g,h] Low Percent Load[i]		8.37[j] or 3.88e-3[f]	lb/10^6 scf gas burned lb/10^6 Btu heat input	Moderately
THC, enclosed ground flares[g,h] Normal to High Percent Load[i]		2.56[j] or 1.20e-3[f]	lb/10^6 scf gas burned lb/10^6 Btu heat input	Moderately
Nitrogen oxides, elevated flares[d]		0.068[b,k]	lb/10^6 Btu	B
Soot, elevated flares[d]		0 – 274[b]	μg/L	B

[a] All of the emissions factors in this table represent the emissions exiting the flare. Since the flare is not the originating source of the THC emissions, but rather the device controlling these pollutants routed from a process at the facility, the emissions factors are representative of controlled emissions rates for THC. These values are not representative of the uncontrolled THC routed to the flare from the associated process, and as such, they may not be appropriate for estimating the uncontrolled THC emissions or potential to emit from the associated process.

[b] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.

[c] Measured as methane equivalent. The THC emissions factor may not be appropriate for reporting volatile organic compounds (VOC) emissions when a VOC emissions factor exists.

[d] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (μg/L); lightly smoking flares, 40 μg/L; average smoking flares, 177 μg/L; and heavily smoking flares, 274 μg/L.

[e] See Table 13.5-4 for a description of these SCCs.

[f] Factor developed using the lower (net) heating value of the vent gas.

[g] THC measured as propane by US EPA Method 25A.

[h] These factors apply to well operated ground flares achieving at least 98% destruction efficiency and operating in compliance with the current General Provisions requirements of 40 CFR Part 60, i.e. >200 btu/scf net heating value in the vent gas and less than the specified maximum exit velocity. The emissions factor data set had an average destruction efficiency of 99.99%. Based on tests using pure propylene fuel. References 12 through 33 and 39 through 45.

[i] The dataset for these tests were broken into four different test conditions: ramping back and forth between 0 and 30% of load; ramping back and forth between 30% and 70% of load; ramping back and forth between 70% and 100% of load; and a fixed rate maximum load condition. Analyses determined that only the first condition was statistically different. Low percent load is represented by a unit operating at approximately less than 30% of maximum load.

[j] Heat input is an appropriate basis for combustion emissions factor. However, based on available data, heat input data is not always known, but gas flowrate is generally available. Therefore, the emissions factor is presented in two different forms.

[k] Factor developed using the higher (gross) heating value of the vent gas.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. CO_2[$lb/10^6$ scf] = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 grains/10^6 scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content (grains/10^6 scf) to 2,000 grains/10^6 scf.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6$ scf$]$ = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 $grains/10^6$ scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content ($grains/10^6$ scf) to 2,000 $grains/10^6$ scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylchloranthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
207-08-9	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D
74-98-6	Propane	1.6E+00	E

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES[a]
(SCC 2-02-002-53)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	2.21 E+00	A
NO_x[c] <90% Load	2.27 E+00	C
CO[c] 90 - 105% Load	3.72 E+00	A
CO[c] <90% Load	3.51 E+00	C
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	3.58 E-01	C
Methane[g]	2.30 E-01	C
VOC[h]	2.96 E-02	C
PM10 (filterable)[i,j]	9.50 E-03	E
PM2.5 (filterable)[j]	9.50 E-03	E
PM Condensable[k]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[l]	2.53 E-05	C
1,1,2-Trichloroethane[l]	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene[l]	6.63 E-04	D
1,3-Dichloropropene[l]	<1.27 E-05	E
Acetaldehyde[l,m]	2.79 E-03	C
Acrolein[l,m]	2.63 E-03	C
Benzene[l]	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride[l]	<1.77 E-05	E

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES (Concluded)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Chlorobenzene[l]	<1.29 E-05	E
Chloroform[l]	<1.37 E-05	E
Ethane[n]	7.04 E-02	C
Ethylbenzene[l]	<2.48 E-05	E
Ethylene Dibromide[l]	<2.13 E-05	E
Formaldehyde[l,m]	2.05 E-02	A
Methanol[l]	3.06 E-03	D
Methylene Chloride[l]	4.12 E-05	C
Naphthalene[l]	<9.71 E-05	E
PAH[l]	1.41 E-04	D
Styrene[l]	<1.19 E-05	E
Toluene[l]	5.58 E-04	A
Vinyl Chloride[l]	<7.18 E-06	E
Xylene[l]	1.95 E-04	A

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM-10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM10 = Particulate Matter ≤ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})\,(\text{heat input, MMBtu/hr})\,(\text{1/operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2,

C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6scf.

[f] Emission factor for TOC is based on measured emission levels from 6 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds. Methane and ethane emissions were not measured for this engine category.

[i] No data were available for uncontrolled engines. PM10 emissions are for engines equipped with a PCC.

[j] Considered $\leq$ 1 μm in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[k] No data were available for condensable emissions. The presented emission factor reflects emissions from 4SLB engines.

[l] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[m] For rich-burn engines, no interference is suspected in quantifying aldehyde emissions. The presented emission factors are based on FTIR and CARB 430 emissions data measurements.

[n] Ethane emission factor is determined by subtracting the VOC emission factor from the NMHC emission factor.

loading operation, resulting in high levels of vapor generation and loss. If the turbulence is great enough, liquid droplets will be entrained in the vented vapors.

A second method of loading is submerged loading. Two types are the submerged fill pipe method and the bottom loading method. In the submerged fill pipe method, the fill pipe extends almost to the bottom of the cargo tank. In the bottom loading method, a permanent fill pipe is attached to the cargo tank bottom. During most of submerged loading by both methods, the fill pipe opening is below the liquid surface level. Liquid turbulence is controlled significantly during submerged loading, resulting in much lower vapor generation than encountered during splash loading.

The recent loading history of a cargo carrier is just as important a factor in loading losses as the method of loading. If the carrier has carried a nonvolatile liquid such as fuel oil, or has just been cleaned, it will contain vapor-free air. If it has just carried gasoline and has not been vented, the air in the carrier tank will contain volatile organic vapors, which will be expelled during the loading operation along with newly generated vapors.

Cargo carriers are sometimes designated to transport only one product, and in such cases are practicing "dedicated service". Dedicated gasoline cargo tanks return to a loading terminal containing air fully or partially saturated with vapor from the previous load. Cargo tanks may also be "switch loaded" with various products, so that a nonvolatile product being loaded may expel the vapors remaining from a previous load of a volatile product such as gasoline. These circumstances vary with the type of cargo tank and with the ownership of the carrier, the petroleum liquids being transported, geographic location, and season of the year.

One control measure for vapors displaced during liquid loading is called "vapor balance service", in which the cargo tank retrieves the vapors displaced during product unloading at bulk plants or service stations and transports the vapors back to the loading terminal. Figure 5.2-5 shows a tank truck in vapor balance service filling a service station underground tank and taking on displaced gasoline vapors for return to the terminal. A cargo tank returning to a bulk terminal in vapor balance service normally is saturated with organic vapors, and the presence of these vapors at the start of submerged loading of the tanker truck results in greater loading losses than encountered during nonvapor balance, or "normal", service. Vapor balance service is usually not practiced with marine vessels, although some vessels practice emission control by means of vapor transfer within their own cargo tanks during ballasting operations, discussed below.

Emissions from loading petroleum liquid can be estimated (with a probable error of ±30 percent)[4] using the following expression:

$$L_L = 12.46 \frac{SPM}{T} \tag{1}$$

where:

L_L = loading loss, pounds per 1000 gallons (lb/10^3 gal) of liquid loaded

S = a saturation factor (see Table 5.2-1)
P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia) (see Section 7.1, "Organic Liquid Storage Tanks")
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole) (see Section 7.1, "Organic Liquid Storage Tanks")
T = temperature of bulk liquid loaded, °R (°F + 460)

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\ (s/12)^a (W/3)^b \qquad (1a)$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\ (s/12)^a (S/30)^d}{(M/0.5)^c} - C \qquad (1b)$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \qquad (2)$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. Vehicle restrictions that limit the speed, weight or number of vehicles on the road;

EMISSIONS FACTORS FOR EQUIPMENT LEAK FUGITIVE COMPONENTS

Technical Disclaimer

This document is intended to help you accurately determine equipment leak fugitive emissions. It does not supersede or replace any state or federal law, rule, or regulation.

This guidance reflects the current understanding of how piping components work and how they generate emissions, how they are monitored or tested, and what data are available for emissions determination, may change over time as we continue our scientific studies and as new information becomes available. We welcome any data, information, or feedback that may improve our understanding of equipment leak fugitive emissions and thereby further improve determinations within the emissions inventory.

The calculation methods represented are intended as an emissions calculation aid; alternate calculation methods may be equally acceptable if they are based upon, and adequately demonstrate, sound engineering assumptions or data. If you have a question regarding the acceptability of a given emissions determination method, contact the Emissions Assessment Section at 512-239-1773.

Introduction

This document provides emission factor guidance for determining equipment leak fugitive emissions from piping components and associated equipment at industrial facilities. It does not address emissions from cooling towers, oil/water separators, material stockpiles, loading operations, or other sources not related to piping components. Use this guidance in conjunction with *2007 Emissions Inventory Guidelines*, Appendix A, Technical Supplement 3: Equipment Leak Fugitives.

Guidance Available in This Document

This document provides appropriate emission factors to be used when determining emissions from piping component fugitives. Specifically, the emission factors included are:

- Correlation equations – synthetic organic chemical manufacturing industry (SOCMI);
- Correlation equations – petroleum industry;
- Average emission factors – SOCMI;
- Average emission factors – oil and gas production;
- Average emission factors – refinery; and
- Average emission factors – petroleum marketing terminal.

Table 4. Average Emission Factors - Petroleum Industry.

Equipment/Service	Petroleum Marketing Terminal [1]	Oil and Gas Production Operations [2]				Refinery [3]
		Gas	Heavy Oil <20° API	Light Oil >20° API	Water/ Light Oil	
Valves		0.00992	0.0000185	0.0055	0.000216	
Gas/Vapor	0.0000287	0.00992				0.059
Light Liquid	0.0000948					0.024
Heavy Liquid	0.0000948					0.000510
Pumps		0.00529	0.0011300	0.02866	0.00005290	
Light Liquid	0.00119					0.251
Heavy Liquid	0.00119					0.046
Flanges/Connectors		0.000860	0.00000086	0.000243	0.00000617	0.000550
Gas/Vapor	0.000092604	0.000860				
Light Liquid	0.00001762					
Heavy Liquid	0.00001720					
Compressors		0.0194	0.0000683	0.0165	0.0309	1.399
Relief Valve Gas/Vapor		0.0194	0.0000683	0.0165	0.0309	0.35
Open-ended Lines [4]		0.00441	0.0003090	0.00309	0.0006	0.0051
Sampling Connections [5]						0.033
Connectors		0.000440	0.0000165	0.0004630	0.000243	
Other [6]		0.0194	0.0000683	0.0165	0.0309	
Gas/Vapor	0.000265					
Light/heavy Liquid	0.000287					
Process Drains		0.0194	0.0000683	0.0165	0.0309	0.07

All factors are in units of (lb/hr)/component.

Notes:
1. Factors taken from EPA document EPA-453/R-95-017; November, 1995; pp. 2-14.
2. Factors taken from EPA document EPA-453/R-95-017; November, 1995; pp. 2-15.
3. Factors taken from EPA document EPA-453/R-95-017; November, 1995; pp. 2-13.
4. The 28 Series quarterly LDAR programs require open-ended lines to be equipped with a cap, blind flange, plug, or a second valve. If so equipped, open-ended lines may be given a 100% control credit.
5. Factor for Sampling Connections is in terms of pounds per hour per sample taken.
6. For Petroleum Marketing Terminals, "Other" includes any component except fittings, pumps, and valves. For Oil & Gas Production Operations, "Other" includes diaphragms, dump arms, hatches, instruments, meters, polished rods, and vents.

SHAMROCK GAS ANALYSIS, INC.

LABORATORY REFERENCE NUMBER : **E46489 - FT7374**

LUCID ENERGY

ID:	**RED HILLS PLANT ACID GAS**	LINE PRESSURE:	**10 PSI**
AREA:	**NOT/REC**	LINE TEMPERATURE:	**99 F**
METER:	**SOUR WATER TANKS**	CYLINDER NUMBER:	**6341**
LEASE:	**SOUR WATER TANKS**	EFFECTIVE DATE:	**6/1/2018**
OPERATOR:	**LUCID**	SAMPLED BY:	**M. BRENNAN**
STATION:	**RED HILLS PLANT ACID GAS**	ANALYZED BY:	**BRENNAN**
SAMPLE DATE:	**5/30/2018**	ANALYZED DATE:	**6/1/2018**
SAMPLE OF:	**GAS**	SAMPLE TYPE:	**SPOT**

For: LUCID ENERGY
Attn: T. KIRK
288 KINCAID ROAD
ARTESIA, NEW MEXICO 88210

Physical Properties per GPA 2145-09 | Calculations per GPA 2172-09

Note: Zero = Less than detection limit

	MOL%	GPM @ 14.73
HYDROGEN SULFIDE	0.083	0.012
NITROGEN	4.397	0.501
CARBON DIOXIDE	0.023	0.004
METHANE	4.015	0.705
ETHANE	0.570	0.158
PROPANE	11.837	3.376
ISOBUTANE	12.712	4.306
N-BUTANE	30.465	9.943
ISOPENTANE	16.224	6.142
N-PENTANE	11.506	4.318
HEXANES PLUS	8.168	3.690
	100.000	33.155

BTU	Vol. Ideal Gas Fuel	Vol. Real Gas Fuel
BTU @ 14.73 PSIA (DRY)	3293.1	3410.0
BTU @ 14.73 PSIA (SAT.)	3235.8	3352.1
Specific Gravity	2.0723	2.1449
Compressibility (Z)	0.9657	

Gasoline Content (Gallons Per Thousand - GPM)

Ethane & Heavier	31.933
Propane & Heavier	31.775
Butane & Heavier	28.399
Pentane & Heavier	14.150
Total 26 psi Reid V.P. Gasoline GPM	19.438

Remarks: Field H2S ppm = 830 (TUTWILER) HEAD SPACE FROM SOUR WATER TANKS
Remarks: NO PREVIOUS BTU AVAILABLE

New Mexico
ENVIRONMENT DEPARTMENT

505 Camino de los Marquez, Suite 1
Santa Fe, NM 87505
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JOHN A. SANCHEZ
LIEUTENANT GOVERNOR

BUTCH TONGATE
CABINET SECRETARY-DESIGATE

JC BORREGO
DEPUTY SECRETARY

DEPARTMENT ACCEPTED VALUES FOR:
AGGREGATE HANDLING, STORAGE PILE, and HAUL ROAD EMISSIONS

TO: Applicants and Air Quality Bureau Permitting Staff

SUBJECT: Department accepted default values for percent silt, wind speed, moisture content, and control efficiencies for haul road control measures

This guidance document provides the Department accepted default values for correction parameters in the emission calculation equations for aggregate handling and storage piles emissions in construction permit applications and notices of intent submitted under 20.2.72 and 20.2.73 NMAC; and the Department accepted control efficiencies for haul road control measures for applications submitted under 20.2.72 NMAC.

Aggregate Handling and Storage Pile Emission Calculations

Applicants should calculate the particulate matter emissions from aggregate handling and storage piles using the EPA's AP-42 Chapter 13.2.4.
http://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf

Equation 1 from Chapter 13.2.4 requires users to input values for two correction parameters, U and M, where U = mean wind speed and M = material moisture content. Below are the accepted values for U and M:

Default Values for Chapter 13.2.4, Equation 1:

Parameter	Default Value
U = Mean wind speed (miles per hour)	11 mph
M = Material moisture content (% water)	2%

Applicants must receive preapproval from the Department if they wish to assume a higher moisture content and/or a lower wind speed in these calculations. Higher moisture contents may require site specific testing either as a permit condition or submitted with the application. Applicants may assume higher wind speeds and lower percent moisture content in their calculations without prior approval from the Department.

Haul Road Emissions and Control Measure Efficiencies

Applicants should calculate the particulate matter emissions from unpaved haul roads using the EPA's AP-42 Chapter 13.2.2. http://www3.epa.gov/ttn/chief/ap42/ch13/final/c13s0202.pdf

Equation 1(a) from Chapter 13.2.2 requires users to input values for two correction parameters, s and W, where s = surface material silt content (%) and W = mean vehicle weight (tons). The applicant should calculate the mean vehicle weight in accordance with the chapter's instructions. Below is the accepted value for the parameter s:

Default Values for Chapter 13.2.2, Equation 1(a):

Parameter	Default Value
s = surface material silt content (%)	4.8%

Applicants may use a higher silt content without prior approval from the Department. Use of a lower silt content requires prior approval from the Department and may require site specific testing in support of the request.

Equation 2 from Chapter 13.2.2 allows users to take credit for the number of days that receive precipitation in excess of 0.01 inches, in the annual emissions calculation, where P = number of days in a year with at least 0.01 inches of precipitation.

Default Values for Chapter 13.2.2, Equation 2:

Parameter	Default Value
P = number of days in a year with at least 0.01 inches of precipitation	70 days

Applications submitted under Part 72 may request to apply control measures to reduce the particulate matter emissions from facility haul roads. Applications submitted under Part 73 may not consider any emission reduction from control measures in the potential emission rate calculation, as registrations issued under Part 73 are not federally enforceable under the Clean Air Act or the New Mexico Air Quality Control Act. In order for those control measures to be federally enforceable, the controls must be a requirement in an air quality permit.

Below are the Department accepted control efficiencies for various haul road control measures:

Haul Road Control Measures and Control Efficiency:

Control Measure	Control Efficiency
None	0%
Base course **or** watering	60%
Base course **and** watering	80%
Base course **and** surfactant	90%
Paved **and** Swept	95%

Bryan Research & Engineering, LLC

BR&E ProMax® 5.0

Simulation Report

Project: Lucid RH 5 1800GPM 245MM Rev 2 (06.17.19).pmx

Licensed to Lucid Energy Group II, LLC and Affiliates

Client Name:
Location:
Job:

ProMax Filename: C:\Users\CKassen\Documents\Projects\Red Hills\Red Hills 5-6\Lucid RH 5 1800GPM 245MM Rev 2 (06.17.19).pmx
ProMax Version: 5.0.19050.0
Simulation Initiated: 6/17/2019 6:27:10 AM

Bryan Research & Engineering, LLC
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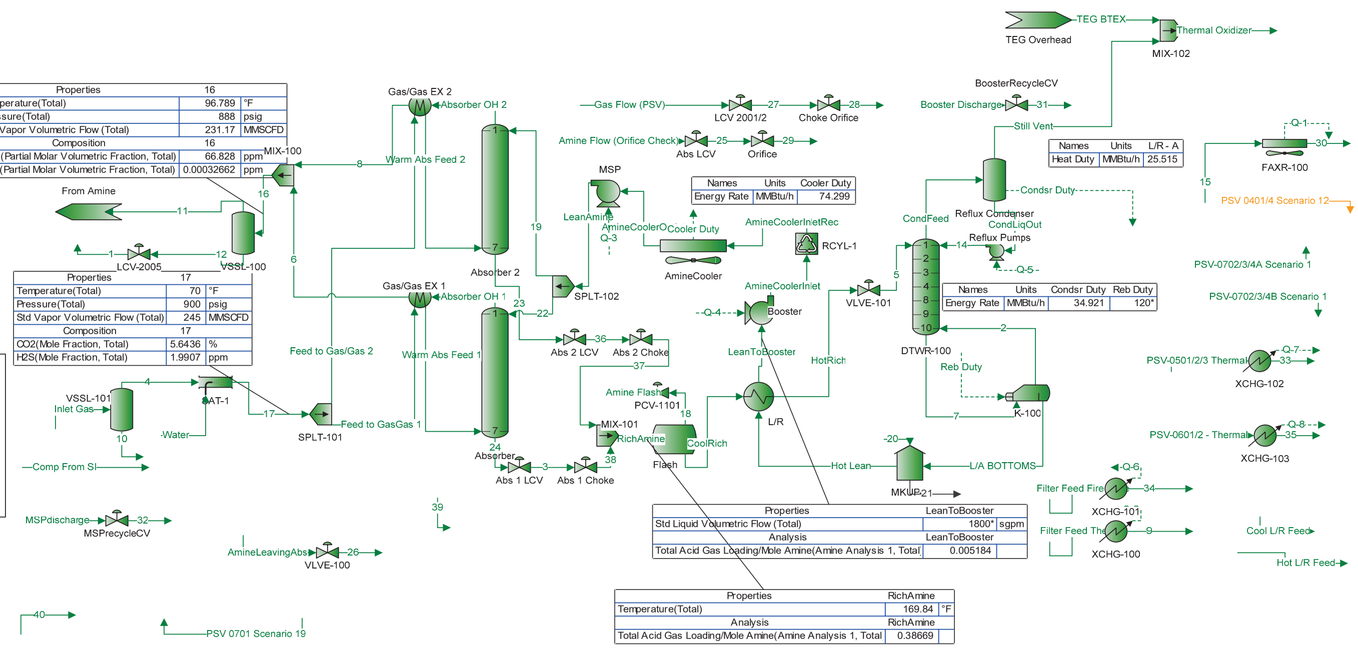
mailto:sales@bre.com
http://www.bre.com/

Report Navigator can be activated via the ProMax Navigator Toolbar.
An asterisk (*), throughout the report, denotes a user specified value.
A question mark (?) after a value, throughout the report, denotes an extrapolated or approximate value.



Latent Heat Estimates For Stream "7"
(Energy / Mass Vaporized)
Latent Heat (Method 1) = 553 Btu/lb
Latent Heat (Method 2) = 609.1 Btu/lb
Latent Heat (Method 3) = 578.3 Btu/lb
Latent Heat (Method 4) = 721.6 Btu/lb
Initial Temperature = 303.9 °F, Mole Frac. Vapor = 0 %
Final Temperature = 462.6 °F, Mole Frac. Vapor = 100 %
At Pressure = 50 psig

Latent Heat Estimates For Stream "CoolRich"
(Energy / Mass Vaporized)
Latent Heat (Method 1) = 430.6 Btu/lb
Latent Heat (Method 2) = 530.7 Btu/lb
Latent Heat (Method 3) = 599.3 Btu/lb
Latent Heat (Method 4) = 757.3 Btu/lb
Initial Temperature = 242.6 °F, Mole Frac. Vapor = 0 %
Final Temperature = 485.7 °F, Mole Frac. Vapor = 100 %
At Pressure = 165 psig

Properties	16	
Temperature(Total)	96.789	°F
Pressure(Total)	888	psig
Std Vapor Volumetric Flow (Total)	231.17	MMSCFD
Composition	16	
CO2(Partial Molar Volumetric Fraction, Total)	66.828	ppm
H2S(Partial Molar Volumetric Fraction, Total)	0.00032662	ppm

Properties	17	
Temperature(Total)	70	°F
Pressure(Total)	900	psig
Std Vapor Volumetric Flow (Total)	245	MMSCFD
Composition	17	
CO2(Mole Fraction, Total)	5.6436	%
H2S(Mole Fraction, Total)	1.9907	ppm

Names	Units	Cooler Duty
Energy Rate	MMBtu/h	74.299

Names	Units	L/R - A
Heat Duty	MMBtu/h	25.515

Names	Units	Condsr Duty	Reb Duty
Energy Rate	MMBtu/h	34.921	120*

Properties	LeanToBooster	
Std Liquid Volumetric Flow (Total)	1800*	sgpm
Analysis	LeanToBooster	
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total)	0.005184	

Properties	RichAmine	
Temperature(Total)	169.84	°F
Analysis	RichAmine	
Total Acid Gas Loading/Mole Amine(Amine Analysis 1, Total)	0.38669	

Process Streams	Absorber OH 1	Absorber OH 2	Amine Flash	Amine Flow (Orifice Check)	AmineCoolerInlet	AmineCoolerInletRec	AmineCoolerOutlet	AmineLeavingAbs
Composition Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Phase: Total From Block:	Absorber	Absorber 2	PCV-1101	--	Booster	RCYL-1	AmineCooler	--
To Block:	Gas/Gas EX 1	Gas/Gas EX 2	--	Abs LCV	RCYL-1	AmineCooler	MSP	VLVE-100
Mole Fraction	%	%	%	%	%	%	%	%
N2	2.27069	2.27069	0.631037	0.00118799	0	0	0	0.00124342
C1	76.6776	76.6776	61.0421	0.108900	0	0	0	0.110713
CO2	0.00739204	0.00739199	14.9059	6.47195	0.0717475	0.0717028	0.0717028	4.56049
C2	11.4814	11.4814	10.7339	0.0282975	0	0	0	0.0288445
H2S	4.39514E-08	4.39510E-08	0.000602237	0.179791	6.53752E-06	1.26822E-05	1.26822E-05	0.130265
C3	5.91719	5.91719	3.92773	0.0106490	0	0	0	0.0106681
iC4	0.717933	0.717933	0.337216	0.000690478	0	0	0	0.000672320
nC4	1.65789	1.65789	1.01886	0.00222788	0	0	0	0.00223227
iC5	0.348843	0.348843	0.0833858	0.000134882	0	0	0	0.000142299
nC5	0.342397	0.342397	0.108418	0.000201887	0	0	0	0.000208747
C6	0.310399	0.310400	0.0678300	4.60812E-05	0	0	0	4.64195E-05
C7	0.00286283	0.00286283	0.000281037	1.38667E-06	0	0	0	1.41622E-06
C8	0.000795958	0.000795958	8.38928E-05	1.61297E-07	0	0	0	1.55670E-07
C9	0.000396330	0.000396330	8.52623E-06	7.21024E-09	0	0	0	7.32082E-09
C10	0	0	0	3.09040E-10	0	0	0	3.19225E-10
Cyclopentane (C5)	0.0195357	0.0195357	0.0198536	2.38108E-05	0	0	0	2.53129E-05
Benzene	0.0101757	0.0101756	0.0479266	0.000344302	0	0	0	0.000373665
Cyclohexane (C6)	0.0106750	0.0106750	0.0118413	1.17812E-05	0	0	0	1.18576E-05
Methylcyclohexane (C7)	0.00364716	0.00364716	0.00183378	1.16928E-06	0	0	0	1.19052E-06
2,2,4-Trimethylpentane(C8)	0.00149290	0.00149290	0.000175780	1.04450E-07	0	0	0	9.18672E-08
Toluene	0.00228121	0.00228121	0.00901039	4.93037E-05	0	0	0	5.38713E-05
Ethylbenzene	8.10833E-05	8.10832E-05	0.000240452	8.55097E-07	0	0	0	9.67555E-07
p-Xylene	0.000372193	0.000372193	0.00119790	5.16188E-06	0	0	0	6.08204E-06
H2O	0.215546	0.215545	7.04940	78.0740	86.0868	86.0869	86.0869	82.4236
MDEA	8.91830E-05	8.91824E-05	0.00102555	12.9314	10.9547	10.9547	10.9547	11.8665
Piperazine	0.000384463	0.000384461	0.000205537	2.19002	2.88668	2.88668	2.88668	0.863902
TEG	0	0	0	0	0	0	0	0
Molar Flow	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
N2	288.170	288.170	0.319540	0.150654	0	0	0	0.168801
C1	9731.05	9731.04	30.9101	13.8100	0	0	0	15.0299
CO2	0.938114	0.938107	7.54793	820.736	20.5001	20.4873	20.4873	619.108
C2	1457.08	1457.08	5.43535	3.58853	0	0	0	3.91577
H2S	5.57781E-06	5.57777E-06	0.000304957	22.8001	0.00186794	0.00362363	0.00362363	17.6841
C3	750.943	750.943	1.98890	1.35044	0	0	0	1.44824
iC4	91.1119	91.1118	0.170757	0.0875625	0	0	0	0.0912706
nC4	210.401	210.401	0.515921	0.282527	0	0	0	0.303041
iC5	44.2712	44.2712	0.0422243	0.0171049	0	0	0	0.0193178
nC5	43.4532	43.4532	0.0548998	0.0256022	0	0	0	0.0283384
C6	39.3924	39.3924	0.0343473	0.00584376	0	0	0	0.00630166
C7	0.363318	0.363318	0.000142309	0.000175850	0	0	0	0.000192258
C8	0.101014	0.101014	4.24811E-05	2.04547E-05	0	0	0	2.11329E-05
C9	0.0502977	0.0502977	4.31745E-06	9.14361E-07	0	0	0	9.93836E-07

Process Streams	Booster Discharge	Comp From SI	CondFeed	CondLiqOut	Cool L/R Feed	CoolRich	Feed to Gas/Gas 2	Feed to GasGas 1
Composition Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Phase: Total From Block:	--	--	DTWR-100	Reflux Condenser	--	Flash	SPLT-101	SPLT-101
To Block:	BoosterRecycleCV	--	Reflux Condenser	Reflux Pumps	--	L/R	Gas/Gas EX 2	Gas/Gas EX 1
Mole Fraction	%	%	%	%	%	%	%	%
N2	0	2.32932*	0.000228050	7.44150E-09	3.89530E-05	2.56212E-05	2.14370	2.14370
C1	0	65.8365*	0.0767438	4.83949E-06	0.00796813	0.00862197	72.4728	72.4728
CO2	0.0719833	4.04992*	44.7562	0.106289	4.71280	5.09046	5.64356	5.64356
C2	0	14.1416*	0.0208359	1.46587E-06	0.00244757	0.00234085	10.8559	10.8559
H2S	0.0148149	0.201997*	0.00163418	9.48707E-06	0.174438	0.000189267	0.000199066	0.000199066
C3	0	8.52034*	0.00639993	3.45703E-07	0.000719089	0.000719019	5.59129	5.59129
iC4	0	0.921240*	0.000451155	1.53648E-08	3.44222E-05	5.06869E-05	0.678089	0.678089
nC4	0	2.40539*	0.00186921	9.59161E-08	0.000156625	0.000210002	1.56644	1.56644
iC5	0	0.505745*	6.74901E-05	1.74648E-09	4.71535E-06	7.58249E-06	0.329313	0.329313
nC5	0	0.615927*	0.000118275	3.77841E-09	8.93854E-06	1.32881E-05	0.323284	0.323284
C6	0	0.347000*	6.01635E-05	1.08753E-09	1.23832E-06	6.75937E-06	0.293009	0.293009
C7	0	0.0414209*	1.29512E-07	1.35141E-12	2.07833E-08	1.45507E-08	0.00270174	0.00270174
C8	0	0.00838527*	5.06223E-08	4.53688E-13	2.53692E-09	5.68745E-09	0.000751181	0.000751181
C9	0	0.00442518*	1.23701E-09	3.31948E-15	2.82415E-11	1.38979E-10	0.000373969	0.000373969
C10	0	0.000849262*	0	0	5.74214E-13	0	0	0
Cyclopentane (C5)	0	0.0223896*	7.65373E-05	1.27005E-08	3.60424E-06	8.59831E-06	0.0184797	0.0184797
Benzene	0	0.0148534*	0.00625730	3.03166E-05	0.000194736	0.000701249	0.0104744	0.0104744
Cyclohexane (C6)	0	0.0148534*	6.65295E-05	9.63487E-09	1.79560E-06	7.47411E-06	0.0101029	0.0101029
Methylcyclohexane (C7)	0	0.00654299*	4.49327E-06	3.08399E-10	9.29348E-08	5.04806E-07	0.00344525	0.00344525
2,2,4-Trimethylpentane(C8)	0	0.00252858*	1.02808E-07	6.05945E-13	1.31324E-09	1.15506E-08	0.00140895	0.00140895
Toluene	0	0.00435682*	0.00116618	4.25187E-06	2.38996E-05	0.000130774	0.00231541	0.00231541
Ethylbenzene	0	0.000236630*	2.45595E-05	7.29308E-08	4.17853E-07	2.75504E-06	8.00344E-05	8.00344E-05
p-Xylene	0	0.00113008*	0.000160623	7.14087E-07	2.66294E-06	1.80046E-05	0.000373540	0.000373540
H2O	88.4765	0.00303745*	55.1015	99.8433	84.1979	81.7320	0.0519006	0.0519006
MDEA	9.75051	0*	0.0163670	0.0315733	9.29598	10.4193	0	0
Piperazine	1.68614	0*	0.00974440	0.0187978	1.60724	2.74527	0	0
TEG	0	0*	0	0	0	0	0	0
Molar Flow	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
N2	0	562.661*	0.00769693	1.30196E-07	0.0112222	0.00769680	288.333	288.333
C1	0	15903.2*	2.59019	8.46713E-05	2.29559	2.59010	9747.80	9747.80
CO2	4.94290	978.283*	1510.57	1.85962	1357.74	1529.21	759.074	759.074
C2	0	3416.00*	0.703234	2.56468E-05	0.705137	0.703209	1460.15	1460.15
H2S	1.01729	48.7936*	0.0551554	0.000165985	50.2549	0.0568574	0.0267749	0.0267749
C3	0	2058.14*	0.216005	6.04839E-06	0.207167	0.215999	752.045	752.045
iC4	0	222.531*	0.0152270	2.68821E-07	0.00991690	0.0152267	91.2048	91.2048
nC4	0	581.036*	0.0630880	1.67814E-06	0.0451232	0.0630863	210.691	210.691
iC5	0	122.166*	0.00227787	3.05562E-08	0.00135847	0.00227784	44.2935	44.2935
nC5	0	148.781*	0.00399191	6.61067E-08	0.00257516	0.00399185	43.4826	43.4826
C6	0	83.8200*	0.00203058	1.90273E-08	0.000356757	0.00203057	39.4106	39.4106
C7	0	10.0055*	4.37116E-06	2.36442E-11	5.98761E-06	4.37114E-06	0.363391	0.363391
C8	0	2.02551*	1.70856E-06	7.93769E-12	7.30877E-07	1.70855E-06	0.101036	0.101036
C9	0	1.06893*	4.17504E-08	5.80773E-14	8.13628E-09	4.17503E-08	0.0502999	0.0502999

PSV-0501/2/3 Thermal	PSV-0601/2 - Thermal	PSV-0702/3/4A Scenario 1	PSV-0702/3/4B Scenario 1	RichAmine	Still Vent	TEG BTEX	Thermal Oxidizer	Warm Abs Feed 1	Warm Abs Feed 2	Water	1
Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
--	--	--	--	MIX-101	Reflux Condenser	TEG Overhead	MIX-102	Gas/Gas EX 1	Gas/Gas EX 2	--	LCV-2005
XCHG-102	XCHG-103	--	--	Flash	MIX-102	MIX-102	--	Absorber	Absorber 2	SAT-1	--
%	%	%	%	%	%	%	%	%	%	%	%
0	1.18307E-08	0	0	0.00108748	0.000473497	0.0235648	0.000522683	2.14370	2.14370	0*	0.00145931
0	4.67621E-06	0	0	0.111328	0.159340	10.5396	0.181450	72.4728	72.4728	0*	0.0821306
0.0719945	0.0907321	0.0719945	0.0719945	5.10698	92.8141	0.0517249	92.6165	5.64356	5.64356	0*	0.250042
0	1.60231E-06	0	0	0.0203997	0.0432605	13.1435	0.0711648	10.8559	10.8559	0*	0.0104992
0.0148028	0.00804485	0.0148028	0.0148028	0.000189962	0.00338288	0	0.00337567	0.000199066	0.000199066	0*	5.90722E-07
0	3.61410E-07	0	0	0.00732733	0.0132880	17.8852	0.0513560	5.59129	5.59129	0*	0.00326174
0	1.09064E-08	0	0	0.000618062	0.000936728	2.55530	0.00637765	0.678089	0.678089	0*	0.000188103
0	7.47721E-08	0	0	0.00192416	0.00388099	10.5640	0.0263745	1.56644	1.56644	0*	0.000613089
0	1.13515E-09	0	0	0.000147890	0.000140130	4.19768	0.00908110	0.329313	0.329313	0*	5.29728E-05
0	2.65638E-09	0	0	0.000195709	0.000245574	5.27162	0.0114739	0.323284	0.323284	0*	6.36870E-05
0	2.08212E-10	0	0	0.000120891	0.000124918	8.81557	0.0189023	0.293009	0.293009	0*	2.83298E-05
0	2.01716E-12	0	0	4.87450E-07	2.68907E-07	0.150648	0.000321156	0.00270174	0.00270174	0*	1.16191E-07
0	2.11448E-13	0	0	1.46851E-07	1.05108E-07	0.0596965	0.000127262	0.000751181	0.000751181	0*	1.87104E-08
0	0	0	0	1.44866E-08	2.56843E-09	0.0446945	9.52041E-05	0.000373969	0.000373969	0*	2.71696E-09
0	0	0	0	0	0	0	0	0	0	0*	0
0	5.56441E-09	0	0	4.19931E-05	0.000158903	2.03330	0.00448960	0.0184797	0.0184797	0*	2.26233E-05
0	8.79866E-06	0	0	0.000780719	0.0129596	7.77818	0.0294999	0.0104744	0.0104744	0*	0.000320953
0	2.41910E-09	0	0	2.73879E-05	0.000138127	1.15134	0.00259024	0.0101029	0.0101029	0*	8.04994E-06
0	5.93351E-11	0	0	3.58981E-06	9.32917E-06	0.458298	0.000985507	0.00344525	0.00344525	0*	1.11691E-06
0	7.19862E-14	0	0	3.07331E-07	2.13463E-07	0.0736412	0.000157072	0.00140895	0.00140895	0*	3.03873E-08

2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22
Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
K-100	Abs 1 LCV	VSSL-101	VLVE-101	Gas/Gas EX 1	DTWR-100	Gas/Gas EX 2	XCHG-100	VSSL-101	VSSL-101	VSSL-100	Reflux Pumps	--	MIX-100	SAT-1	Flash	SPLT-102	--	MKUP-1	SPLT-102
DTWR-100	Abs 1 Choke	SAT-1	DTWR-100	MIX-100	K-100	MIX-100	--	--	From Amine	LCV-2005	DTWR-100	FAXR-100	VSSL-100	SPLT-101	PCV-1101	Absorber 2	MKUP-1	--	Absorber
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
0	0.00108746	2.14475	2.56212E-05	2.27069	0	2.27069	3.89530E-05	0.309367	2.27296	0.00145931	7.44150E-09	0.000268462	2.27069	2.14370	0.631037	0	0	0	0
0	0.111327	72.5082	0.00862197	76.6776	0	76.6776	0.00796813	25.4454	76.7543	0.0821306	4.83949E-06	0.0558686	76.6776	72.4728	61.0421	0	0	0	0
0.254095	5.10698	5.64632	5.09046	0.00739204	0.107690	0.00739199	4.71280	3.88421	0.00714901	0.250042	0.106289	42.1859	0.00739202	5.64356	14.9059	0.0717028	0	0.0721446	0.0717028
0	0.0203995	10.8612	0.00234085	11.4814	0	11.4814	0.00244757	13.7473	11.4928	0.0104992	1.46587E-06	0.0173849	11.4814	10.8559	10.7339	0	0	0	0
1.14032E-05	0.000189962	0.000199163	0.000189267	4.39514E-08	7.51719E-06	4.39510E-08	0.174438	0.000284948	4.34036E-08	5.90722E-07	9.48707E-06	1.45966	4.39512E-08	0.000199066	0.000602237	1.26822E-05	0	6.57371E-06	1.26822E-05
0	0.00732725	5.59403	0.000719019	5.91719	0	5.91719	0.000719088	16.8289	5.92311	0.00326174	3.45703E-07	0.00509842	5.91719	5.59129	3.92773	0	0	0	0
0	0.000618055	0.678420	5.06869E-05	0.717933	0	0.717933	3.44222E-05	3.84382	0.718652	0.000188103	1.53648E-08	0.000243539	0.717933	0.678089	0.337216	0	0	0	0
0	0.00192414	1.56721	0.000210002	1.65789	0	1.65789	0.000156625	11.8188	1.65955	0.000613089	9.59161E-08	0.00111692	1.65789	1.56644	1.01886	0	0	0	0
0	0.000147888	0.329474	7.58249E-06	0.348843	0	0.348843	4.71534E-06	4.40490	0.349193	5.29728E-05	1.74648E-09	3.33057E-05	0.348843	0.329313	0.0833858	0	0	0	0
0	0.000195707	0.323442	1.32881E-05	0.342397	0	0.342397	8.93853E-06	5.24220	0.342740	6.36870E-05	3.77841E-09	6.33584E-05	0.342397	0.323284	0.108418	0	0	0	0
0	0.000120890	0.293152	6.75937E-06	0.310399	0	0.310400	1.23832E-06	11.9407	0.310710	2.83298E-05	1.08753E-09	8.77210E-06	0.310399	0.293009	0.0678300	0	0	0	0
0	4.87445E-07	0.00270306	1.45507E-08	0.00286283	0	0.00286283	2.07833E-08	0.227478	0.00286570	1.16191E-07	1.35141E-12	1.46936E-07	0.00286283	0.00270174	0.000281037	0	0	0	0
0	1.46850E-07	0.000751549	5.68745E-09	0.000795958	0	0.000795958	2.53692E-09	0.138779	0.000796755	1.87104E-08	4.53688E-13	1.80118E-08	0.000795958	0.000751181	8.38928E-05	0	0	0	0
0	1.44864E-08	0.000374152	1.38979E-10	0.000396330	0	0.000396330	2.82414E-11	0.177074	0.000396727	2.71696E-09	3.31948E-15	0	0.000396330	0.000373969	8.52623E-06	0	0	0	0
0	0	0	0	0	0	0	5.74213E-13	0	0	0	0	0	0	0	0	0	0	0	0
0	4.19927E-05	0.0184887	8.59831E-06	0.0195357	0	0.0195357	3.60424E-06	0.392360	0.0195552	2.26233E-05	1.27005E-08	2.64749E-05	0.0195357	0.0184797	0.0198536	0	0	0	0
0	0.000780709	0.0104796	0.000701249	0.0101757	0	0.0101756	0.000194737	0.392310	0.0101855	0.000320953	3.03166E-05	0.00172418	0.0101757	0.0104744	0.0479266	0	0	0	0
0	2.73876E-05	0.0101079	7.47411E-06	0.0106750	0	0.0106750	1.79560E-06	0.479235	0.0106857	8.04994E-06	9.63487E-09	1.33788E-05	0.0106750	0.0101029	0.0118413	0	0	0	0
0	3.58977E-06	0.00344694	5.04806E-07	0.00364716	0	0.00364716	9.29347E-08	0.313145	0.00365081	1.11691E-06	3.08399E-10	6.72908E-07	0.00364716	0.00344525	0.00183378	0	0	0	0
0	3.07327E-07	0.00140964	1.15506E-08	0.00149290	0	0.00149290	1.31324E-09	0.113147	0.00149440	3.03873E-08	6.05945E-13	9.28333E-09	0.00149290	0.00140895	0.000175780	0	0	0	0

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
Absorber 2	Absorber	Abs LCV	VLVE-100	LCV 2001/2	Choke Orifice	Orifice	FAXR-100	BoosterRecycleCV	MSPrecycleCV	XCHG-102	XCHG-101	XCHG-103	Abs 2 LCV	Abs 2 Choke	Abs 1 Choke	--	--
Abs 2 LCV	Abs 1 LCV	Orifice	--	Choke Orifice	--	--	--	--	--	--	--	--	Abs 2 Choke	MIX-101	MIX-101	--	--
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
0.00108749	0.00108746	0.00118799	0.00124342	2.40733	2.40733	0.00118799	0.000268462	0	0	0	3.89530E-05	1.18307E-08	0.00108749	0.00108749	0.00108746	0.00125212	2.44029*
0.111329	0.111327	0.108900	0.110713	66.8596	66.8596	0.108900	0.0558686	0	0	0	0.00796813	4.67621E-06	0.111329	0.111329	0.111327	0.0903625	92.0539*
5.10698	5.10698	6.47195	4.56049	7.01930	7.01930	6.47195	42.1859	0.0719833	0.0719945	0.0719945	4.71280	0.0907321	5.10698	5.10698	5.10698	4.73288	0.808624*
0.0203999	0.0203995	0.0282975	0.0288445	13.3982	13.3982	0.0282975	0.0173849	0	0	0	0.00244757	1.60231E-06	0.0203999	0.0203999	0.0203995	0.0201172	4.69721*
0.000189962	0.000189962	0.179791	0.130265	0.189476	0.189476	0.179791	1.45966	0.0148149	0.0148028	0.0148028	0.174438	0.00804485	0.000189962	0.000189962	0.000189962	0.174789	0*
0.00732742	0.00732725	0.0106490	0.0106681	7.16831	7.16831	0.0106490	0.00509842	0	0	0	0.000719088	3.61410E-07	0.00732742	0.00732742	0.00732725	0.00711856	0*
0.000618070	0.000618055	0.000690478	0.000672320	0.665291	0.665291	0.000690478	0.000243539	0	0	0	3.44222E-05	1.09064E-08	0.000618070	0.000618070	0.000618055	0.000428022	0*
0.00192419	0.00192414	0.00222788	0.00223227	1.59214	1.59214	0.00222788	0.00111692	0	0	0	0.000156625	7.47721E-08	0.00192419	0.00192419	0.00192414	0.00141600	0*
0.000147892	0.000147888	0.000134882	0.000142299	0.258535	0.258535	0.000134882	3.33057E-05	0	0	0	4.71534E-06	1.13515E-09	0.000147892	0.000147892	0.000147888	8.66817E-05	0*
0.000195712	0.000195707	0.000201887	0.000208747	0.288010	0.288010	0.000201887	6.33584E-05	0	0	0	8.93853E-06	2.65638E-09	0.000195712	0.000195712	0.000195707	0.000127065	0*
0.000120893	0.000120890	4.60812E-05	4.64195E-05	0.0903727	0.0903727	4.60812E-05	8.77210E-06	0	0	0	1.23832E-06	2.08212E-10	0.000120893	0.000120893	0.000120890	2.37658E-05	0*
4.87456E-07	4.87445E-07	1.38667E-06	1.41622E-06	0.00629454	0.00629454	1.38667E-06	1.46936E-07	0	0	0	2.07833E-08	2.01716E-12	4.87456E-07	4.87456E-07	4.87445E-07	7.27603E-07	0*
1.46853E-07	1.46850E-07	1.61297E-07	1.55670E-07	0.000654576	0.000654576	1.61297E-07	1.80118E-08	0	0	0	2.53692E-09	2.11448E-13	1.46853E-07	1.46853E-07	1.46850E-07	7.47526E-08	0*
1.44867E-08	1.44864E-08	7.21024E-09	7.32082E-09	0.000143201	0.000143201	7.21024E-09	0	0	0	0	2.82414E-11	0	1.44867E-08	1.44867E-08	1.44864E-08	3.27673E-09	0*
0	0	3.09040E-10	3.19225E-10	1.48107E-05	1.48107E-05	3.09040E-10	0	0	0	0	5.74213E-13	0	0	0	0	1.33501E-10	0*
4.19936E-05	4.19927E-05	2.38108E-05	2.53129E-05	0.00923258	0.00923258	2.38108E-05	2.64749E-05	0	0	0	3.60424E-06	5.56441E-09	4.19936E-05	4.19936E-05	4.19927E-05	1.62445E-05	0*
0.000780728	0.000780709	0.000344302	0.000373665	0.00402785	0.00402785	0.000344302	0.00172418	0	0	0	0.000194737	8.79866E-06	0.000780728	0.000780728	0.000780709	0.000215403	0*
2.73883E-05	2.73876E-05	1.17812E-05	1.18576E-05	0.00365125	0.00365125	1.17812E-05	1.33788E-05	0	0	0	1.79560E-06	2.41910E-09	2.73883E-05	2.73883E-05	2.73876E-05	6.69655E-06	0*
3.58986E-06	3.58977E-06	1.16928E-06	1.19052E-06	0.000956189	0.000956189	1.16928E-06	6.72908E-07	0	0	0	9.29347E-08	5.93351E-11	3.58986E-06	3.58986E-06	3.58977E-06	6.65513E-07	0*
3.07335E-07	3.07327E-07	1.04450E-07	9.18672E-08	0.000397351	0.000397351	1.04450E-07	9.28333E-09	0	0	0	1.31324E-09	7.19862E-14	3.07335E-07	3.07335E-07	3.07327E-07	4.48933E-08	0*

Process Streams — Properties

Phase: Vapor

Property	Units	Absorber OH 1	Absorber OH 2	Amine Flash	Amine Flow (Orifice Check)	AmineCoolerInlet	AmineCoolerInletRec	AmineCoolerOutlet	AmineLeavingAbs	Booster Discharge	Comp From SI	CondFeed
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:		Absorber	Absorber 2	PCV-1101	--	Booster	RCYL-1	AmineCooler	--	--	--	DTWR-100
To Block:		Gas/Gas EX 1	Gas/Gas EX 2	--	Abs LCV	RCYL-1	AmineCooler	MSP	VLVE-100	BoosterRecycleCV	--	Reflux Condenser
Temperature	°F	123.741	123.741	166.270							60	214.494
Pressure	psia	907.696	907.696	19.6959							914.696	24.6959
Mole Fraction Vapor	%	100	100	100							100	100
Mole Fraction Light Liquid	%	0	0	0							0	0
Mole Fraction Heavy Liquid	%	0	0	0							0	0
Molecular Weight	lb/lbmol	21.2310	21.2310	23.8191							22.8617	29.6814
Mass Density	lb/ft^3	3.63169	3.63169	0.0700507							5.12376	0.102169
Molar Flow	lbmol/h	12690.9	12690.9	50.6373							22247.6	3375.11
Mass Flow	lb/h	269440	269440	1206.13							508619	100178
Vapor Volumetric Flow	ft^3/h	74191.4	74191.3	17218.0							99266.6	980514
Liquid Volumetric Flow	gpm	9249.84	9249.83	2146.66							12376.1	122246
Std Vapor Volumetric Flow	MMSCFD	115.583	115.583	0.461185							202.623	30.7392
Std Liquid Volumetric Flow	sgpm	1530.60	1530.60	5.71003							2722.72	230.317
Compressibility		0.847549	0.847549	0.996997							0.731823	0.991659
Specific Gravity		0.733052	0.733052	0.822412							0.789356	1.02482
API Gravity												
Enthalpy	Btu/h	-4.29751E+08	-4.29751E+08	-2.92735E+06							-8.97155E+08	-4.45199E+08
Mass Enthalpy	Btu/lb	-1594.98	-1594.98	-2427.05							-1763.91	-4444.07
Mass Cp	Btu/(lb*°F)	0.615219	0.615220	0.434196							0.666939	0.301469
Ideal Gas CpCv Ratio		1.23369	1.23369	1.23865							1.24672	1.28838
Dynamic Viscosity	cP	0.0132311	0.0132311	0.0133197							0.0132443	0.0167069
Kinematic Viscosity	cSt	0.227440	0.227440	11.8703							0.161369	10.2083
Thermal Conductivity	Btu/(h*ft*°F)	0.0227095	0.0227095	0.0196337							0.0206507	0.0141000
Surface Tension	lbf/ft											
Net Ideal Gas Heating Value	Btu/ft^3	1133.01	1133.01	874.245							1116.05	2.45712
Net Liquid Heating Value	Btu/lb	20188.5	20188.5	13811.8							18455.8	-373.048
Gross Ideal Gas Heating Value	Btu/ft^3	1248.75	1248.75	967.695							1228.94	30.3982
Gross Liquid Heating Value	Btu/lb	22257.6	22257.6	15300.9							20330.1	-15.8139

Property	CondLiqOut	Cool L/R Feed	CoolRich	Feed to Gas/Gas 2	Feed to GasGas 1	Filter Feed Fire Case	Filter Feed Thermal	Gas Flow (PSV)	Hot L/R Feed	Hot Lean
Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:	Reflux Condenser	--	Flash	SPLT-101	SPLT-101	--	--	--	--	MKUP-1
To Block:	Reflux Pumps	--	L/R	Gas/Gas EX 2	Gas/Gas EX 1	XCHG-101	XCHG-100	LCV 2001/2	--	L/R
Temperature				70	70			120		
Pressure				914.696	914.696			1114.70		
Mole Fraction Vapor				100	100			100		
Mole Fraction Light Liquid				0	0			0		
Mole Fraction Heavy Liquid				0	0			0		
Molecular Weight				22.5191	22.5191			23.5567		
Mass Density				4.70694	4.70694			5.31349		
Molar Flow				13450.3	13450.3			13284.3		
Mass Flow				302888	302888			312935		
Vapor Volumetric Flow				64349.1	64349.1			58894.4		
Liquid Volumetric Flow				8022.75	8022.75			7342.68		
Std Vapor Volumetric Flow				122.5	122.5			120.989		
Std Liquid Volumetric Flow				1614.11	1614.11			1621.49		
Compressibility				0.769873	0.769873			0.794414		
Specific Gravity				0.777525	0.777525			0.813352		
API Gravity										
Enthalpy				-5.66762E+08	-5.66762E+08			-5.79573E+08		
Mass Enthalpy				-1871.19	-1871.19			-1852.06		
Mass Cp				0.626356	0.626356			0.614178		
Ideal Gas CpCv Ratio				1.24979	1.24979			1.23140		
Dynamic Viscosity				0.0132500	0.0132500			0.0145367		
Kinematic Viscosity				0.175734	0.175734			0.170790		
Thermal Conductivity				0.0208790	0.0208790			0.0228472		
Surface Tension										
Net Ideal Gas Heating Value				1070.86	1070.86			1085.21		
Net Liquid Heating Value				17982.8	17982.8			17411.4		
Gross Ideal Gas Heating Value				1180.18	1180.18			1194.91		
Gross Liquid Heating Value				19825.3	19825.3			19179.1		

Property	HotRich	Inlet Gas	L/A BOTTOMS	LeanAmine	LeanToBooster	MSPdischarge	PSV 0401/4 Scenario 12	PSV 0701 Scenario 19
Status:	Solved	Solved	Solved	Solved	Solved	Solved	Approximate Solution	Solved
From Block:	L/R	--	K-100	MSP	L/R	--	--	--
To Block:	VLVE-101	VSSL-101	MKUP-1	SPLT-102	Booster	MSPrecycleCV	--	--
Temperature	205	70					458.292	48.8679
Pressure	69.6959	914.696					75.1959	164.696
Mole Fraction Vapor	100	100					100	100
Mole Fraction Light Liquid	0	0					0	0
Mole Fraction Heavy Liquid	0	0					0	0
Molecular Weight	31.9838	22.5213					27.2183	21.9621
Mass Density	0.316400	4.70739					0.213170	0.699439
Molar Flow	5.71098	26887.4					33072.0	418.066
Mass Flow	182.659	605538					900162	9181.62
Vapor Volumetric Flow	577.303	128636					4.22274E+06	13127.1
Liquid Volumetric Flow	71.9754	16037.7					526472	1636.63
Std Vapor Volumetric Flow	0.0520134	244.880					301.207	3.80758
Std Liquid Volumetric Flow	0.579388	3227.75					1805.43	51.4577
Compressibility	0.987713	0.769875					0.974632	0.947591
Specific Gravity	1.10432	0.777601					0.939776	0.758295
API Gravity								
Enthalpy	-634316	-1.13215E+09					-3.35585E+09	-1.42855E+07
Mass Enthalpy	-3472.69	-1869.65					-3728.05	-1555.88
Mass Cp	0.316276	0.626363					0.689409	0.480150
Ideal Gas CpCv Ratio	1.24859	1.24977					1.12004	1.24762
Dynamic Viscosity	0.0163406	0.0132484					0.0167178	0.0103193
Kinematic Viscosity	3.22412	0.175697					4.89590	0.921042
Thermal Conductivity	0.0169598	0.0208787					0.0204839	0.0163223
Surface Tension								
Net Ideal Gas Heating Value	397.997	1071.39					335.699	1165.55
Net Liquid Heating Value	4559.47	17990.3					3913.60	20069.8
Gross Ideal Gas Heating Value	446.594	1180.73					411.239	1283.48
Gross Liquid Heating Value	5136.20	19833.1					4966.80	22107.8

PSV-0501/2/3 Thermal	PSV-0601/2 - Thermal	PSV-0702/3/4A Scenario 1	PSV-0702/3/4B Scenario 1	RichAmine	Still Vent	TEG BTEX	Thermal Oxidizer	Warm Abs Feed 1	Warm Abs Feed 2	Water	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
--	--	--	--	MIX-101	Reflux Condenser	TEG Overhead	MIX-102	Gas/Gas EX 1	Gas/Gas EX 2	--	LCV-2005	K-100	Abs 1 LCV	VSSL-101	VLVE-101	Gas/Gas EX 1	DTWR-100	Gas/Gas EX 2	XCHG-100	VSSL-101	VSSL-100	VSSL-100	Reflux Pumps	--	MIX-100	SAT-1	Flash	SPLT-102	--	MKUP-1	SPLT-102	Absorber 2	Absorber	Abs LCV	VLVE-100	LCV 2001/2	Choke Orifice	Orifice	FAXR-100	BoosterRecycleCV	MSPrecycleCV	XCHG-102	XCHG-101	XCHG-103	Abs 2 LCV	Abs 2 Choke	Abs 1 Choke	--	--
XCHG-102	XCHG-103	--	--	Flash	MIX-102	MIX-102	--	Absorber	Absorber 2	SAT-1	--	DTWR-100	Abs 1 Choke	SAT-1	DTWR-100	MIX-100	K-100	MIX-100	--	--	From Amine	LCV-2005	DTWR-100	FAXR-100	VSSL-100	SPLT-101	PCV-1101	Absorber 2	MKUP-1	--	Absorber	Abs 2 LCV	Abs 1 LCV	Orifice	--	Choke Orifice	--	--	--	--	--	--	--	--	Abs 2 Choke	MIX-101	MIX-101	--	--
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%

Mass Flow (lb/h)	Absorber OH 1	Absorber OH 2	Amine Flash	Amine Flow (Orifice Check)	AmineCoolerInlet	AmineCoolerInletRec	AmineCoolerOutlet	AmineLeavingAbs	Booster Discharge	Comp From SI	CondFeed	CondLiqOut	Cool L/R Feed	CoolRich	Feed to Gas/Gas 2	Feed to GasGas 1	Filter Feed Fire Case	Filter Feed Thermal	Gas Flow (PSV)	Hot L/R Feed	Hot Lean	HotRich	Inlet Gas	L/A BOTTOMS	LeanAmine	LeanToBooster	MSPdischarge	PSV 0401/4 Scenario 12	PSV 0701 Scenario 19
[illegible]																													
H2O				178368	443125	443126	443126	201580	109451	0.672431		31470.0	436999	442327			8348.31	232.162		5879.09	443125	442311	0.0883711	440294	443126	443125	112762		
MDEA				195413	372983	372983	372983	191963	79783.9	0		65.8257	319133	372980			6096.63	169.544		4293.40	372983	372980	0	372980	372983	372983	82197.4		
Piperazine				23922.1	71044.4	71044.4	71044.4	10101.9	9972.99	0		28.3286	39884.3	71036.0			761.938	21.1890		536.576	71044.4	71036.0	0	71036.0	71044.4	71044.4	10274.7		
TEG				0	0	0	0	0	0	0		0	0	0			0	0		0	0	0	0	0	0	0	0		

Process Streams

Properties — Phase: **Light Liquid**

Property	Units	Absorber OH 1	Absorber OH 2	Amine Flash	Amine Flow (Orifice Check)	AmineCoolerInlet	AmineCoolerInletRec	AmineCoolerOutlet	AmineLeavingAbs	Booster Discharge	Comp From SI
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:		Absorber	Absorber 2	PCV-1101	--	Booster	RCYL-1	AmineCooler	--	--	--
To Block:		Gas/Gas EX 1	Gas/Gas EX 2	--	Abs LCV	RCYL-1	AmineCooler	MSP	VLVE-100	BoosterRecycleCV	--
Temperature	°F				178.892	217.403	217.051	120	166.125	206.363	60
Pressure	psia				909.696	70.6959	70.6959	65.6959	914.696	70.6959	914.696
Mole Fraction Vapor	%				0	0	0	0	0	0	0
Mole Fraction Light Liquid	%				100	100	100	100	100	100	100
Mole Fraction Heavy Liquid	%				0	0	0	0	0	0	0
Molecular Weight	lb/lbmol				34.3039	31.0807	31.0807	31.0807	31.8187	29.0473	40.1813
Mass Density	lb/ft^3				70.8599	61.5832	61.5938	64.0759	68.0657	61.8796	30.4083
Molar Flow	lbmol/h				12681.4	28572.5	28572.5	28572.5	13575.5	6866.72	1908.01
Mass Flow	lb/h				435022	888055	888055	888055	431953	199460	76666.2
Vapor Volumetric Flow	ft^3/h				6139.19	14420.4	14417.9	13859.4	6346.12	3223.35	2521.22
Liquid Volumetric Flow	gpm				765.405	1797.87	1797.56	1727.93	791.204	401.873	314.335
Std Vapor Volumetric Flow	MMSCFD				115.498	260.228	260.228	260.228	123.640	62.5395	17.3774
Std Liquid Volumetric Flow	sgpm				890.193	1800	1800	1800	869.710	400	313.527
Compressibility					0.0642647	0.00491049	0.00491219	0.00512260	0.0636700	0.00464295	0.216729
Specific Gravity					1.13614	0.987404	0.987574	1.02737	1.09134	0.992157	0.487557
API Gravity					-8.75267	4.01705	4.01719	4.01807	-4.33115	4.26078	158.722
Enthalpy	Btu/h				-1.67116E+09	-3.54379E+09	-3.54408E+09	-3.61838E+09	-1.78428E+09	-8.57727E+08	-1.02452E+08
Mass Enthalpy	Btu/lb				-3841.55	-3990.51	-3990.83	-4074.50	-4130.72	-4300.25	-1336.33
Mass Cp	Btu/(lb*°F)				0.718521	0.899627	0.899348	0.825958	0.745097	0.902684	0.687482
Ideal Gas CpCv Ratio					1.12827	1.12893	1.12899	1.15033	1.14386	1.14516	1.14175
Dynamic Viscosity	cP				5.61206	1.03343	1.03701	3.56996	2.71884	0.953935	0.0939603
Kinematic Viscosity	cSt				4.94425	1.04761	1.05105	3.47815	2.49364	0.962388	0.192900
Thermal Conductivity	Btu/(h*ft*°F)				0.168124?	0.193968	0.193992	0.197573	0.186868?	0.211800	0.0595430
Surface Tension	lbf/ft				0.00307750?	0.00311470	0.00311676	0.00364246	0.00337349?	0.00332825?	0.000227841?
Net Ideal Gas Heating Value	Btu/ft^3				535.299	483.819	483.819	483.819	454.781	402.656	2034.46
Net Liquid Heating Value	Btu/lb				5312.90	5214.38	5214.38	5214.38	4766.31	4529.24	19075.5
Gross Ideal Gas Heating Value	Btu/ft^3				622.600	570.172	570.171	570.171	537.437	483.267	2213.95
Gross Liquid Heating Value	Btu/lb				6278.66	6268.71	6268.71	6268.71	5752.11	5582.37	20771.2

Property	Units	CondFeed	CondLiqOut	Cool L/R Feed	CoolRich	Feed to Gas/Gas 2	Feed to GasGas 1	Filter Feed Fire Case	Filter Feed Thermal	Gas Flow (PSV)
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:		DTWR-100	Reflux Condenser	--	Flash	SPLT-101	SPLT-101	--	--	--
To Block:		Reflux Condenser	Reflux Pumps	--	L/R	Gas/Gas EX 2	Gas/Gas EX 1	XCHG-101	XCHG-100	LCV 2001/2
Temperature	°F		120.000	158.181	169.838			158.063	158.063	
Pressure	psia		24.6959	179.696	74.6959			84.6959	84.6959	
Mole Fraction Vapor	%		0	0	0			0	0	
Mole Fraction Light Liquid	%		100	100	100			100	100	
Mole Fraction Heavy Liquid	%		0	0	0			0	0	
Molecular Weight	lb/lbmol		18.0877	29.7664	31.7483			29.7664	29.7664	
Mass Density	lb/ft^3		61.7235	68.5486	69.7755			68.5438	68.5438	
Molar Flow	lbmol/h		1749.59	28809.7	30040.7			550.372	15.3055	
Mass Flow	lb/h		31646.0	857559	953744			16382.6	455.590	
Vapor Volumetric Flow	ft^3/h		512.706	12510.2	13668.7			239.009	6.64669	
Liquid Volumetric Flow	gpm		63.9218	1559.72	1704.16			29.7985	0.828678	
Std Vapor Volumetric Flow	MMSCFD		15.9346	262.387	273.600			5.01257	0.139397	
Std Liquid Volumetric Flow	sgpm		63.3159	1746.78	1961.31			33.3700	0.928000	
Compressibility			0.00116336	0.0117684	0.00503096			0.00554825	0.00554825	
Specific Gravity			0.989655	1.09909	1.11876			1.09901	1.09901	
API Gravity			9.87263	-4.67024	-6.78049			-4.66016	-4.66016	
Enthalpy	Btu/h		-2.13605E+08	-3.72552E+09	-3.87635E+09			-7.11764E+07	-1.97937E+06	
Mass Enthalpy	Btu/lb		-6749.83	-4344.33	-4064.35			-4344.64	-4344.64	
Mass Cp	Btu/(lb*°F)		0.993900	0.740867	0.742158			0.740914	0.740915	
Ideal Gas CpCv Ratio			1.32209	1.15889	1.14188			1.15892	1.15892	
Dynamic Viscosity	cP		0.573158	2.85983	4.48440			2.85865	2.85865	
Kinematic Viscosity	cSt		0.579699	2.60448	4.01218			2.60358	2.60358	
Thermal Conductivity	Btu/(h*ft*°F)		0.364821	0.195299?	0.181118?			0.195181?	0.195181?	
Surface Tension	lbf/ft		0.00465178	0.00344566?	0.00321179?			0.00344651?	0.00344651?	
Net Ideal Gas Heating Value	Btu/ft^3		1.72884	384.960	460.335			384.960	384.960	
Net Liquid Heating Value	Btu/lb		-1018.72	4222.97	4852.85			4222.97	4222.97	
Gross Ideal Gas Heating Value	Btu/ft^3		52.1105	461.830	542.408			461.830	461.830	
Gross Liquid Heating Value	Btu/lb		38.2955	5202.97	5833.85			5202.97	5202.97	

Property	Units	Hot L/R Feed	Hot Lean	HotRich	Inlet Gas	L/A BOTTOMS	LeanAmine	LeanToBooster	MSPdischarge	PSV 0401/4 Scenario 12	PSV 0701 Scenario 19
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Approximate Solution	Solved
From Block:		--	MKUP-1	L/R	--	K-100	MSP	L/R	--	--	--
To Block:		--	L/R	VLVE-101	VSSL-101	MKUP-1	SPLT-102	Booster	MSPrecycleCV	--	--
Temperature	°F	210	248.736	205	70	249.246	122.443	217.254	126.369		
Pressure	psia	179.696	25.6959	69.6959	914.696	25.6959	1014.70	20.6959	1014.70		
Mole Fraction Vapor	%	0	0	0	0	0	0	0	0		
Mole Fraction Light Liquid	%	100	100	100	100	100	100	100	100		
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0	0		
Molecular Weight	lb/lbmol	29.7664	31.0807	31.7483	46.1102	31.1527	31.0807	31.0807	29.0473		
Mass Density	lb/ft^3	67.6533	60.5786	69.2378	33.1233	60.5640	64.1167	61.5815	63.9562		
Molar Flow	lbmol/h	387.586	28572.5	30035.0	264.978	28415.2	28572.5	28572.5	7074.44		
Mass Flow	lb/h	11537.0	888055	953561	12218.2	885212	888055	888055	205494		
Vapor Volumetric Flow	ft^3/h	170.531	14659.6	13772.3	368.870	14616.1	13850.6	14420.8	3213.03		
Liquid Volumetric Flow	gpm	21.2611	1827.68	1717.06	45.9890	1822.27	1726.83	1797.92	400.586		
Std Vapor Volumetric Flow	MMSCFD	3.52998	260.228	273.548	2.41332	258.795	260.228	260.228	64.4313		
Std Liquid Volumetric Flow	sgpm	23.5000	1800	1960.73	46.2767	1794.31	1800	1800	412.1		
Compressibility		0.0110015	0.00173417	0.00448038	0.224012	0.00173735	0.0787382	0.00143788	0.0732773		
Specific Gravity		1.08473	0.971297	1.11014	0.531089	0.971064	1.02803	0.987378	1.02545		
API Gravity		-4.67024	4.02494	-6.77408	130.797	4.01200	3.85273	4.02582	4.10396		
Enthalpy	Btu/h	-4.96627E+07	-3.51848E+09	-3.85020E+09	-1.55594E+07	-3.49924E+09	-3.61463E+09	-3.54400E+09	-8.97593E+08		
Mass Enthalpy	Btu/lb	-4304.63	-3962.01	-4037.71	-1273.46	-3953.00	-4070.28	-3990.74	-4367.98		
Mass Cp	Btu/(lb*°F)	0.796470	0.925085	0.776479	0.633510	0.925215	0.824535	0.899737	0.843479		
Ideal Gas CpCv Ratio		1.14748	1.12328	1.13454	1.12186	1.12278	1.14971	1.12895	1.16365		
Dynamic Viscosity	cP	1.50844	0.776054	2.75201	0.117687	0.776616	3.49652	1.03367	2.55707		
Kinematic Viscosity	cSt	1.39193	0.799746	2.48134	0.221806	0.800517	3.40443	1.04788	2.49597		
Thermal Conductivity	Btu/(h*ft*°F)	0.194187?	0.191538	0.179837?	0.0609366	0.191015	0.197659	0.193971	0.213359		
Surface Tension	lbf/ft	0.00315251?	0.00292723	0.00302567?	0.000325052?	0.00292100	0.00363208	0.00311544	0.00378329		
Net Ideal Gas Heating Value	Btu/ft^3	384.960	483.819	460.347	2311.99	486.484	483.819	483.819	402.655		
Net Liquid Heating Value	Btu/lb	4222.97	5214.38	4852.90	18886.2	5234.35	5214.38	5214.38	4529.24		
Gross Ideal Gas Heating Value	Btu/ft^3	461.830	570.172	542.426	2510.39	573.035	570.171	570.172	483.267		
Gross Liquid Heating Value	Btu/lb	5202.97	6268.71	5833.98	20519.5	6288.66	6268.71	6268.71	5582.37		

PSV-0501/2/3 Thermal	PSV-0601/2 - Thermal	PSV-0702/3/4A Scenario 1	PSV-0702/3/4B Scenario 1	RichAmine	Still Vent	TEG BTEX
Solved	Solved	Solved	Solved	Solved	Solved	Solved
--	--	--	--	MIX-101	Reflux Condenser	TEG Overhead
XCHG-102	XCHG-103	--	--	Flash	MIX-102	MIX-102
90	90	120	123	169.838		120.353
179.696	69.6959	179.696	1554.70	74.6959		14.2000
0	0	0	0	0		0
100	100	100	100	100		100
0	0	0	0			0
29.0473	18.0759	29.0473	29.0473	31.7483		19.3212
64.5608	62.1182	64.0087	64.0739	69.7755		62.1566
505.906	219.890	8837.47	6866.72	30040.7		0.0132750
14695.2	3974.72	256705	199460	953744		0.0256490
227.618	63.9863	4010.47	3112.96	13668.7		0.000412650
28.3784	7.97752	500.007	388.110	1704.16		5.14473E-05
4.60759	2.00268	80.4883	62.5395	273.600		1.20904E-05
29.47	7.95100	514.8	400	1961.31		5.11242E-05
0.0137060	0.00343814	0.0131088	0.112716	0.00503096		0.000709132
1.03515	0.995983	1.02629	1.02734	1.11876		0.996599
4.24256	9.88835	4.24256	4.01506	-6.78049		8.78898
-6.46630E+07	-2.69614E+07	-1.12316E+09	-8.71552E+08	-3.87635E+09		-163.169
-4400.28	-6783.22	-4375.30	-4369.56	-4064.35		-6361.61
0.823511	0.995248	0.842146	0.839517	0.742158		0.969506
1.17373	1.32389	1.16533	1.16454	1.14188		1.29188
4.55306	0.785576	2.77067	2.71419	4.48440		0.697030
4.40265	0.789493	2.70225	2.64447	4.01218		0.700073
0.212164	0.353746	0.213177	0.213348	0.181187		0.337274
0.00396817	0.00487333	0.00381476	0.00380248	0.00321179		0.00454942
402.655	1.39725	402.655	402.655	460.335		46.1721
4529.24	-1026.37	4529.24	4529.24	4852.85		-95.1958
483.267	51.7609	483.267	483.267	542.408		99.9982
5582.37	30.9567	5582.37	5582.37	5833.85		961.992

QStream Report

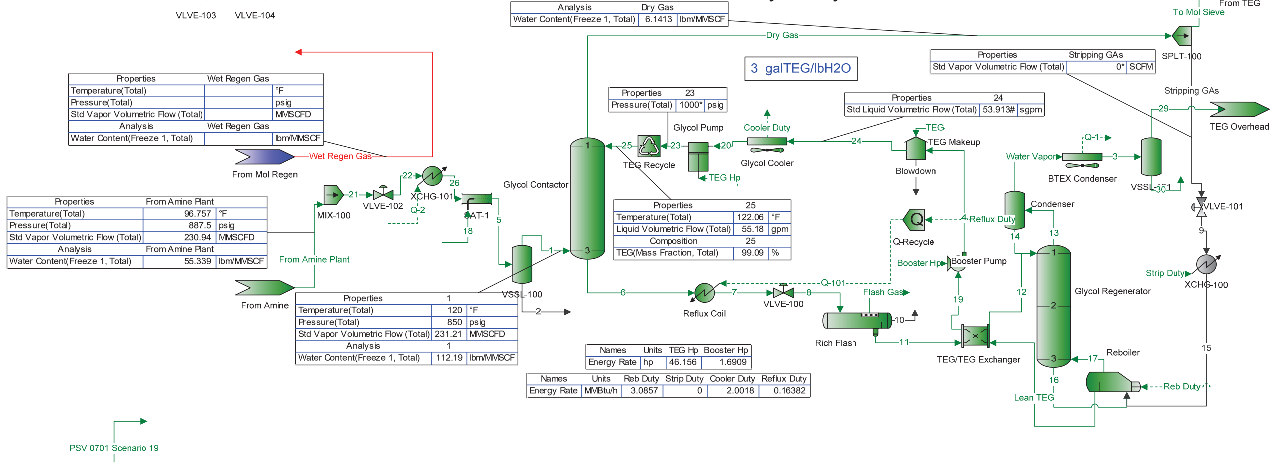
Client Name:		Job:	
Location:			
Flowsheet:	AMINE		

Energy Streams

Energy Stream	Status	Energy Rate		Power		From Block	To Block
Condsr Duty	Solved	3.49209E+07	Btu/h	13724.4	hp	Reflux Condenser	--
Cooler Duty	Solved	7.42994E+07	Btu/h	29200.8	hp	AmineCooler	--
Q-1	Solved	3.29697E+07	Btu/h	12957.6	hp	FAXR-100	--
Q-2	Solved	-10073.0	Btu/h	-3.95885	hp	XCHG-100	--
Q-3	Solved	3.74325E+06	Btu/h	1471.15	hp	--	MSP
Q-4	Solved	205271	Btu/h	80.6747	hp	--	Booster
Q-5	Solved	5534.40	Btu/h	2.17510	hp	--	Reflux Pumps
Q-6	Solved	-1.38335E+07	Btu/h	-5436.79	hp	XCHG-101	--
Q-7	Solved	-367098	Btu/h	-144.275	hp	XCHG-102	--
Q-8	Solved	-118609	Btu/h	-46.6151	hp	XCHG-103	--
Reb Duty	Solved	1.20000E+08*	Btu/h	47161.8*	hp	--	K-100

Notes:

Basic Glycol Dehydration Unit



Process Streams — Properties (Phase: Total)

Process Streams	Units	Blowdown	Dry Gas	Flash Gas	From Amine Plant	Lean TEG	PSV 0701 Scenario 19	Stripping GAs	TEG	TEG Fuel Gas	To Mol Sieve	Water Vapor	Wet Regen Gas
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved
From Block:		TEG Makeup	Glycol Contactor	Rich Flash	From Amine	Reboiler	--	SPLT-100	--	--	SPLT-100	Condenser	From Mol Regen
To Block:		--	SPLT-100	--	MIX-100	TEG/TEG Exchanger	--	VLVE-101	TEG Makeup	VLVE-103	From TEG	BTEX Condenser	--
Temperature	°F		123.308	134.689	96.7571	400.000	120*		100*	100*	123.308	211.097	
Pressure	psia	44.6959	863.196	74.6959	902.196	15.2000	179.696*	863.196	44.1959*	64.6959*	863.196	14.7000	
Mole Fraction Vapor	%		100	100	100	0	100		0	100	100	100	
Mole Fraction Light Liquid	%		0	0	0	100	0		100	0	0	0	
Mole Fraction Heavy Liquid	%		0	0	0	0	0		0	0	0	0	
Molecular Weight	lb/lbmol	140.802	21.2310	27.4425	21.2338	140.802	21.9620	21.2310	148.984	21.9156	21.2310	19.9005	
Mass Density	lb/ft^3		3.43230	0.329189	3.92809	60.0048	0.658648		69.3628	0.239654	3.43230	0.0409792	
Molar Flow	lbmol/h	0	25317.9	9.16292	25356.3	216.100	418.069	0	0.00520513	13.1758	25317.9	59.5868	
Mass Flow	lb/h	0	537526	251.454	538412	30427.4	9181.62	0	0.775478	288.755	537526	1185.81	
Vapor Volumetric Flow	ft^3/h		156608	763.857	137067	507.082	13940.1		0.0111800	1204.88	156608	28936.8	
Liquid Volumetric Flow	gpm		19525.1	95.2341	17088.9	63.2206	1737.99		0.00139387	150.219	19525.1	3607.71	
Std Vapor Volumetric Flow	MMSCFD	0	230.586	0.0834523	230.936	1.96816	3.80761*	0*	4.74063E-05	0.12*	230.586	0.542694	
Std Liquid Volumetric Flow	sgpm	0	3057.48	1.26449	3060.25	53.9115	51.4868	0	0.00137258	1.62090	3057.48	2.60967	
Compressibility			0.853452	0.976255	0.816726	0.00386609	0.963190		0.0158051	0.985031	0.853452	0.991706	
Specific Gravity			0.733052	0.947519	0.733149	0.962097	0.758290		1.11214	0.756689	0.733052	0.687114	
API Gravity						-6.09932			-6.36228				
Enthalpy	Btu/h	0	-8.52935E+08	-337961	-8.65775E+08	-6.53374E+07	-1.39429E+07	0	-1779.35	-440975	-8.52935E+08	-5.92655E+06	
Mass Enthalpy	Btu/lb	-2254.48	-1586.78	-1344.03	-1608.02	-2147.33	-1518.57	-1586.78	-2294.52	-1527.16	-1586.78	-4997.89	
Mass Cp	Btu/(lb*°F)		0.608094	0.482472	0.628913	0.670956	0.505143		0.539661	0.484182	0.608094	0.457461	
Ideal Gas CpCv Ratio			1.23374	1.18032	1.24071	1.02606	1.22871		1.03243	1.23450	1.23374	1.28142	
Dynamic Viscosity	cP		0.0130874	0.0108866	0.0129677	0.796473	0.0115279		21.1484	0.0110434	0.0130874	0.0126110	
Kinematic Viscosity	cSt		0.238039	2.06456	0.206092	0.828637	1.09264		19.0340	2.87671	0.238039	19.2117	
Thermal Conductivity	Btu/(h*ft*°F)		0.0224826	0.0175981	0.0218803	0.106518?	0.0191943		0.112159	0.0179906	0.0224826	0.0153158	
Surface Tension	lbf/ft					0.00204072?			0.00301110				
Net Ideal Gas Heating Value	Btu/ft^3	3503.66	1134.99	1465.58	1134.13	3503.66	1166.40	1134.99	3737.08	1163.53	1134.99	142.775	
Net Liquid Heating Value	Btu/lb	9171.73	20225.6	20156.7	20206.6	9171.73	20085.4	20225.6	9254.08	20078.6	20225.6	1790.19	
Gross Ideal Gas Heating Value	Btu/ft^3	3834.11	1250.84	1605.68	1249.93	3834.11	1284.37	1250.84	4086.19	1281.28	1250.84	201.554	
Gross Liquid Heating Value	Btu/lb	10062.3	22296.7	22094.7	22276.7	10062.3	22124.3	22296.7	10143.3	22118.1	22296.7	2911.09	

Process Streams	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:		VSSL-100	VSSL-100	BTEX Condenser	Booster Pump	SAT-1	Glycol Contactor	Reflux Coil	VLVE-100	VLVE-101	Rich Flash	Rich Flash	TEG/TEG Exchanger	Glycol Regenerator	Condenser	XCHG-100
To Block:		Glycol Contactor	--	VSSL-101	TEG Makeup	VSSL-100	Reflux Coil	VLVE-100	Rich Flash	XCHG-100	--	TEG/TEG Exchanger	Glycol Regenerator	Condenser	Glycol Regenerator	Reboiler
Temperature	°F	120	120	120*	232.718	120	122.860	131.706	134.689			134.689	300*	294.255	211.097	325*
Pressure	psia	864.696	864.696	14.2000	44.6959*	864.696	864.696	859.696	74.6959*	24.6959*	74.6959	74.6959	69.6959	14.7000	14.7000	22.6959
Mole Fraction Vapor	%	100		5.82315	0	100	0	0.00856081	3.21676			0	0.327587	100	0	
Mole Fraction Light Liquid	%	0		94.1768	100	0	100	99.9914	96.7832			100	99.6724	0	100	
Mole Fraction Heavy Liquid	%	0		0	0	0	0	0	0			0	0	0	0	
Molecular Weight	lb/lbmol	21.2300		19.9005	140.802	21.2300	111.865	111.865	111.865			114.671	114.671	20.4838	26.3164	
Mass Density	lb/ft^3	3.47268		0.784266	65.4282	3.47268	67.1374	66.9059	25.9166			67.8907	52.5848	0.0374528	64.0488	
Molar Flow	lbmol/h	25386.7	0	59.5868	216.100	25386.7	284.850	284.850	284.850	0	0	275.687	275.687	65.5455	5.95868	0
Mass Flow	lb/h	538958	0	1185.81	30427.4	538958	31864.6	31864.6	31864.6	0	0	31613.2	31613.2	1342.62	156.811	0
Vapor Volumetric Flow	ft^3/h	155200		1512.00	465.049	155200	474.618	476.260	1229.50			465.648	601.185	35848.3	2.44831	
Liquid Volumetric Flow	gpm	19349.6		188.509	57.9802	19349.6	59.1731	59.3779	153.289			58.0548	74.9529	4469.40	0.305243	
Std Vapor Volumetric Flow	MMSCFD	231.212	0	0.542694	1.96816	231.212	2.59430	2.59430	2.59430	0	0	2.51085	2.51085	0.596963	0.0542694	0
Std Liquid Volumetric Flow	sgpm	3061.35	0	2.60967	53.9115	3061.35	57.7857	57.7857	57.7857	0	0	56.5212	56.5212	2.91027	0.300599	0
Compressibility		0.849775		0.0579223	0.0129449	0.849775	0.230468	0.226488	0.0505475			0.0197800	0.0186428	0.993693	0.000839069	
Specific Gravity		0.733016			1.04905	0.733016	1.07646					1.08854		0.707253	1.02694	
API Gravity					-6.10351		-2.73968					-4.64850			2.77937	
Enthalpy	Btu/h	-8.60394E+08	0	-7.01210E+06	-6.85978E+07	-8.60394E+08	-7.79523E+07	-7.77885E+07	-7.77885E+07	0	0	-7.74505E+07	-7.41859E+07	-6.56274E+06	-800010	0
Mass Enthalpy	Btu/lb	-1596.40		-5913.34	-2254.48	-1596.40	-2446.36	-2441.22	-2441.22			-2449.95	-2346.68	-4888.01	-5101.74	
Mass Cp	Btu/(lb*°F)	0.609239		0.896179	0.608880	0.609239	0.580505	0.584983	0.585616			0.586436	0.658191	0.468770	0.930006	
Ideal Gas CpCv Ratio		1.23469		1.29055	1.02930	1.23469	1.04214	1.04164	1.04148			1.04044	1.03441	1.26245	1.19310	
Dynamic Viscosity	cP	0.0130656			2.80525	0.0130656	9.32769					9.43877		0.0142254	0.588145	
Kinematic Viscosity	cSt	0.234880			2.67661	0.234880	8.67339					8.67928		23.7115	0.573261	
Thermal Conductivity	Btu/(h*ft*°F)	0.0223792			0.113184?	0.0223792	0.115524?					0.117344?		0.0176216	0.262773?	
Surface Tension	lbf/ft				0.00260916?		0.00289166					0.00296301			0.00402734	
Net Ideal Gas Heating Value	Btu/ft^3	1132.77		142.775	3503.66	1132.77	2735.05	2735.05	2735.05			2777.24	2777.24	151.337	236.957	
Net Liquid Heating Value	Btu/lb	20185.1		1790.19	9171.73	20185.1	8983.72	8983.72	8983.72			8894.85	8894.85	1889.73	2642.43	
Gross Ideal Gas Heating Value	Btu/ft^3	1248.50		201.554	3834.11	1248.50	3002.54	3002.54	3002.54			3048.97	3048.97	211.067	306.205	
Gross Liquid Heating Value	Btu/lb	22254.1		2911.09	10062.3	22254.1	9891.15	9891.15	9891.15			9794.08	9794.08	2996.34	3640.99	

Process Streams	Units	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:		Glycol Regenerator	Reboiler	--	TEG/TEG Exchanger	Glycol Cooler	MIX-100	VLVE-102	Glycol Pump	TEG Makeup	TEG Recycle	XCHG-101	VLVE-103	VLVE-104	VSSL-101	VSSL-101
To Block:		Reboiler	Glycol Regenerator	SAT-1	Booster Pump	Glycol Pump	VLVE-102	XCHG-101	TEG Recycle	Glycol Cooler	Glycol Contactor	SAT-1	VLVE-104	--	TEG Overhead	--
Temperature	°F	302.430	400.000	527.040	232.616	120*	96.7571	94.2651	122.061	232.715	122.061	120*	96.5771	95.9195	120	120
Pressure	psia	15.2000	15.2000	864.696	14.7000	39.6959	902.196	864.696*	1014.70*	44.6959	1014.70	864.696	22.6959*	14.6969*	14.2000	14.2000
Mole Fraction Vapor	%	0	100	79.2059	0	0	100	99.9968	0	0	0	100	100	100	100	0
Mole Fraction Light Liquid	%	100	0	20.7941	100	100	0	0.00323020	100	100	100	0	0	0	0	100
Mole Fraction Heavy Liquid	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molecular Weight	lb/lbmol	117.017	28.5146	18.0153	140.802	140.802	21.2338	21.2338	140.802	140.802	140.802	21.2338	21.9156	21.9156	50.1613	18.0295
Mass Density	lb/ft^3	63.6694	0.0473091	2.30061	65.4283	68.7326	3.92809	3.76630	68.7583	65.4283	68.7583	3.47335	0.0837738	0.0542103	0.116378	61.5891
Molar Flow	lbmol/h	274.177	58.0771	30.3293	216.100	216.105	25356.3	25356.3	216.105	216.105	216.132	25356.3	13.1758	13.1758	3.46983	56.1170
Mass Flow	lb/h	32083.4	1656.05	546.391	30427.4	30428.1	538412	538412	30428.1	30428.1	30431.9	538412	288.755	288.755	174.051	1011.76
Vapor Volumetric Flow	ft^3/h	503.906	35004.8	237.499	465.049	442.703	137067	142955	442.538	465.061	442.593	155012	3446.85	5326.58	1495.57	16.4276
Liquid Volumetric Flow	gpm	62.8246	4364.24	29.6102	57.9801	55.1942	17088.9	17823.0	55.1735	57.9816	55.1804	19326.2	429.737	664.093	186.461	2.04811
Std Vapor Volumetric Flow	MMSCFD	2.49710	0.528944	0.276228	1.96816	1.96820	230.936	230.936	1.96820	1.96820	1.96845	230.936	0.12	0.12	0.0316019	0.511092
Std Liquid Volumetric Flow	sgpm	57.0635	3.15199	1.09228	53.9115	53.9129	3060.25	3060.25	53.9129	53.9129*	53.9197	3060.25	1.62090	1.62090	0.586924	2.02275
Compressibility		0.00341575	0.993051	0.639454	0.00425807	0.0130722	0.816726	0.820076	0.332840	0.0129450	0.332840	0.849764	0.994632	0.996509	0.983882	0.000668225
Specific Gravity		1.02085	0.984535		1.04906	1.10204	0.733149		1.10245	1.04906	1.10245	0.733149	0.756689	0.756689	1.73194	0.987500
API Gravity		-5.31489			-6.09925	-6.10281			-6.24071	-6.10352	-6.24069					10.2795
Enthalpy	Btu/h	-7.51676E+07	-6.74449E+06	-3.15646E+06	-6.86021E+07	-7.06014E+07	-8.65775E+08	-8.65775E+08	-7.04839E+07	-6.85996E+07	-7.04928E+07	-8.57238E+08	-440975	-440975	-159470	-6.85263E+06
Mass Enthalpy	Btu/lb	-2342.88	-4072.65	-5776.93	-2254.62	-2320.27	-1608.02	-1608.02	-2316.41	-2254.48	-2316.41	-1592.16	-1527.16	-1527.16	-916.224	-6772.99
Mass Cp	Btu/(lb*°F)	0.657493	0.505208	0.803611	0.608888	0.556207	0.628913	0.622610	0.556378	0.608878	0.556378	0.609326	0.478034	0.476869	0.401450	0.981286
Ideal Gas CpCv Ratio		1.03362	1.16073	1.30432	1.02930	1.03336	1.24071	1.24136	1.03326	1.02930	1.03326	1.23461	1.23541	1.23558	1.11021	1.32325
Dynamic Viscosity	cP	1.41828	0.0158201		2.80443	13.8988	0.0129677		13.7543	2.80534	13.7543	0.0130613	0.0109322	0.0109112	0.00898356	0.570804
Kinematic Viscosity	cSt	1.39062	20.8759		2.67583	12.6240	0.206092		12.4880	2.67670	12.4880	0.234757	8.14661	12.5652	4.81901	0.578578
Thermal Conductivity	Btu/(h*ft*°F)	0.115612?	0.0185431		0.113186?	0.113516	0.0218803		0.113540?	0.113184?	0.113540?	0.0223801	0.0177103	0.0176569	0.0113187	0.367104
Surface Tension	lbf/ft	0.00250149?			0.00260945?	0.00296381			0.00295876	0.00260917	0.00295876					0.00466078
Net Ideal Gas Heating Value	Btu/ft^3	2825.03	299.871	0	3503.66	3503.67	1134.13	1134.13	3503.67	3503.67	3503.67	1134.13	1163.53	1163.53	2440.50	0.701878
Net Liquid Heating Value	Btu/lb	8866.80	3264.07	-1059.76	9171.73	9171.73	20206.6	20206.6	9171.73	9171.73	9171.73	20206.6	20078.6	20078.6	18266.2	-1044.15
Gross Ideal Gas Heating Value	Btu/ft^3	3101.20	374.132	50.31	3834.11	3834.11	1249.93	1249.93	3834.11	3834.11	3834.11	1249.93	1281.28	1281.28	2635.77	51.0408
Gross Liquid Heating Value	Btu/lb	9762.43	4252.37	0	10062.3	10062.3	22276.7	22276.7	10062.3	10062.3	10062.3	22276.7	22118.1	22118.1	19743.9	15.3791

Process Streams

Properties

Phase: Vapor

Property	Units	Blowdown	Dry Gas	Flash Gas	From Amine Plant	Lean TEG	PSV 0701 Scenario 19	Stripping GAs	TEG	TEG Fuel Gas	To Mol Sieve	Water Vapor	Wet Regen Gas	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:		TEG Makeup	Glycol Contactor	Rich Flash	From Amine	Reboiler	--	SPLT-100	--	--	SPLT-100	Condenser	From Mol Regen	VSSL-100	VSSL-100	BTEX Condenser	Booster Pump	SAT-1	Glycol Contactor	Reflux Coil	VLVE-100	VLVE-101	Rich Flash	Rich Flash	TEG/TEG Exchanger	Glycol Regenerator	Condenser	XCHG-100	Glycol Regenerator	Reboiler	--	TEG/TEG Exchanger	Glycol Cooler	MIX-100	VLVE-102	Glycol Pump	TEG Makeup	TEG Recycle	XCHG-101	VLVE-103	VLVE-104	VSSL-101	VSSL-101
To Block:		--	SPLT-100	--	MIX-100	TEG/TEG Exchanger	--	VLVE-101	TEG Makeup	VLVE-103	From TEG	BTEX Condenser	--	Glycol Contactor	--	VSSL-101	TEG Makeup	VSSL-100	Reflux Coil	VLVE-100	Rich Flash	XCHG-100	--	TEG/TEG Exchanger	Glycol Regenerator	Condenser	Glycol Regenerator	Reboiler	Reboiler	Glycol Regenerator	SAT-1	Booster Pump	Glycol Pump	VLVE-102	XCHG-101	TEG Recycle	Glycol Cooler	Glycol Contactor	SAT-1	VLVE-104	--	TEG Overhead	--
Temperature	°F		123.308	134.689	96.7571		120			100	123.308	211.097		120		120		120		131.706	134.689				300	294.255				400.000	527.040			96.7571	94.2651				120	96.5771	95.9195	120	
Pressure	psia		863.196	74.6959	902.196		179.696			64.6959	863.196	14.7000		864.696		14.2000		864.696		859.696	74.6959				69.6959	14.7000				15.2000	864.696			902.196	864.696				864.696	22.6959	14.6969	14.2000	
Mole Fraction Vapor	%		100	100	100		100			100	100	100		100		100		100		100	100				100	100				100	100			100	100				100	100	100	100	
Mole Fraction Light Liquid	%		0	0	0		0			0	0	0		0		0		0		0	0				0	0				0	0			0	0				0	0	0	0	
Mole Fraction Heavy Liquid	%		0	0	0		0			0	0	0		0		0		0		0	0				0	0				0	0			0	0				0	0	0	0	
Molecular Weight	lb/lbmol		21.2310	27.4425	21.2338		21.9620			21.9156	21.2310	19.9005		21.2300		50.1613		21.2300		21.3329	27.4425				33.8974	20.4838				28.5146	18.0153			21.2338	21.2339				21.2338	21.9156	21.9156	50.1613	
Mass Density	lb/ft^3		3.43230	0.329189	3.92809		0.658648			0.239654	3.43230	0.0409792		3.47268		0.116378		3.47268		3.35977	0.329189				0.294816	0.0374528				0.0473091	1.84086			3.92809	3.76620				3.47335	0.0837738	0.0542103	0.116378	
Molar Flow	lbmol/h		25317.9	9.16292	25356.3		418.069			13.1758	25317.9	59.5868		25386.7		3.46983		25386.7		0.0243854	9.16292				0.903113	65.5455				58.0771	24.0226			25356.3	25355.5				25356.3	13.1758	13.1758	3.46983	
Mass Flow	lb/h		537526	251.454	538412		9181.62			288.755	537526	1185.81		538958		174.051		538958		0.520212	251.454				30.6132	1342.62				1656.05	432.774			538412	538397				538412	288.755	288.755	174.051	
Vapor Volumetric Flow	ft^3/h		156608	763.857	137067		13940.1			1204.88	156608	28936.8		155200		1495.57		155200		0.154836	763.857				103.838	35848.3				35004.8	235.093			137067	142955				155012	3446.85	5326.58	1495.57	
Liquid Volumetric Flow	gpm		19525.1	95.2341	17088.9		1737.99			150.219	19525.1	3607.71		19349.6		186.461		19349.6		0.0193042	95.2341				12.9461	4469.40				4364.24	29.3103			17088.9	17822.9				19326.2	429.737	664.093	186.461	
Std Vapor Volumetric Flow	MMSCFD		230.586	0.0834523	230.936		3.80761			0.12	230.586	0.542694		231.212		0.0316019		231.212		0.000222093	0.0834523				0.00822521	0.596963				0.528944	0.218789			230.936	230.928				230.936	0.12	0.12	0.0316019	
Std Liquid Volumetric Flow	sgpm		3057.48	1.26449	3060.25		51.4868			1.62090	3057.48	2.60967		3061.35		0.586924		3061.35		0.00295200	1.26449				0.122132	2.91027				3.15199	0.865146			3060.25	3060.22				3060.25	1.62090	1.62090	0.586924	
Compressibility			0.853452	0.976255	0.816726		0.963190			0.985031	0.853452	0.991706		0.849775		0.983882		0.849775		0.860118	0.976255				0.982957	0.993693				0.993051	0.799154			0.816726	0.820102				0.849764	0.994632	0.996509	0.983882	
Specific Gravity			0.733052	0.947519	0.733149		0.758290			0.756689	0.733052	0.687114		0.733016		1.73194		0.733016		0.736570	0.947519				1.17039	0.707253				0.984535	0.622021			0.733149	0.733153				0.733149	0.756689	0.756689	1.73194	
API Gravity																																											
Enthalpy	Btu/h		-8.52935E+08	-337961	-8.65775E+08		-1.39429E+07			-440975	-8.52935E+08	-5.92655E+06		-8.60394E+08		-159470		-8.60394E+08		-821.628	-337961				-47540.5	-6.56274E+06				-6.74449E+06	-2.43716E+06			-8.65775E+08	-8.65674E+08				-8.57238E+08	-440975	-440975	-159470	
Mass Enthalpy	Btu/lb		-1586.78	-1344.03	-1608.02		-1518.57			-1527.16	-1586.78	-4997.89		-1596.40		-916.224		-1596.40		-1579.41	-1344.03				-1552.94	-4888.01				-4072.65	-5631.49			-1608.02	-1607.87				-1592.16	-1527.16	-1527.16	-916.224	
Mass Cp	Btu/(lb*°F)		0.608094	0.482472	0.628913		0.505143			0.484182	0.608094	0.457461		0.609239		0.401450		0.609239		0.606006	0.482472				0.536537	0.468770				0.505208	0.636722			0.628913	0.622600				0.609326	0.478034	0.476869	0.401450	
Ideal Gas CpCv Ratio			1.23374	1.18032	1.24071		1.22871			1.23450	1.23374	1.28142		1.23469		1.11021		1.23469		1.23044	1.18032				1.12398	1.26245				1.16073	1.30432			1.24071	1.24136				1.23461	1.23541	1.23558	1.11021	
Dynamic Viscosity	cP		0.0130874	0.0108866	0.0129677		0.0115279			0.0110434	0.0130874	0.0126110		0.0130656		0.00898356		0.0130656		0.0131650	0.0108866				0.0131515	0.0142254				0.0158201	0.0199023			0.0129677	0.0128155				0.0130613	0.0109322	0.0109112	0.00898356	
Kinematic Viscosity	cSt		0.238039	2.06456	0.206092		1.09264			2.87671	0.238039	19.2117		0.234880		4.81901		0.234880		0.244618	2.06456				2.78485	23.7115				20.8759	0.674935			0.206092	0.212427				0.234757	8.14661	12.5652	4.81901	
Thermal Conductivity	Btu/(h*ft*°F)		0.0224826	0.0175981	0.0218803		0.0191943			0.0179906	0.0224826	0.0153158		0.0223792		0.0113187		0.0223792		0.0227196	0.0175981				0.0213314	0.0176216				0.0185431	0.0292634			0.0218803	0.0216021				0.0223801	0.0177103	0.0176569	0.0113187	
Surface Tension	lbf/ft																																										
Net Ideal Gas Heating Value	Btu/ft^3		1134.99	1465.58	1134.13		1166.40			1163.53	1134.99	142.775		1132.77		2440.50		1132.77		1140.80	1465.58				1568.96	151.337				299.871	0			1134.13	1134.16				1134.13	1163.53	1163.53	2440.50	
Net Liquid Heating Value	Btu/lb		20225.6	20156.7	20206.6		20085.4			20078.6	20225.6	1790.19		20185.1		18266.2		20185.1		20230.7	20156.7				17316.5	1889.73				3264.07	-1059.76			20206.6	20207.2				20206.6	20078.6	20078.6	18266.2	
Gross Ideal Gas Heating Value	Btu/ft^3		1250.84	1605.68	1249.93		1284.37			1281.28	1250.84	201.554		1248.50		2635.77		1248.50		1257.10	1605.68				1719.08	211.067				374.132	50.31			1249.93	1249.97				1249.93	1281.28	1281.28	2635.77	
Gross Liquid Heating Value	Btu/lb		22296.7	22094.7	22276.7		22124.3			22118.1	22296.7	2911.09		22254.1		19743.9		22254.1		22299.9	22094.7				18997.5	2996.34				4252.37	0			22276.7	22277.3				22276.7	22118.1	22118.1	19743.9	

Process Streams — Composition

Phase: Light Liquid

Process Streams	Blowdown	Dry Gas	Flash Gas	From Amine Plant	Lean TEG	PSV 0701 Scenario 19	Stripping GAs	TEG	TEG Fuel Gas	To Mol Sieve	Water Vapor	Wet Regen Gas
Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved
From Block:	TEG Makeup	Glycol Contactor	Rich Flash	From Amine	Reboiler	--	SPLT-100	--	--	SPLT-100	Condenser	From Mol Regen
To Block:	--	SPLT-100	--	MIX-100	TEG/TEG Exchanger	--	VLVE-101	TEG Makeup	VLVE-103	From TEG	BTEX Condenser	--
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%
N2					[illegible]			[illegible]				
C1					[illegible]			[illegible]				
CO2					[illegible]			[illegible]				
C2					[illegible]			[illegible]				
H2S					[illegible]			[illegible]				
C3					[illegible]			[illegible]				
iC4					[illegible]			[illegible]				
nC4					[illegible]			[illegible]				
iC5					[illegible]			[illegible]				
nC5					[illegible]			[illegible]				
C6					[illegible]			[illegible]				
C7					[illegible]			[illegible]				
C8					[illegible]			[illegible]				
C9					[illegible]			[illegible]				
C10					[illegible]			[illegible]				
Cyclopentane					[illegible]			[illegible]				
Benzene					[illegible]			[illegible]				
Cyclohexane					[illegible]			[illegible]				
Methylcyclohexane					[illegible]			[illegible]				
2,2,4-Trimethylpentane					[illegible]			[illegible]				
Toluene					[illegible]			[illegible]				
Ethylbenzene					[illegible]			[illegible]				
p-Xylene					[illegible]			[illegible]				
H2O					[illegible]			[illegible]				
MDEA					[illegible]			[illegible]				
Piperazine					[illegible]			[illegible]				
TEG					[illegible]			[illegible]				
CHEMTHERM 550					[illegible]			[illegible]				
Molar Flow	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
N2					[illegible]			[illegible]				
C1					[illegible]			[illegible]				
CO2					[illegible]			[illegible]				
C2					[illegible]			[illegible]				
H2S					[illegible]			[illegible]				
C3					[illegible]			[illegible]				
iC4					[illegible]			[illegible]				
nC4					[illegible]			[illegible]				
iC5					[illegible]			[illegible]				
nC5					[illegible]			[illegible]				
C6					[illegible]			[illegible]				
C7					2.67634E-08			0				
C8					3.96648E-08			0				
C9					1.06010E-07			0				
C10					0			0				
Cyclopentane					1.18130E-06			0				
Benzene					0.000307210			0				
Cyclohexane					1.45563E-06			0				
Methylcyclohexane					9.55428E-07			0				
2,2,4-Trimethylpentane					1.07294E-08			0				
Toluene					0.000399379			0				
Ethylbenzene					3.96206E-05			0				
p-Xylene					0.000183551			0				
H2O					15.3207			4.68461E-05				
MDEA					0.00705047			0				
Piperazine					2.68917E-07			0				
TEG					200.771			0.00515828				
CHEMTHERM 550					0			0				
Mass Fraction	%	%	%	%	%	%	%	%	%	%	%	%
N2					7.34123E-17			0				
C1					7.00718E-13			0				
CO2					2.15447E-12			0				
C2					4.74376E-11			0				
H2S					0			0				
C3					5.55234E-10			0				
iC4					2.12508E-10			0				
nC4					2.26353E-09			0				
iC5					5.50042E-09			0				
nC5					1.07561E-08			0				
C6					8.67029E-08			0				
C7					8.81359E-09			0				
C8					1.48907E-08			0				
C9					4.46846E-08			0				
C10					0			0				
Cyclopentane					2.72281E-07			0				
Benzene					7.88658E-05			0				
Cyclohexane					4.02615E-07			0				
Methylcyclohexane					3.08307E-07			0				
2,2,4-Trimethylpentane					4.02798E-09			0				
Toluene					0.000120938			0				
Ethylbenzene					1.38241E-05			0				
p-Xylene					6.40433E-05			0				
H2O					0.907098			0.108829				
MDEA					0.00276117			0				
Piperazine					7.61267E-08			0				
TEG					99.0899			99.8912				
CHEMTHERM 550					0			0				
Mass Flow	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
N2					2.23374E-14			0				
C1					2.13210E-10			0				
CO2					6.55548E-10			0				
C2					1.44340E-08			0				
H2S					0			0				
C3					1.68943E-07			0				
iC4					6.46605E-08			0				
nC4					6.88732E-07			0				
iC5					1.67363E-06			0				
nC5					3.27281E-06			0				
C6					2.63814E-05			0				
C7					2.68174E-06			0				
C8					4.53085E-06			0				
C9					1.35963E-05			0				
C10					0			0				
Cyclopentane					8.28480E-05			0				
Benzene					0.0239968			0				
Cyclohexane					0.000122505			0				
Methylcyclohexane					9.38097E-05			0				
2,2,4-Trimethylpentane					1.22561E-06			0				
Toluene					0.0367981			0				
Ethylbenzene					0.00420632			0				
p-Xylene					0.0194867			0				
H2O					276.006			0.000843946				
MDEA					0.840150			0				
Piperazine					2.31633E-05			0				
TEG					30150.4			0.774634				
CHEMTHERM 550					0			0				

Process Streams	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:	VSSL-100	VSSL-100	BTEX Condenser	Booster Pump	SAT-1	Glycol Contactor	Reflux Coil	VLVE-100	VLVE-101	Rich Flash	Rich Flash	TEG/TEG Exchanger	Glycol Regenerator	Condenser	XCHG-100	Glycol Regenerator	Reboiler	--	TEG/TEG Exchanger	Glycol Cooler	MIX-100	VLVE-102	Glycol Pump	TEG Makeup	TEG Recycle	XCHG-101	VLVE-103	VLVE-104	VSSL-101	VSSL-101
To Block:	Glycol Contactor	--	VSSL-101	TEG Makeup	VSSL-100	Reflux Coil	VLVE-100	Rich Flash	XCHG-100	--	TEG/TEG Exchanger	Glycol Regenerator	Condenser	Glycol Regenerator	Reboiler	Reboiler	Glycol Regenerator	SAT-1	Booster Pump	Glycol Pump	VLVE-102	XCHG-101	TEG Recycle	Glycol Cooler	Glycol Contactor	SAT-1	VLVE-104	--	TEG Overhead	--
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
N2			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C1			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
CO2			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C2			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
H2S			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C3			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
iC4			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
nC4			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
iC5			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
nC5			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C6			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C7			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C8			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C9			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C10			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Cyclopentane			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Benzene			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Cyclohexane			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Methylcyclohexane			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
2,2,4-Trimethylpentane			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Toluene			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Ethylbenzene			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
p-Xylene			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
H2O			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
MDEA			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Piperazine			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
TEG			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
CHEMTHERM 550			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
Molar Flow	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
N2			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C1			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
CO2			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C2			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
H2S			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C3			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
iC4			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
nC4			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
iC5			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
nC5			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C6			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
C7			1.70126E-07	2.67634E-08		0.00600724	0.00600651	0.00522742			0.00522742	0.00491646		6.22103E-08		8.34226E-07		0	2.67634E-08	2.67634E-08		5.34894E-10	2.67634E-08	2.67634E-08	2.85396E-08					1.70126E-07
C8			3.35173E-08	3.96648E-08		0.00226014	0.00225994	0.00207144			0.00207144	0.00198230		2.57239E-08		9.47739E-07		0	3.96648E-08	3.96648E-08		5.10734E-11	3.96648E-08	3.96648E-08	4.22442E-08					3.35173E-08
C9			1.50488E-08	1.06010E-07		0.00163032	0.00163022	0.00155095			0.00155095	0.00150190		1.24113E-08		1.92310E-06		0	1.06010E-07	1.06010E-07		1.47779E-11	1.06010E-07	1.06010E-07	1.12912E-07					1.50488E-08
C10			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Cyclopentane			5.20117E-05	1.18130E-06		0.0790604	0.0790553	0.0706054			0.0706054	0.0674690		3.12280E-06		2.71523E-05		0	1.18130E-06	1.18130E-06		1.78872E-07	1.18130E-06	1.18130E-06	1.25813E-06					5.20117E-05
Benzene			0.00611897	0.000307210		0.281006	0.281003	0.276316			0.276316	0.272281		0.000154746		0.00336813		0	0.000307210	0.000307210		2.76089E-06	0.000307210	0.000307210	0.000323491					0.00611897
Cyclohexane			2.78796E-05	1.45563E-06		0.0438087	0.0438059	0.0399788			0.0399788	0.0385075		2.13317E-06		2.82681E-05		0	1.45563E-06	1.45563E-06		6.84790E-08	1.45563E-06	1.45563E-06	1.54856E-06					2.78796E-05
Methylcyclohexane			4.80034E-06	9.55428E-07		0.0170847	0.0170838	0.0159079			0.0159079	0.0153906		6.59613E-07		1.68918E-05		0	9.55428E-07	9.55428E-07		8.18244E-09	9.55428E-07	9.55428E-07	1.01616E-06					4.80034E-06
2,2,4-Trimethylpentane			7.76856E-08	1.07294E-08		0.00296039	0.00296000	0.00255531			0.00255531	0.00239788		3.50172E-08		3.63322E-07		0	1.07294E-08	1.07294E-08		3.32064E-10	1.07294E-08	1.07294E-08	1.14215E-08					7.76856E-08
Toluene			0.00163293	0.000399379		0.0960302	0.0960295	0.0951400			0.0951400	0.0941669		6.54502E-05		0.00343893		0	0.000399379	0.000399379		3.58681E-07	0.000399379	0.000399379	0.000419273					0.00163293
Ethylbenzene			5.21680E-05	3.96206E-05		0.00396459	0.00396457	0.00393957			0.00393957	0.00390771		2.66180E-06		0.000287599		0	3.96206E-05	3.96206E-05		7.51438E-09	3.96206E-05	3.96206E-05	4.14909E-05					5.21680E-05
p-Xylene			0.000192554	0.000183551		0.0178533	0.0178532	0.0177372			0.0177372	0.0175950		1.21563E-05		0.00132765		0	0.000183551	0.000183551		2.66521E-08	0.000183551	0.000183551	0.000192257					0.000192554
H2O			56.1063	15.3207		71.9005	71.9005	71.8401			71.8401	71.6407		5.58426		68.7801		6.30672	15.3207	15.3207		0.818220	15.3207	15.3207	15.3229					56.1063
MDEA			4.15843E-05	0.00705047		0.00711252	0.00711252	0.00711250			0.00711250	0.00711222		1.56398E-05		0.00767673		0	0.00705047	0.00705047		0	0.00705047	0.00705047	0.00712467					4.15843E-05
Piperazine			2.12219E-08	2.68917E-07		2.90195E-07	2.90195E-07	2.90139E-07			2.90139E-07	2.89917E-07		5.82323E-08		5.55019E-07		0	2.68917E-07	2.68917E-07		0	2.68917E-07	2.68917E-07	3.29727E-07					2.12219E-08
TEG			0.00198669	200.771		200.773	200.773	200.773			200.773	200.772		0.374139		205.381		0	200.771	200.776		0	200.776	200.776	200.801					0.00198669
CHEMTHERM 550			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Mass Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
N2			3.40035E-07	7.34123E-17		0.00402766	0.00398067	7.24661E-05			7.24661E-05	1.67142E-05		3.85915E-08		5.88933E-14		0	7.34123E-17	0		0.00228948	0	0	0					3.40035E-07
C1			0.000176264	7.00718E-13		0.274526	0.273591	0.0185638			0.0185638	0.00804106		2.25723E-05		2.61094E-10		0	7.00718E-13	0		0.0748174	0	0	0					0.000176264
CO2			3.90698E-05	2.15447E-12		0.000622046	0.000621802	0.000251105			0.000251105	0.000191024		2.72825E-06		2.67353E-10		0	2.15447E-12	0		0.000307068	0	0	0					3.90698E-05
C2			0.000513878	4.74376E-11		0.214630	0.214366	0.0433948			0.0433948	0.0279354		8.40997E-05		8.49279E-09		0	4.74376E-11	0		0.0204263	0	0	0					0.000513878
H2S			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
C3			0.000707799	5.55234E-10		0.262595	0.262395	0.0865850			0.0865850	0.0640489		0.000189098		6.80699E-08		0	5.55234E-10	0		0.00815622	0	0	0					0.000707799
iC4			7.39305E-05	2.12508E-10		0.0433820	0.0433501	0.0163037			0.0163037	0.0125688		2.54088E-05		2.17136E-08		0	2.12508E-10	0		0.000640493	0	0	0					7.39305E-05
nC4			0.000511871	2.26353E-09		0.143581	0.143508	0.0674086			0.0674086	0.0547816		0.000196858		1.93709E-07		0	2.26353E-09	2.26347E-09		0.00208850	2.26347E-09	2.26347E-09	2.41861E-09					0.000511871
iC5			0.000151267	5.50042E-09		0.0541730	0.0541540	0.0332462			0.0332462	0.0288045		8.39392E-05		3.27633E-07		0	5.50042E-09	5.50028E-09		0.000262319	5.50028E-09	5.50028E-09	5.87895E-09					0.000151267
nC5			0.000107890	1.07561E-08		0.0638251	0.0638066	0.0417493			0.0417493	0.0367239		0.000109251		5.90211E-07		0	1.07561E-08	1.07559E-08		0.000121255	1.07559E-08	1.07559E-08	1.14958E-08					0.000107890
C6			0.000133830	8.67029E-08		0.107033	0.107013	0.0833867			0.0833867	0.0761344		0.000211557		3.58643E-06		0	8.67029E-08	8.67007E-08		6.48171E-05	8.67007E-08	8.67007E-08	9.25533E-08					0.000133830
C7			1.68488E-06	8.81359E-09		0.00188905	0.00188885	0.00165690			0.00165690	0.00155985		3.97522E-06		2.60543E-07		0	8.81359E-09	8.81336E-09		3.63204E-07	8.81336E-09	8.81336E-09	9.39710E-09					1.68488E-06
C8			3.78413E-07	1.48907E-08		0.000810217	0.000810157	0.000748479			0.000748479	0.000716962		1.87385E-06		3.37430E-07		0	1.48907E-08	1.48903E-08		3.95345E-08	1.48903E-08	1.48903E-08	1.58567E-08					3.78413E-07
C9			1.90766E-07	4.46846E-08		0.000656205	0.000656174	0.000629221			0.000629221	0.000609912		1.01511E-06		7.68771E-07		0	4.46846E-08	4.46835E-08		1.28438E-08	4.46835E-08	4.46835E-08	4.75865E-08					1.90766E-07
C10			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Cyclopentane			0.000360533	2.72281E-07		0.0174009	0.0174001	0.0156636			0.0156636	0.0149823		0.000139666		5.93536E-06		0	2.72281E-07	2.72274E-07		8.50101E-05	2.72274E-07	2.72274E-07	2.89947E-07					0.000360533
Benzene			0.0472409	7.88658E-05		0.0688849	0.0688853	0.0682739			0.0682739	0.0673421		0.00770831		0.000820022		0	7.88658E-05	7.88638E-05		0.00146141	7.88638E-05	7.88638E-05	8.30328E-05					0.0472409
Cyclohexane			0.000231907	4.02615E-07		0.0115706	0.0115700	0.0106430			0.0106430	0.0102613		0.000114486		7.41513E-06		0	4.02615E-07	4.02605E-07		3.90541E-05	4.02605E-07	4.02605E-07	4.28253E-07					0.000231907
Methylcyclohexane			4.65848E-05	3.08307E-07		0.00526440	0.00526419	0.00494078			0.00494078	0.00478475		4.13012E-05		5.16947E-06		0	3.08307E-07	3.08299E-07		5.44427E-06	3.08299E-07	3.08299E-07	3.27854E-07					4.65848E-05
2,2,4-Trimethylpentane			8.77078E-07	4.02798E-09		0.00106124	0.00106112	0.000923317			0.000923317	0.000867272		2.55082E-06		1.29356E-07		0	4.02798E-09	4.02788E-09		2.57042E-07	4.02788E-09	4.02788E-09	4.28714E-09					8.77078E-07
Toluene			0.0148707	0.000120938		0.0277677	0.0277680	0.0277291			0.0277291	0.0274721		0.00384570		0.000987606		0	0.000120938	0.000120935		0.000223952	0.000120935	0.000120935	0.000126943					0.0148707
Ethylbenzene			0.000547405	1.38241E-05		0.00132090	0.00132092	0.00132301			0.00132301	0.00131358		0.000180211		9.51675E-05		0	1.38241E-05	1.38238E-05		5.40607E-06	1.38238E-05	1.38238E-05	1.44745E-05					0.000547405
p-Xylene			0.00202049	6.40433E-05		0.00594828	0.00594834	0.00595660			0.00595660	0.00591456		0.000823014		0.000439323		0	6.40433E-05	6.40417E-05		1.91743E-05	6.40417E-05	6.40417E-05	6.70708E-05					0.00202049
H2O			99.9023	0.907098		4.06503	4.06510	4.09392			4.09392	4.08652		64.1549		3.86210		100	0.907098	0.907078		99.8890	0.907078	0.907078	0.907092					99.9023
MDEA			0.000489769	0.00276117		0.00265983	0.00265987	0.00268098			0.00268098	0.00268347		0.00118848		0.00285125		0	0.00276117	0.00276110		0	0.00276110	0.00276110	0.00278980					0.000489769
Piperazine			1.80672E-07	7.61267E-08		7.84449E-08	7.84461E-08	7.90536E-08			7.90536E-08	7.90694E-08		3.19868E-06		1.49008E-07		0	7.61267E-08	7.61248E-08		0	7.61248E-08	7.61248E-08	9.33269E-08					1.80672E-07
TEG			0.0294880	99.0899		94.6213	94.6229	95.3739			95.3739	95.4657		35.8301		96.1327		0	99.0899	99.0899		0	99.0899	99.0899	99.0898					0.0294880
CHEMTHERM 550			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Mass Flow	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
N2			3.44033E-06	2.23374E-14		1.28340	1.26840	0.0229088			0.0229088	0.00527877		6.05158E-08		1.88950E-11		0	2.23374E-14	0		0.000337854	0	0	0					3.44033E-06
C1			0.00178337	2.13210E-10		87.4765	87.1773	5.86861			5.86861	2.53957		3.53958E-05		8.37678E-08		0	2.13210E-10	0		0.0110407	0	0	0					0.00178337
CO2			0.000395292	6.55548E-10		0.198212	0.198132	0.0793822			0.0793822	0.0603302		4.27820E-06		8.57758E-08		0	6.55548E-10	0		4.53136E-05	0	0	0					0.000395292
C2			0.00519920	1.44340E-08		68.3911	68.3056	13.7185			13.7185	8.82271		0.000131878		2.72477E-06		0	1.44340E-08	0		0.00301428	0	0	0					0.00519920
H2S			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
C3			0.00716122	1.68943E-07		83.6749	83.6098	27.3723			27.3723	20.2283		0.000296527		2.18391E-05		0	1.68943E-07	0		0.00120360	0	0	0					0.00716122
iC4			0.000747998	6.46605E-08		13.8235	13.8131	5.15413			5.15413	3.96956		3.98438E-05		6.96647E-06		0	6.46605E-08	0		9.45165E-05	0	0	0					0.000747998
nC4			0.00517890	6.88732E-07		45.7517	45.7276	21.3100			21.3100	17.3014		0.000308696		6.21486E-05		0	6.88732E-07	6.88732E-07		0.000308197	6.88732E-07	6.88732E-07	7.36029E-07					0.00517890
iC5			0.00153045	1.67363E-06		17.2620	17.2557	10.5102			10.5102	9.09720		0.000131626		0.000105116		0	1.67363E-06	1.67363E-06		3.87100E-05	1.67363E-06	1.67363E-06	1.78908E-06					0.00153045
nC5			0.00109158	3.27281E-06		20.3376	20.3314	13.1983			13.1983	11.5983		0.000171317		0.000189360		0	3.27281E-06	3.27281E-06		1.78933E-05	3.27281E-06	3.27281E-06	3.49839E-06					0.00109158
C6			0.00135404	2.63814E-05		34.1055	34.0987	26.3612			26.3612	24.0452		0.000331745		0.00115065		0	2.63814E-05	2.63814E-05		9.56495E-06	2.63814E-05	2.63814E-05	2.81658E-05					0.00135404
C7			1.70469E-05	2.68174E-06		0.601938	0.601864	0.523798			0.523798	0.492639		6.23359E-06		8.35911E-05		0	2.68174E-06	2.68174E-06		5.35974E-08	2.68174E-06	2.68174E-06	2.85972E-06					1.70469E-05
C8			3.82863E-06	4.53085E-06		0.258173	0.258149	0.236618			0.236618	0.226435		2.93840E-06		0.000108259		0	4.53085E-06	4.53085E-06		5.83404E-09	4.53085E-06	4.53085E-06	4.82549E-06					3.82863E-06
C9			1.93009E-06	1.35963E-05		0.209097	0.209084	0.198917			0.198917	0.192626		1.59181E-06		0.000246648		0	1.35963E-05	1.35963E-05		1.89534E-09	1.35963E-05	1.35963E-05	1.44815E-05					1.93009E-06
C10			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Cyclopentane			0.00364773	8.28480E-05		5.54473	5.54438	4.95176			4.95176	4.73179		0.000219011		0.00190427		0	8.28480E-05	8.28480E-05		1.25448E-05	8.28480E-05	8.28480E-05	8.82364E-05					0.00364773
Benzene			0.477964	0.0239968		21.9499	21.9497	21.5835			21.5835	21.2684		0.0120875		0.263091		0	0.0239968	0.0239968		0.000215658	0.0239968	0.0239968	0.0252685					0.477964
Cyclohexane			0.00234634	0.000122505		3.68692	3.68668	3.36460			3.36460	3.24077		0.000179526		0.00237903		0	0.000122505	0.000122505		5.76316E-06	0.000122505	0.000122505	0.000130326					0.00234634
Methylcyclohexane			0.000471326	9.38097E-05		1.67748	1.67739	1.56194			1.56194	1.51115		6.47648E-05		0.00165854		0	9.38097E-05	9.38097E-05		8.03402E-07	9.38097E-05	9.38097E-05	9.97723E-05					0.000471326
2,2,4-Trimethylpentane			8.87391E-06	1.22561E-06		0.338161	0.338117	0.291890			0.291890	0.273907		3.99996E-06		4.15017E-05		0	1.22561E-06	1.22561E-06		3.79312E-08	1.22561E-06	1.22561E-06	1.30466E-06					8.87391E-06
Toluene			0.150455	0.0367981		8.84807	8.84801	8.76605			8.76605	8.67639		0.00603048		0.316858		0	0.0367981	0.0367981		3.30483E-05	0.0367981	0.0367981	0.0386312					0.150455
Ethylbenzene			0.00553842	0.00420632		0.420901	0.420899	0.418245			0.418245	0.414863		0.000282590		0.0305330		0	0.00420632	0.00420632		7.97765E-07	0.00420632	0.00420632	0.00440488					0.00553842
p-Xylene			0.0204425	0.0194867		1.89540	1.89538	1.88307			1.88307	1.86797		0.00129058		0.140950		0	0.0194867	0.0194867		2.82952E-06	0.0194867	0.0194867	0.0204109					0.0204425
H2O			1010.77	276.006		1295.31	1295.31	1294.22			1294.22	1290.63		100.602		1239.09		113.617	276.006	276.007		14.7405	276.007	276.007	276.046					1010.77
MDEA			0.00495528	0.840150		0.847544	0.847544	0.847542			0.847542	0.847508		0.00186367		0.914776		0	0.840150	0.840150		0	0.840150	0.840150	0.848991					0.00495528
Piperazine			1.82796E-06	2.31633E-05		2.49961E-05	2.49961E-05	2.49913E-05			2.49913E-05	2.49721E-05		5.01588E-06		4.78069E-05		0	2.31633E-05	2.31633E-05		0	2.31633E-05	2.31633E-05	2.84012E-05					1.82796E-06
TEG			0.298348	30150.4		30150.7	30150.7	30150.7			30150.7	30150.5		56.1856		30842.6		0	30150.4	30151.2		0	30151.2	30151.2	30155.0					0.298348
CHEMTHERM 550			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0

Process Streams — Properties

Phase: Light Liquid

Property	Units	Blowdown	Dry Gas	Flash Gas	From Amine Plant	Lean TEG	PSV 0701 Scenario 19	Stripping GAs	TEG	TEG Fuel Gas	To Mol Sieve	Water Vapor	Wet Regen Gas
Status:		Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved
From Block:		TEG Makeup	Glycol Contactor	Rich Flash	From Amine	Reboiler	--	SPLT-100	--	--	SPLT-100	Condenser	From Mol Regen
To Block:		--	SPLT-100	--	MIX-100	TEG/TEG Exchanger	--	VLVE-101	TEG Makeup	VLVE-103	From TEG	BTEX Condenser	--
Temperature	°F					400.000			100				
Pressure	psia					15.2000			44.1959				
Mole Fraction Vapor	%					0			0				
Mole Fraction Light Liquid	%					100			100				
Mole Fraction Heavy Liquid	%					0			0				
Molecular Weight	lb/lbmol					140.802			148.984				
Mass Density	lb/ft^3					60.0048			69.3628				
Molar Flow	lbmol/h					216.100			0.00520513				
Mass Flow	lb/h					30427.4			0.775478				
Vapor Volumetric Flow	ft^3/h					507.082			0.0111800				
Liquid Volumetric Flow	gpm					63.2206			0.00139387				
Std Vapor Volumetric Flow	MMSCFD					1.96816			4.74063E-05				
Std Liquid Volumetric Flow	sgpm					53.9115			0.00137258				
Compressibility						0.00386609			0.0158051				
Specific Gravity						0.962097			1.11214				
API Gravity						-6.09932			-6.36228				
Enthalpy	Btu/h					-6.53374E+07			-1779.35				
Mass Enthalpy	Btu/lb					-2147.33			-2294.52				
Mass Cp	Btu/(lb*°F)					0.670956			0.539661				
Ideal Gas CpCv Ratio						1.02606			1.03243				
Dynamic Viscosity	cP					0.796473			21.1484				
Kinematic Viscosity	cSt					0.828637			19.0340				
Thermal Conductivity	Btu/(h*ft*°F)					0.106518?			0.112159				
Surface Tension	lbf/ft					0.00204072?			0.00301110				
Net Ideal Gas Heating Value	Btu/ft^3					3503.66			3737.08				
Net Liquid Heating Value	Btu/lb					9171.73			9254.08				
Gross Ideal Gas Heating Value	Btu/ft^3					3834.11			4086.19				
Gross Liquid Heating Value	Btu/lb					10062.3			10143.3				

Property	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved
From Block:	VSSL-100	VSSL-100	BTEX Condenser	Booster Pump	SAT-1	Glycol Contactor	Reflux Coil	VLVE-100	VLVE-101	Rich Flash	Rich Flash	TEG/TEG Exchanger	Glycol Regenerator	Condenser	XCHG-100	Glycol Regenerator	Reboiler	--	TEG/TEG Exchanger	Glycol Cooler	MIX-100	VLVE-102	Glycol Pump	TEG Makeup	TEG Recycle	XCHG-101	VLVE-103	VLVE-104	VSSL-101	VSSL-101
To Block:	Glycol Contactor	--	VSSL-101	TEG Makeup	VSSL-100	Reflux Coil	VLVE-100	Rich Flash	XCHG-100	--	TEG/TEG Exchanger	Glycol Regenerator	Condenser	Glycol Regenerator	Reboiler	Reboiler	Glycol Regenerator	SAT-1	Booster Pump	Glycol Pump	VLVE-102	XCHG-101	TEG Recycle	Glycol Cooler	Glycol Contactor	SAT-1	VLVE-104	--	TEG Overhead	--
Temperature (°F)			120	232.718		122.860	131.706	134.689			134.689	300		211.097		302.430		527.040	232.616	120		94.2651	122.061	232.715	122.061					120
Pressure (psia)			14.2000	44.6959		864.696	859.696	74.6959			74.6959	69.6959		14.7000		15.2000		864.696	14.7000	39.6959		864.696	1014.70	44.6959	1014.70					14.2000
Mole Fraction Vapor (%)			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Mole Fraction Light Liquid (%)			100	100		100	100	100			100	100		100		100		100	100	100		100	100	100	100					100
Mole Fraction Heavy Liquid (%)			0	0		0	0	0			0	0		0		0		0	0	0		0	0	0	0					0
Molecular Weight (lb/lbmol)			18.0295	140.802		111.865	111.872	114.671			114.671	114.936		26.3164		117.017		18.0153	140.802	140.802		18.0168	140.802	140.802	140.802					18.0295
Mass Density (lb/ft^3)			61.5891	65.4282		67.1374	66.9266	67.8907			67.8907	63.5021		64.0488		63.6694		47.2327	65.4283	68.7326		61.9115	68.7583	65.4283	68.7583					61.5891
Molar Flow (lbmol/h)			56.1170	216.100		284.850	284.825	275.687			275.687	274.784		5.95868		274.177		6.30672	216.100	216.105		0.819060	216.105	216.105	216.132					56.1170
Mass Flow (lb/h)			1011.76	30427.4		31864.6	31864.1	31613.2			31613.2	31582.5		156.811		32083.4		113.617	30427.4	30428.1		14.7568	30428.1	30428.1	30431.9					1011.76
Vapor Volumetric Flow (ft^3/h)			16.4276	465.049		474.618	476.105	465.648			465.648	497.346		2.44831		503.906		2.40548	465.049	442.703		0.238354	442.538	465.061	442.593					16.4276
Liquid Volumetric Flow (gpm)			2.04811	57.9802		59.1731	59.3586	58.0548			58.0548	62.0068		0.305243		62.8246		0.299904	57.9801	55.1942		0.0297168	55.1735	57.9816	55.1804					2.04811
Std Vapor Volumetric Flow (MMSCFD)			0.511092	1.96816		2.59430	2.59408	2.51085			2.51085	2.50262		0.0542694		2.49710		0.0574392	1.96816	1.96820		0.00745968	1.96820	1.96820	1.96845					0.511092
Std Liquid Volumetric Flow (sgpm)			2.02275	53.9115		57.7857	57.7828	56.5212			56.5212	56.3991		0.300599		57.0635		0.227129	53.9115	53.9129		0.0295657	53.9129	53.9129	53.9197					2.02275
Compressibility			0.000668225	0.0129449		0.230468	0.226434	0.0197800			0.0197800	0.0154735		0.000839069		0.00341575		0.0311465	0.00425807	0.0130722		0.0423299	0.332840	0.0129450	0.332840					0.000668225
Specific Gravity			0.987500	1.04905		1.07646	1.07308	1.08854			1.08854	1.01817		1.02694		1.02085		0.757313	1.04906	1.10204		0.992669	1.10245	1.04906	1.10245					0.987500
API Gravity			10.2795	-6.10351		-2.73968	-2.74425	-4.64850			-4.64850	-4.80540		2.77937		-5.31489		10.1778	-6.09925	-6.10281		10.3647	-6.24071	-6.10352	-6.24069					10.2795
Enthalpy (Btu/h)			-6.85263E+06	-6.85978E+07		-7.79523E+07	-7.77877E+07	-7.74505E+07			-7.74505E+07	-7.41383E+07		-800010		-7.51676E+07		-719298	-6.86021E+07	-7.06014E+07		-100294	-7.04839E+07	-6.85996E+07	-7.04928E+07					-6.85263E+06
Mass Enthalpy (Btu/lb)			-6772.99	-2254.48		-2446.36	-2441.23	-2449.95			-2449.95	-2347.45		-5101.74		-2342.88		-6330.88	-2254.62	-2320.27		-6796.44	-2316.41	-2254.48	-2316.41					-6772.99
Mass Cp (Btu/(lb*°F))			0.981286	0.608880		0.580505	0.584983	0.586436			0.586436	0.658309		0.930006		0.657493		1.43930	0.608888	0.556207		0.980229	0.556378	0.608878	0.556378					0.981286
Ideal Gas CpCv Ratio			1.32325	1.02930		1.04214	1.04164	1.04044			1.04044	1.03433		1.19310		1.03362		1.30432	1.02930	1.03336		1.32460	1.03326	1.02930	1.03326					1.32325
Dynamic Viscosity (cP)			0.570804	2.80525		9.32769	8.00439	9.43877			9.43877	1.39418		0.588145		1.41828		0.164021	2.80443	13.8988		0.748604	13.7543	2.80534	13.7543					0.570804
Kinematic Viscosity (cSt)			0.578578	2.67661		8.67339	7.46636	8.67928			8.67928	1.37060		0.573261		1.39062		0.216788	2.67583	12.6240		0.754849	12.4880	2.67670	12.4880					0.578578
Thermal Conductivity (Btu/(h*ft*°F))			0.367104	0.113184?		0.115524?	0.115591?	0.117344?			0.117344?	0.115194?		0.262773?		0.115612?		0.338427	0.113186?	0.113516		0.356175	0.113540?	0.113184?	0.113540?					0.367104
Surface Tension (lbf/ft)			0.00466078	0.00260916?		0.00289166	0.00286943	0.00296301			0.00296301	0.00249167?		0.00402734		0.00250149?		0.00139572	0.00260945?	0.00296381		0.00484603	0.00295876	0.00260917	0.00295876					0.00466078
Net Ideal Gas Heating Value (Btu/ft^3)			0.701878	3503.66		2735.05	2735.19	2777.24			2777.24	2781.21		236.957		2825.03		0	3503.66	3503.67		1.08437	3503.67	3503.67	3503.67					0.701878
Net Liquid Heating Value (Btu/lb)			-1044.15	9171.73		8983.72	8983.54	8894.85			8894.85	8886.69		2642.43		8866.80		-1059.76	9171.73	9171.73		-1035.79	9171.73	9171.73	9171.73					-1044.15
Gross Ideal Gas Heating Value (Btu/ft^3)			51.0408	3834.11		3002.54	3002.69	3048.97			3048.97	3053.34		306.205		3101.20		50.31	3834.11	3834.11		51.4556	3834.11	3834.11	3834.11					51.0408
Gross Liquid Heating Value (Btu/lb)			15.3791	10062.3		9891.15	9890.95	9794.08			9794.08	9785.16		3640.99		9762.43		0	10062.3	10062.3		25.1638	10062.3	10062.3	10062.3					15.3791

QStream Report

Client Name:		Job:	
Location:			
Flowsheet:	TEG		

Energy Streams

Energy Stream	Status	Energy Rate		Power		From Block	To Block
Booster Hp	Solved	4302.28	Btu/h	1.69086	hp	--	Booster Pump
Cooler Duty	Solved	2.00183E+06	Btu/h	786.749	hp	Glycol Cooler	--
Q-1	Solved	1.08555E+06	Btu/h	426.637	hp	BTEX Condenser	--
Q-2	Solved	8.53698E+06	Btu/h	3355.16	hp	--	XCHG-101
Q-101	Solved	163838	Btu/h	64.3906	hp	Q-Recycle	Reflux Coil
Reb Duty	Solved	3.08570E+06	Btu/h	1212.73	hp	--	Reboiler
Reflux Duty	Solved	163815	Btu/h	64.3818	hp	Condenser	Q-Recycle
Strip Duty	Solved	0	Btu/h	0	hp	--	XCHG-100
TEG Hp	Solved	117440	Btu/h	46.1556	hp	--	Glycol Pump

Notes:

Warnings Report

Project (Lucid RH 5 1800GPM 245MM Rev 2 (06.17.19).pmx)

ProMax:ProMax!Project!Flowsheets!AMINE!Blocks!XCHG-100!Properties!Pressure Drop

Warning: A negative pressure drop of -95 psi was encountered in block XCHG-100.

ProMax:ProMax!Project!Flowsheets!AMINE!Blocks!XCHG-101!Properties!Pressure Drop

Warning: A negative pressure drop of -95 psi was encountered in block XCHG-101.

ProMax:ProMax!Project!Environments!Dehy

Warning: Calculated stream Heating Values are approximate due to the presence of component(s) with unknown chemical formula: CHEMTHERM 550. These compo

Warning: It is recommended to use a Heat Transfer Fluid property package in a dedicated flowsheet for the following components: CHEMTHERM 550.

ProMax:ProMax!Project!Flowsheets!HT Fluid!Blocks!Pipe Loss!Properties!Pressure Drop

Warning: A negative pressure drop of -5 psi was encountered in block Pipe Loss.

ProMax:ProMax!Project!Flowsheets!AMINE!Blocks!From Amine

Warning: The following components were zeroed out in stream From Amine Plant on flowsheet TEG because they were less than the mole fraction transfer threshold ir
H2S, MDEA, Piperazine.

Warning: Cross Flowsheet Connector From Amine is not in mass balance. Check Untransferred Flows in the Composition table on the Streams tab.

ProMax:ProMax!Project!Flowsheets!TEG!Blocks!From Amine

Warning: The following components were zeroed out in stream From Amine Plant on flowsheet TEG because they were less than the mole fraction transfer threshold ir
H2S, MDEA, Piperazine.

Warning: Cross Flowsheet Connector From Amine is not in mass balance. Check Untransferred Flows in the Composition table on the Streams tab.

ProMax:ProMax!Project!Flowsheets!AMINE!Blocks!VSSL-100!Sizing Properties

Warning: The specified value of 5 min for Light Liquid Holdup Time cannot be met due to separation or minimum size requirements. Actual value is 626.201 min.

Warning: The specified value of 2.5 min for Light Liquid Surge Time cannot be met due to separation or minimum size requirements. Actual value is 313.1 min.

ProMax:ProMax!Project!Flowsheets!TEG!Blocks!TEG Makeup!Properties!Pressure Drop

Warning: A negative pressure drop of -0.5 psi was encountered in block TEG Makeup

Owner:	Lucid	Owner Ref.:	H-101
Purchaser:	Lucid	Purchaser Ref.:	TBD
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	P19-0502 /
Service:	Hot Oil Heater	Project:	Acid Gas Expansion
Quantity:	1	Location:	TBD
SHO Duty:	70.00 MMBTU/ hr	SHO Model:	SHO5000
CMS Release:	89.24 MMBTU/ hr	CMS Model:	CMS8500
SHOS Flow:	2,910 USgpm @ 178 ft TDH	SHOS.Model:	N/A

Ftnt & Rev

PROCESS DESIGN CONDITIONS

Heater Section	- - -	Radiant / Convection	Radiant / Convection	Radiant / Convection	Radiant / Convection
Operating Case	- - -	Design Case			
Service	- - -	Hot Oil Heater			
Heat Absorption (R/C)	MMBTU/ hr	41.64 / 28.36			
Process Fluid	- - -	Chemtherm 550			
Process Mass Flow Rate, Total	Lb/ hr	1,200,000			
Process Bulk Velocity (calc. R/C)	ft/ s	11 / 11			
Process Mass Velocity (calc. R/C)	Lb/ s ft2	554 / 554			
Coking Allowance (dP calcs)	in				
Pressure Drop, Clean (allow. / calc.)	psi	30 / 31			
Pressure Drop, Fouled (allow. / calc.)	psi				
Average Heat Flux (allowable)	BTU/ hr ft2	13,000			
Average Heat Flux (calculated)	BTU/ hr ft2	14,200			
Maximum Heat Flux (allowable)	BTU/ hr ft2				
Maximum Heat Flux (calc. R/C)	BTU/ hr ft2	25,900 / 35,120			
Fouling Factor, Internal	hr ft2 °F/ BTU	0.002			
Corrosion or Erosion Characteristics	- - -				
Max. Film Temperature (allow. / calc.)	°F	640 / 492			
Inlet Conditions:					
Temperature	°F	280			
Pressure	psig	75			
Mass Flow Rate, Liquid	Lb/ hr	1,200,000			
Mass Flow Rate, Vapor	Lb/ hr	0			
Weight Percent, Liquid / Vapor	wt%	100% / 0%			
Density, Liquid / Vapor	Lb/ ft3	51.43 / 0.00			
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	- - - / 0.0			
Viscosity, Liquid / Vapor	cp	2.3127 / 0.000			
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.5602 / 0.000			
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.0705 / 0.000			
Outlet Conditions:					
Temperature	°F	380			
Pressure	psig	44			
Mass Flow Rate, Liquid	Lb/ hr	1,200,000			
Mass Flow Rate, Vapor	Lb/ hr	0			
Weight Percent, Liquid / Vapor	wt%	100% / 0%			
Density, Liquid / Vapor	Lb/ ft3	49.25 / 0.00			
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	- - - / 0.0			
Viscosity, Liquid / Vapor	cp	1.129 / 0.000			
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.609 / 0.000			
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.068 / 0.000			

revision	date	description	by	chk'd	appv'd
A		Issued with Proposal			

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FIRED HEATER DATA SHEET
AMERICAN ENGINEERING SYSTEM of UNITS

P19-0502-HTRds-

Ftnt & Rev

COMBUSTION DESIGN CONDITIONS

Overall Performance:

Operating Case	- - -	Design Case			
Service	- - -	Hot Oil Heater			
Excess Air	mol%	25.0%			
Calculated Heat Release (LHV)	MMBTU/ hr	81.13			
Guaranteed Efficiency	HR%	84.3%			
Calculated Efficiency	HR%	86.3%			
Radiation Loss	HR%	2.00%			
Flow Rate, Combustion Gen./ Imp.	Lb/ hr	85,719			
Flue Gas Temp. Leaving (R/C)	°F	1,596 / 479			
Flue Gas Mass Velocity	Lb/ sec ft2	0.919			

Fuel(s) Data:

		Gas 1 Mol.Wt.	Gas 2 Mol.Wt.	Gas 3 Mol.Wt.	Design Fuel Oil
LHV	BTU/ scf	898			- - -
LHV	BTU/ Lb	20,247			
P @ Burner	psig	150			
T @ Burner	°F	100			
MW	Lb/ Lbmole	16.82			- - -
Flow @ design	lb/hr	4,007			
Flow @ design	scfh	90,394			
Atomizing Media		- - -			
Atom. Media P & T		- - -			

Components:

		Gas 1	Gas 2	Gas 3	Design Fuel Oil
N	wt%	- - -			
S	wt%	- - -			
Ash	wt%	- - -			
Ni	ppm	- - -			
Va	ppm	- - -			
Na	ppm	- - -			
Fe	ppm	- - -			
H2	mol%	0.0%			- - -
O2	mol%	0.0%			- - -
N2 + Ar	mol%	3.3%			- - -
CO	mol%	0.0%			- - -
CO2	mol%	0.0%			- - -
CH4	mol%	94.1%			- - -
C2H6	mol%	2.5%			- - -
C2H4	mol%	0.0%			- - -
C3H8	mol%	0.1%			- - -
C3H6	mol%	0.0%			- - -
C4H10	mol%	0.0%			- - -
C4H8	mol%	0.0%			- - -
C5H12	mol%	0.0%			- - -
C5H10	mol%	0.0%			- - -
C6+	mol%	0.0%			- - -
H2S	ppmv	0.0%			- - -
SO2	mol%	0.0%			- - -
NH3	mol%	0.0%			- - -
H2O	mol%	0.0%			- - -
spare	mol%	0.0%			- - -

Blower/Fan Peformance:

Volumetric Flow	acfm	20,400
Rated Power	HP	100
Fan Speed	RPM	1,800
Sound Pressure	dBA	< 85
Area Classificatior	NEC	Class I, Div. II, Groups C&D

Burner Design:

OEM	- - -	Callidus Technologies, LLC	
Type	- - -	Enhanced IFGR	
Quantities	- - -	1	ULTRA Low NOx
Model No.	- - -	CUBL-16W-HC-HZ	Cylindrical
Windbox	- - -	yes ...	
Location	- - -	EndWall Center ...	Horizontally Fired

Pilot Design:

Type / Model		Self-Inspirating /	by O.E.M.
Ignition	- - -	Electric	requires elec.ign.system
Heat Release	- -	> 350000 BTU/ hr on ...	Gas 1

Burner Performance:

Minimum Heat Release	MMBTU/ hr	17.85
Design Heat Release	MMBTU/ hr	81.13
Maximum Heat Release	MMBTU/ hr	89.24
Burner Turndown	Max:Min	5.00
Volumetric Ht. Release	BTU/ hr ft3	10,118
Pressure @ Arch	inH2O	3.40
Pressure @ Burner	inH2O	17.00
Combustion Air T @ Burner	°F	60
Flue Gas T @ Burner	°F	1,400

Guaranteed Emissions:

Basis of Guarantee	- - -	3.0% O2,	dry (LHV)
NOx Emissions	Lb/MMBTU	0.040	30 ppm
SOx Emissions	Lb/MMBTU	no quote	
CO Emissions	Lb/MMBTU	0.041	50 ppm
VOC Emissions	Lb/MMBTU	0.019	14 ppm
UHC Emissions	Lb/MMBTU	0.007	14 ppm
SPM10 Emissions	Lb/MMBTU	0.013	14 ppm
Noise Emissions	dBA @ 3ft	85	

Net Flame Clearances:

Est. Flame Size	approx. 37.5 ft L x 6.5 ft Diameter
Hor Clearance	0 ft NET Tube Clearance
Vert. Clearance	0 ft NET Tube Clearance
Axial Clearance	3.5 ft NET Refractory Clearance (to Target hot face)

Nominal Flame Clearances:

from burner CL ...		Vertical	Horizontal
to Tube CL, API	ft	35.72	23.81
to Tube CL, calc.	ft	6.50	6.50
to Refrac., calc.	ft	n / a	41.00

Owner Ref.: H-101 THM Ref.: P19-0502

PRESSURE PARTS DESIGN

Coil Design:		RADIANT	SHIELD	CONVECTION
Service		Hot Oil Heater	Hot Oil Heater	Hot Oil Heater
Design Basis for Tube Temperature		API 530	API 530	API 530
Design Basis for Tube Wall Thickness		ASME Sec. VIII-1	ASME Sec. VIII-1	ASME Sec. VIII-1
Design Life	hr	100,000	100,000	100,000
Design Pressure (elastic / rupture)	psig	150 /	150 /	150 /
Design Fluid Temperature	°F	380	380	380
Design Temperature Allowance	°F	25	25	25
Design Corrosion Allowance (tubes/fittings)	in	0.063 / 0.063	0.063 / 0.063	0.063 / 0.063
Maximum Tube Temperature (clean)	°F	517		
Maximum Tube Temperature (fouled)	°F	574	492	621
Design Tube Temperature	°F	599	646	646
Inside Film Coefficient	BTU/ hr ft2 °F	253	201	201
Weld Inspection	RT or Other	100 of 10%	100 of 10%	100 of 10%
Weld Heat Treatment	s.rel., t.stab. or none	None	None	None
Hydrostatic Test Pressure	psig	per API	per API	per API
Coil Arrangement:		Horizontal	Horizontal	Horizontal
Coil Type	- - -	Helical	Serpentine	Serpentine
Tube Material (pipe or tube spec)	ASTM	SA106GrB	SA106GrB	SA106GrB
Supplementary Mfg Requirements	ASTM	None	None	None
Tube Outside Diameter	in	6.625	6.625	6.625
Tube Wall Thickness (aw / mw)	in	0.280 / 0.245	0.280 / 0.245	0.280 / 0.245
Number of Cells (radiant or convection)	- - -	1	1	1
Number of Flow Passes (total / cell)	- - -	3 / 3	3 / 3	3 / 3
Number of Tubes per Row (total / cell)	- - -		4 / 4	4 / 4
Overall Tube (1 turn in radiant) Length	ft	40.84	16.04	16.04
Effective Tube Length / Helix Diameter	ft	40.84 / 13.00	14.46	14.46
Number of Turns or Tubes (total / pass)		41.4 / 13.8	8.0 / 8.0	0.0 / 0.0
Total Exposed Surface	ft2	2,932	201	0
Number of Ext.Surf. Tubes (total / cell)	- - -	0 / 0.0	0 / 0.0	40 / 40.0
Total Exposed Surface	ft2	0	0	9,686
Tube Spacing (horiz. / tube centers)	in	- - - / 11.50	12.00 / 12.00	12.00 / 12.00
Tube Spacing (horiz. to refractory)	in	9.00	6.00	6.00
Coil Fluid Volume	USgal	2632	113	1130
Coil Fittings:		Hot Oil Heater	Hot Oil Heater	Hot Oil Heater
Fitting Type	- - -	SR 90° Elbows	SR 180° U-Bends	SR 180° U-Bends
Fitting Material	ASTM	SA234 WPB	SA234 WPB	SA234 WPB
Supplementary Mfg Requirements	ASTM	None	None	None
Fitting Outside Diameter	in	6.625	6.625	6.625
Fitting Wall Thickness (aw / mw)	in	0.280 / 0.245	0.280 / 0.245	0.280 / 0.245
Fitting Location	internal or external	Internal	External	External
Tube Attachment	welded or rolled	Welded	Welded	Welded
Coil Terminals:		Outlet		Inlet
Terminal Type	beveled or flanged	Flanged		Flanged
Flange Material	ASTM	SA105		SA105
Supplementary Mfg Requirements	ASTM	None		None
Flange Size and Rating	NPS/ ASME	6" NPS / 300#		6" NPS / 300#
Flange Type	RFWN or RTJ	RFWN		RFWN
Location	- - -	Burner Endwall		Terminal End
Extended Surface:		CONVECTION	CONVECTION	CONVECTION
Service	- - -	Hot Oil Heater	Hot Oil Heater	Hot Oil Heater
Fin or Stud Row Number	starting @ bottom	No.1 / No.2-3	No.4 / No.5	No.6-10 /
Ext. Surface Type	seg.fins, solid fins, studs	HF Seg. Fins	HF Seg. Fins	HF Seg. Fins
Fin/Stud Material	- - -	C.S. / C.S.	C.S. / C.S.	C.S. /
Fin/Stud Height	in	0.50 / 0.50	0.75 / 0.75	1.00 /
Fin/Stud Thickness	in	0.11 / 0.11	0.11 / 0.105	0.11 /
Fin/Stud Density	fin/ in	3.00 / 5.00	4.00 / 5.00	5.00 /

PRESSURE PARTS DESIGN (continued)

		RADIANT	SHIELD	CONVECTION	
Crossovers:					
Type, location / connections	- - -	External	/ Flanged	None	
Tube / Fittings Material	ASTM	SA106GrB	/ SA234 WPB		
Tube & Fitting OD / Thickness (aw)	in	6.625	/ 0.280		

Inlet Manifold(s):	type			Simple LOG	
Location	- - -			Top - Term. End	
Design Basis for Manifold Thicknes	- - -			ASME B31.3	
Design Conditions (temp./press.)	°F/ psig			646 / 150	
Pipe Material	ASTM			SA106GrB	
Fittings Material	ASTM			SA234 WPB	
Flange Material / Style	ASTM			SA105 / RFWN	
Outside Diameters, each Branch	in			16" NPS	
Wall Thickness(es); aw ~~or mw~~	in			SCH40 (0.5)	
End Types (terminal/ dead)	beveled or flanged			Flanged / W.Cap	
Manifold Terminal Type	NPS/ ASME			16" NPS / 300# Flg	
Coil Connection Type	extrusion, olet, etc.			Weld-O-Let	
Coil Terminal Type	NPS/ ASME			6" NPS / 300# Flg	

Outlet Manifold(s):	type	Simple LOG			
Location	- - -	Burner Endwal			
Design Basis for Manifold Thicknes	- - -	ASME B31.3			
Design Conditions (temp./press.)	°F/ psig	599 / 150			
Pipe Material	ASTM	SA106GrB			
Fittings Material	ASTM	SA234 WPB			
Flange Material / Style	ASTM	SA105 / RFWN			
Outside Diameters, each Branch	in	16" NPS			
Wall Thickness(es); aw ~~or mw~~	in	SCH40 (0.5)			
End Types (terminal/ dead)	beveled or flanged	Flanged / W.Cap			
Manifold Terminal Type	NPS/ ASME	16" NPS / 300# Flg			
Coil Connection Type	extrusion, olet, etc.	Weld-O-Let			
Coil Terminal Type	NPS/ ASME	6" NPS / 300# Flg			

COIL & MANIFOLD SUPPORTS DESIGN

		RADIANT	SHIELD	CONVECTION	
Tube Supports:					
Service		Hot Oil Heater	Hot Oil Heater	Hot Oil Heater	
Location	Top, Bottom, Ends	Bottom	Ends	Ends	
Support Type	casting, tubesht, spring, etc.	SS Pipe Rail	Welded Tbsheets	Welded Tbsheets	
Support Thicknesses	in	SCH40	0.375	0.375	
Support Materials	ASTM	A240 T304	A36 CS	A36 CS	
Support Temperatures (calc./ design)	°F / °F	1,006 / 1,190	639 / 790	639 / 790	
TbSht Ferrules Thickness/Materials	in/ ASTM	- - - / - - -	14 ga. / 304 SS	14 ga. / 304 SS	
Refractory & Anchor Materials & Types		none	per refrac. section	per refrac. section	

Intermediate Guides & Supports:		None	None	None	
Location	- - -				
Guide/ Support Type	casting, spring, etc.				
Material	ASTM				
Spacing, average	ft				
Tube Guides:	Top, Bottom, Ends	None	None	None	
Material	ASTM				

Manifold Supports:		Outlet Manifold		Intlet Manifold	
Material	ASTM	A36		N/A	
Materials Design & Supply	- - -	by THM			
Location	Top, Bottom, Ends	Burner Endwal			
Support Type	roller, shoe, spring, etc.	Simple Shelf			
Number of Supports	- - -	One (1)			

CASING / REFRACTORY SYSTEMS DESIGN

Radiant Section Design:		BURNER ENDWALL		SHIELDED SIDEWALLS	TARGET ENDWALL
Total Refractory Thickness	in	6.0		4.0	6.0
Hot Face Temperature (design)	°F	2,000		2,000	2,000
Hot Face Temperaure (calculated)	°F	1,596		1,006	1,596
Hot Face Layer	in/ - - -	1/ 8# CF Blanket		1/ 8# CF Blanket	1/ 8# CF Blanket
Back-Up Layer No.1	in/ - - -	1/ 8# CF Blanket		3/ 6# CF Blanket	1/ 8# CF Blanket
Back-Up Layer No.2	in/ - - -	4/ 6# CF Blanket		None	4/ 6# CF Blanket
Foil Vapor Barrier	in/ - - -	None		None	None
Castable Reinforcement (SS Needles)	wt%	None		None	None
Anchors / Tie Backs:	- - -	Pins & Clips		Pins & Clips	Pins & Clips
Material	- - -	310 S.S.		304 S.S.	310 S.S.
Attachment	- - -	Welded		Welded	Welded
Casing:					
Material	in/ ASTM	0.1875 / A36		0.1875 / A36	0.1875 / A36
Internal Coating	- - -	None		None	None
External Temperature, Typical	°F	180		180	180
Comments / Clarifications	- - -	w/ cfb wraps		w/o cfb wraps	w/ cfb wraps
		SHOP Installed		SHOP Installed	SHOP Installed

		SIDEWALLS		ENDWALLS	
Convection Section Design		SHIELD	FINNED	TUBESHEETS	HEADER BOXES
Total Refractory Thickness	in	3.0	3.0	3.0	2.0
Hot Face Temperature (design)	°F	2,000	2,000	2,200	2,000
Hot Face Temperaure (calculated)	°F	1,038	1,038	1,038	722
Hot Face Layer	in/ - - -	1/ 8# CF Blanket	1/ 8# CF Blanket	3/ Sparlite HS	1/ 8# CF Blanket
Back-Up Layer No.1	in/ - - -	2/ 6# CF Blanket	2/ 6# CF Blanket	None	1/ 8# CF Blanket
Back-Up Layer No.2	in/ - - -	None	None	None	None
Foil Vapor Barrier	in/ - - -	None	None	None	None
Castable Reinforcement (SS Needles)	wt%	None	None	None	None
Anchors / Tie Backs:	- - -	Pins & Clips	Pins & Clips	Bullhorns	Pins & Clips
Material	- - -	310 S.S.	304 S.S.	304 S.S.	304 S.S.
Attachment	- - -	Welded	Welded	Welded	Welded
Casing:					
Material	in/ ASTM	0.1875 / A36	0.1875 / A36		0.1345 / A36
Internal Coating	- - -	None	None	None	None
External Temperature, Typical	°F	180	180		180
Comments / Clarifications	- - -	Cleaning/Sootblowing lanes: none			Bolted Assembly
	- - -	SHOP Installed	SHOP Installed	SHOP Installed	SHOP Installed

		FLUE GAS DUCTS			
Stack & Uptakes Design:		BREECHING	15° TRANSITION	DISCH. DUCT	
Quantity		One	One	One	
Type / Location	- - -	Full L / Conv	Full L / Conv	Self.Spt / Grade	
Length / Metal Outside Diameter (top)	ft/ ft	1.00 / n/ a	2.02 / n/ a	7 / 4.000	
Discharge Elev., minimum/ calculated	ft/ ft	n/ a / n/ a	n/ a / n/ a	20 / 36	
Total Refractory Thickness	in	3.0	0.0	0.0	
Hot Face Temperature (design)	°F	2,000			
Hot Face Temperaure (calculated)	°F	479	479	479	
Hot Face Layer	in/ - - -	1/ 8# CF Blanket	None	None	
Back-Up Layer No.1	in/ - - -	2/ 6# CF Blanket			
Castable Reinforcement (SS Needles)		None			
Anchors / Tie Backs:	- - -	Pins & Clips			
Material	- - -	304 S.S.			
Attachment	- - -	Welded			
Casing:					
Minimum Thickness/ Materia	in/ ASTM	0.1875 / A36	0.1875 / A36	0.1875 / A36	
Corrosion Allowance	in	None	None	None	
Internal Coating	- - -	None	None	None	
External Temperature, Typical	°F	180	479	479	
Comments / Clarifications	- - -	SHOP Installed			

MECHANICAL / STRUCTURAL DESIGN BASIS

Refractory & Coatings Design:

Refractory Design	Per Std560: 180°F Avg. Casing Temperature @ Ambient Conditions of 0 MPH & 80°F	
Refractory Dryout	SHOP dryout = None // FIELD dryout per THM standard.	
Coating, Internal	None	
Coating, External	Base Coat:	3-4 PPG Dimetcote 9 IOZ Silicate - Flat Green on SP-6
	Int. Coat:	None
	Top Coat:	1.5-2 PPG Pitt-Therm 97-724 Series Air Dry Silicone - Federal Standard 595B #16132 Gray

Applicable Standards:

API	~~Std 560 (ISO 13705); Fired Heaters for ...~~	AISC	Specification for Design, ... Steel for Buildings
API	Std 530 (ISO 13704); Calc. of Heater Tube ...	AWS	D 1.1; Structural Welding Code
ASME	B31.3, Chemical Plant and ... Piping	ASTM	tube/ smls pipe/ fitting spec's noted herein
ASME	Sections I, II, VIII, IX; ASME B&PV Code	ASTM	refractories per C27, C155, C401 & C612
ASME	Section V; Non Destructive Examination	NFPA	NFPA 70; National Electrical Code

Wind Design:		Seismic Design:	
Spec. or Standard	ASCE 7-10	Spec. or Standard	ASCE 7-10
Velocity/ Imp. Factor	100 mph / 1	Risck Cat./Imp. Factor	III / 1.25
Site Exposure	"C"	Ss/S1/Soil Class	0.5 / 0.15 / D
Physical Design:		**Site Design Basis:**	
Plot Limitations	None	Site Elevation	3600 ft AMSL
Tube Limitations	None	Stack Design Temp.	90 °F
Firebox Pressure	Positive; approximately +1.0 inH2O	FG Discharge Elev.	36 ft AG
Ambient Temp's	-20 °F Min/ 60 °F Dsn/ 110 °F Max	Area Classification	Class I, Div. II, Groups C&D

MAJOR SUBSYSTEMS & ACCESSORIES

Major Services & Subsystems		Major Accessories:		
Process Design	INCLUDED in base pricing	Casing/ Tube Seals	12	TubeSox; Radiant & Conv.
Mechanical Design	INCLUDED in base pricing	Observation Doors	2	4 in Dia. w/ H.T. glass
Structural Design	INCLUDED in base pricing	Observation Doors	1	4 in Dia. w/ HT glass on Arch
Radiant Section	INCLUDED in base pricing	Access Doors	1	Std 24" x 24"
Convection Section	INCLUDED in base pricing	Expansion Joints	None	
Combustion Mgmt	INCLUDED in base pricing	Ladders & Platforms	Not Included	
Burner Piping	INCLUDED in base pricing	L&P Coating	N/A	
Forced Draft System	INCLUDED in base pricing			

Casing Penetrations			Pressure Part Penetrations		
Fbox Purge/ Snuff	None		Coil TSTC's, Radiant	None	
CA Temp/Pres	None		Coil TSTC's, Convection	None	
FG Temperature	2	1.5"NPS 3000# Coupling	Process TI conn's	3	1.5" NPS 300# RFWN
FG Pressure	2	1.5"NPS 3000# Coupling	Process PI conn's	1	1.5" NPS 300# RFWN
FG Comp. (Sample)	2	1.5"NPS 3000# Coupling	spare		
FG Sample	2	4"NPS 150# RFWN's	spare		
O2 Analyzer Port	1	3" NPS 150# RFWN	spare		

Dampers

	FD Fan (blower) qty = 0	Uptake Ducts	Stack qty = 0
Function	Note:		Note:
Design	Fan inlet damper is inappropriate		Stack Damper (which provides draft
Materials	for forced draft SHO's where O2		control) is inappropriate for forced
Bearings	Control is provided by the CMS O2		draft SHO's where the combustion
Operator	Trim Module which controls the fan		conditions are controlled real-time
Positioner	(blower) motor's VFD/ VSD.		via the CMS.
Instruments			

Sootblowers:	Qty.	Type	Location	FG T	Material	Steam T & P	O.E.M. / Ref.
Lane 1:	None						
Lane 2 :	None						

Owner:	Unknown	Owner Ref.:	H-741	Ftnt & Rev
Purchaser:	UOPR	Purchaser Ref.:	J463	
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	
Service:	Regen Gas Heater	Project:	200 MMscfd Cryo Plant	
Quantity:	1	Location:	Unknown	
SHO Duty:	7.29 MMBTU/ hr	SHO Model:	SHO500	
CMS Release:	9.20 MMBTU/ hr	CMS Model:	CMS1500	

PROCESS DESIGN CONDITIONS

Heater Section	---	Radiant / Convection	Radiant / Convection		
Operating Case	---	Over-Design Case	Design Case		
Service	---	Regen Gas Heater	Regen Gas Heater		
Heat Absorption (R/C)	MMBTU/ hr	4.36 / 2.93	3.52 / 2.08		
Process Fluid	---	Gas	Gas		
Process Mass Flow Rate, Total	Lb/ hr	22,924	20,840		
Process Bulk Velocity (calc. R/C)	ft/ s	42 / 21	39 / 19		
Process Mass Velocity (calc. R/C)	Lb/ s ft2	80 / 80	73 / 73		
Coking Allowance (dP calcs)	in				
Pressure Drop, Clean (allow. / calc.)	psi	10 / 7	10 / 6		
Pressure Drop, Fouled (allow. / calc.)	psi				
Average Heat Flux (allowable)	BTU/ hr ft2	13,000	13,000		
Average Heat Flux (calculated)	BTU/ hr ft2	15,410	12,460		
Maximum Heat Flux (allowable)	BTU/ hr ft2				
Maximum Heat Flux (calc. R/C)	BTU/ hr ft2	27,400 / 31,140	22,200 / 23,990		
Fouling Factor, Internal	hr ft2 °F/ BTU	0.001	0.001		
Corrosion or Erosion Characteristics	---				
Max. Film Temperature (allow. / calc.)	°F	650 / 669	650 / 654		
Inlet Conditions:					
Temperature	°F	75	135		
Pressure	psig	934	934		
Mass Flow Rate, Liquid	Lb/ hr	0	0		
Mass Flow Rate, Vapor	Lb/ hr	22,924	20,840		
Weight Percent, Liquid / Vapor	wt%	0% / 100%	0% / 100%		
Density, Liquid / Vapor	Lb/ ft3	0.00 / 3.82	0.00 / 3.82		
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	--- / 21.6	--- / 21.6		
Viscosity, Liquid / Vapor	cp	0.0001 / 0.014	0.001 / 0.014		
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0 / 0.617	0.000 / 0.617		
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0 / 0.023	0.000 / 0.023		
Outlet Conditions:					
Temperature	°F	550	550		
Pressure	psig	928	929		
Mass Flow Rate, Liquid	Lb/ hr	0	0		
Mass Flow Rate, Vapor	Lb/ hr	22,924	20,840		
Weight Percent, Liquid / Vapor	wt%	0% / 100%	0% / 100%		
Density, Liquid / Vapor	Lb/ ft3	0.00 / 1.88	0.00 / 1.88		
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	--- / 21.6	--- / 21.6		
Viscosity, Liquid / Vapor	cp	0.000 / 0.020	0.0001 / 0.020		
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.000 / 0.719	0 / 0.719		
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.000 / 0.042	0 / 0.042		

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FIRED HEATER DATA SHEET
AMERICAN ENGINEERING SYSTEM of UNITS

MJ17-265-HTRds- Rev. 1

Owner Ref.: H-741 THM Ref.: MJ17-265

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COMBUSTION DESIGN CONDITIONS

Overall Performance:

	Units				
Operating Case	---	Over-Design Case	Design Case		
Service	---	Regen Gas Heate	Regen Gas Heate		
Excess Air	mol%	15.0%	15.0%		
Calculated Heat Release (LHV)	MMBTU/ hr	8.37	6.30		
Guaranteed Efficiency	HR%	83.1%	85.0%		
Calculated Efficiency	HR%	87.1%	89.0%		
Radiation Loss	HR%	3.00%	3.00%		
Flow Rate, Combustion Gen./ Imp.	Lb/ hr	8,145	6,130		
Flue Gas Temp. Leaving (R/C)	°F	1,649 / 447	1,526 / 377		
Flue Gas Mass Velocity	Lb/ sec ft2	0.260	0.196		

Fuel(s) Data:

	Units	Gas 1 Mol.Wt.			
LHV	BTU/ scf	976			
LHV	BTU/ Lb	20,426			
P @ Burner	psig	75			
T @ Burner	°F	100			
MW	Lb/ Lbmole	18.13			
m @ ??? °F	cp	---			
m @ ??? °F	cp	---			
Atomizing Media		---			
Atom. Media P & T		---			

Components:

	Units	Gas 1			
N	wt%	---			
S	wt%	---			
Ash	wt%	---			
Ni	ppm	---			
Va	ppm	---			
Na	ppm	---			
Fe	ppm	---			
H2	mol%	0.0%			
O2	mol%	0.0%			
N2 + Ar	mol%	1.0%			
CO	mol%	0.0%			
CO2	mol%	1.0%			
CH4	mol%	88.0%			
C2H6	mol%	8.0%			
C2H4	mol%	0.0%			
C3H8	mol%	2.0%			
C3H6	mol%	0.0%			
C4H10	mol%	0.0%			
C4H8	mol%	0.0%			
C5H12	mol%	0.0%			
C5H10	mol%	0.0%			
C6+	mol%	0.0%			
H2S	ppmv	0.0%			
SO2	mol%	0.0%			
NH3	mol%	0.0%			
H2O	mol%	0.0%			
spare	mol%	0.0%			

Blower/Fan Peformance:

	Units	
Volumetric Flow	acfm	1,800
Rated Power	HP	10
Fan Speed	RPM	3,600
Sound Pressure	dBA	< 85
Area Classification	NEC	Unclassified

Burner Design:

OEM	---	Callidus Technologies, LLC	
Type	---	Enhanced IFGR	ULTRA Low NOx
Quantities	---	1	Burner
Model No.	---	CUBL-3W	Cylindrical
Windbox	---	yes ...	
Location	---	EndWall Center ...	Horizontally Fired

Pilot Design:

Type / Model		Self-Inspirating /	by O.E.M.
Ignition	---	Electric	requires elec.ign.system
Heat Release	--	> 90000 BTU/ hr on ...	Gas 1

Burner Performance:

	Units	
Minimum Heat Release	MMBTU/ hr	1.84
Design Heat Release	MMBTU/ hr	8.37
Maximum Heat Release	MMBTU/ hr	9.20
Burner Turndown	Max:Min	5.00
Volumetric Ht. Release	BTU/ hr ft3	17,106
Pressure @ Arch	inH2O	0.50
Pressure @ Burner	inH2O	7.64
Combustion Air T @ Burner	°F	60
Flue Gas T @ Burner	°F	1,450

Guaranteed Emissions:

	Units		
Basis of Guarantee	---	3.0% O2,	dry (LHV)
NOx Emissions	Lb/MMBTU	0.053	40 ppm
SOx Emissions	Lb/MMBTU	no quote	
CO Emissions	Lb/MMBTU	0.041	50 ppm
VOC Emissions	Lb/MMBTU	0.019	15 ppm
UHC Emissions	Lb/MMBTU	0.007	15 ppm
SPM10 Emissions	Lb/MMBTU	0.014	16 ppm
Noise Emissions	dBA @ 3ft	85	

Net Flame Clearances:

Est. Flame Size	approx. 10.9 ft L x 2.5 ft Diameter
Hor Clearance	0.75 ft NET Tube Clearance
Vert. Clearance	0.75 ft NET Tube Clearance
Axial Clearance	-1.77 ft NET Refractory Clearance (to Arch hot face)

Nominal Flame Clearances:

from burner CL ...		Vertical	Horizontal
to Tube CL, API	ft	5.70	3.80
to Tube CL, calc.	ft	3.25	3.25
to Refrac., calc.	ft	n / a	9.17

Owner Ref.: H-741 THM Ref.: MJ17-265

PRESSURE PARTS DESIGN

						Ftnt & Rev
1						
2						
3	Coil Design:		RADIANT	SHIELD	CONVECTION	
4	Service		Regen Gas Heater	Regen Gas Heater	Regen Gas Heater	
5	Design Basis for Tube Temperature		API 530	API 530	API 530	
6	Design Basis for Tube Wall Thickness		ASME Sec. VIII-1	ASME Sec. VIII-1	ASME Sec. VIII-1	
7	Design Life	hr	100,000	100,000	100,000	
8	Design Pressure (elastic / rupture)	psig	1,095 /	1,095 /	1,095 /	
9	Design Fluid Temperature	°F	550	550	550	
10	Design Temperature Allowance	°F	29	29	29	
11	Design Corrosion Allowance (tubes/fittings)	in	0.0625 / 0.0625	0.0625 / 0.0625	0.0625 / 0.0625	
12						
13	Maximum Tube Temperature (clean)	°F	702			
14	Maximum Tube Temperature (fouled)	°F	734	372	475	
15	Design Tube Temperature	°F	763	650	650	
16	Inside Film Coefficient	BTU/ hr ft2 °F	271	233	233	
17	Weld Inspection	RT or Other	100 of 100%	100 of 100%	100 of 100%	
18	Weld Heat Treatment	s.rel., t.stab. or none	None	None	None	
19	Hydrostatic Test Pressure	psig	per API	per API	per API	
20						
21	Coil Arrangement:		Horizontal	Horizontal	Horizontal	
22	Coil Type	---	Helical	Serpentine	Serpentine	
23	Tube Material (pipe or tube spec)	ASTM	SA106GrB	SA106GrB	SA106GrB	
24	Supplementary Mfg Requirements	ASTM	None	None	None	
25	Tube Outside Diameter	in	4.500	4.500	4.500	
26	Tube Wall Thickness (aw / mw)	in	0.337 / 0.295	0.337 / 0.295	0.337 / 0.295	
27	Number of Cells (radiant or convection)	---	1	1	1	
28	Number of Flow Passes (total / cell)	---	1 / 1	1 / 1	1 / 1	
29	Number of Tubes per Row (total / cell)	---		4 / 4	4 / 4	
30	Overall Tube (1 turn in radiant) Length	ft	20.42	9.04	9.04	
31	Effective Tube Length / Helix Diameter	ft	20.42 / 6.50	7.46	7.46	
32	Number of Turns or Tubes (total / pass)		11.8 / 11.8	4.0 / 4.0	0.0 / 0.0	
33	Total Exposed Surface	ft2	283	35	0	
34	Number of Ext.Surf. Tubes (total / cell)	---	0 / 0.0	0 / 0.0	12 / 12.0	
35	Total Exposed Surface	ft2	0	0	1,309	
36	Tube Spacing (horiz. / tube centers)	in	--- / 8.00	8.00 / 8.00	8.00 / 8.00	
37	Tube Spacing (horiz. to refractory)	in	6.00	4.00	4.00	
38						
39	Coil Fittings:		Regen Gas Heater	Regen Gas Heater	Regen Gas Heater	
40	Fitting Type	---	SR 90° Elbows	SR 180° U-Bends	SR 180° U-Bends	
41	Fitting Material	ASTM	SA234 WPB	SA234 WPB	SA234 WPB	
42	Supplementary Mfg Requirements	ASTM	None	None	None	
43	Fitting Outside Diameter	in	4.500	4.500	4.500	
44	Fitting Wall Thickness (aw / mw)	in	0.337 / 0.295	0.337 / 0.295	0.337 / 0.295	
45	Fitting Location	internal or external	Internal	External	External	
46	Tube Attachment	welded or rolled	Welded	Welded	Welded	
47						
48	Coil Terminals:		Outlet		Inlet	
49	Terminal Type	beveled or flanged	Flanged		Flanged	
50	Flange Material	ASTM	SA105		SA105	
51	Supplementary Mfg Requirements	ASTM	None		None	
52	Flange Size and Rating	NPS/ ASME	4" NPS / 900#		4" NPS / 900#	
53	Flange Type	RFWN or RTJ	RFWN		RFWN	
54	Location	---	Burner Endwall		Terminal End	
55						
56	Extended Surface:			CONVECTION	CONVECTION	
57	Service	---		Regen Gas Heater	Regen Gas Heater	
58	Fin or Stud Row Number	starting @ bottom		No.1 / No.2-3		
59	Ext. Surface Type	seg.fins, solid fins, studs		HF Seg. Fins		
60	Fin/Stud Material	---		C.S. / C.S.		
61	Fin/Stud Height	in		1.00 / 1.00		
62	Fin/Stud Thickness	in		0.06 / 0.06		
63	Fin/Stud Density	fin/ in		4.00 / 5.00		
64						

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PRESSURE PARTS DESIGN (continued)

Crossovers:		RADIANT	SHIELD	CONVECTION	
Type, location / connections	---	External	/ Flanged	None	
Tube / Fittings Material	ASTM	SA106GrB	/ SA234 WPB		
Tube & Fitting OD / Thickness (aw)	in	4.500	/ 0.337		
Inlet Manifold(s):	type			N/A	
Location	---				
Design Basis for Manifold Thickness	---				
Design Conditions (temp./press.)	°F/ psig				
Pipe Material	ASTM				
Fittings Material	ASTM				
Flange Material / Style	ASTM				
Outside Diameters, each Branch	in				
Wall Thickness(es); aw ~~or mw~~	in				
End Types (terminal/ dead)	beveled or flanged				
Manifold Terminal Type	NPS/ ASME				
Coil Connection Type	extrusion, olet, etc.				
Coil Terminal Type	NPS/ ASME				
Outlet Manifold(s):	type	N/A			
Location	---				
Design Basis for Manifold Thickness	---				
Design Conditions (temp./press.)	°F/ psig				
Pipe Material	ASTM				
Fittings Material	ASTM				
Flange Material / Style	ASTM				
Outside Diameters, each Branch	in				
Wall Thickness(es); aw ~~or mw~~	in				
End Types (terminal/ dead)	beveled or flanged				
Manifold Terminal Type	NPS/ ASME				
Coil Connection Type	extrusion, olet, etc.				
Coil Terminal Type	NPS/ ASME				

COIL & MANIFOLD SUPPORTS DESIGN

Tube Supports:		RADIANT	SHIELD	CONVECTION	
Service		Regen Gas Heate	Regen Gas Heate	Regen Gas Heater	
Location	Top, Bottom, Ends	Bottom	Ends	Ends	
Support Type	casting, tubesht, spring, etc.	SS Pipe Rail	Welded Tbsheets	Welded Tbsheets	
Support Thicknesses	in	SCH40	0.375	0.375	
Support Materials	ASTM	A240 T304	A36 CS	A36 CS	
Support Temperatures (calc./ design)	°F / °F	1,130 / 1,310	612 / 770	612 / 770	
TbSht Ferrules Thickness/Materials	in/ ASTM	--- / ---	14 ga. / 304 SS	14 ga. / 304 SS	
Refractory & Anchor Materials & Types		none	per refrac. section	per refrac. section	
Intermediate Guides & Supports:		None	None	None	
Location	---				
Guide/ Support Type	casting, spring, etc.				
Material	ASTM				
Spacing, average	ft				
Tube Guides:	Top, Bottom, Ends	None	None	None	
Material	ASTM				
Manifold Supports:		Outlet Manifold		Intlet Manifold	
Material	ASTM	A36		N/A	
Materials Design & Supply	---	by THM			
Location	Top, Bottom, Ends				
Support Type	roller, shoe, spring, etc.	Simple Shelf			
Number of Supports	---	One (1)			

							Ftnt & Rev
1	CASING / REFRACTORY SYSTEMS DESIGN						
2							
3			BURNER		SHIELDED	ARCH	
4	Radiant Section Design:		ENDWALL		SIDEWALLS	ENDWALL	
5	Total Refractory Thickness	in	5.0		3.0	5.0	
6	Hot Face Temperature (design)	°F	2,000		2,000	2,000	
7	Hot Face Temperaure (calculated)	°F	1,649		1,130	1,649	
8	Hot Face Layer	in/ - - -	1/ 8# CF Blanket		1/ 8# CF Blanket	1/ 8# CF Blanket	
9	Back-Up Layer No.1	in/ - - -	1/ 8# CF Blanket		2/ 6# CF Blanket	1/ 8# CF Blanket	
10	Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 6# CF Blanket	
11	Foil Vapor Barrier	in/ - - -	None		None	None	
12	Castable Reinforcement (SS Needles)	wt%	None		None	None	
13	Anchors / Tie Backs:	- - -	Pins & Clips		Pins & Clips	Pins & Clips	
14	Material	- - -	310 S.S.		304 S.S.	310 S.S.	
15	Attachment	- - -	Welded		Welded	Welded	
16	Casing:						
17	Material	in/ ASTM	0.1875 / A36		0.1345 / A36	0.1875 / A36	
18	Internal Coating	- - -	None		None	None	
19	External Temperature, Typical	°F	180		180	180	
20	Comments / Clarifications	- - -	w/ cfb wraps		w/o cfb wraps	w/ cfb wraps	
21			SHOP Installed		SHOP Installed	SHOP Installed	
22							
23			SIDEWALLS		ENDWALLS		
24	Convection Section Design:		SHIELD	FINNED	TUBESHEETS	HEADER BOXES	
25	Total Refractory Thickness	in	3.0	3.0	3.0	2.0	
26	Hot Face Temperature (design)	°F	2,000	2,000	2,200	2,000	
27	Hot Face Temperaure (calculated)	°F	1,048	1,048	1,048	766	
28	Hot Face Layer	in/ - - -	1/ 8# CF Blanket	1/ 8# CF Blanket	3/ Sparlite HS	1/ 8# CF Blanket	
29	Back-Up Layer No.1	in/ - - -	2/ 6# CF Blanket	2/ 6# CF Blanket	None	1/ 8# CF Blanket	
30	Back-Up Layer No.2	in/ - - -	None	None	None	None	
31	Foil Vapor Barrier	in/ - - -	None	None	None	None	
32	Castable Reinforcement (SS Needles)	wt%	None	None	None	None	
33	Anchors / Tie Backs:	- - -	Pins & Clips	Pins & Clips	Bullhorns	Pins & Clips	
34	Material	- - -	310 S.S.	304 S.S.	304 S.S.	304 S.S.	
35	Attachment	- - -	Welded	Welded	Welded	Welded	
36	Casing:						
37	Material	in/ ASTM	0.1345 / A36	0.1345 / A36		0.1345 / A36	
38	Internal Coating	- - -	None	None	None	None	
39	External Temperature, Typical	°F	180	180		180	
40	Comments / Clarifications	- - -	Cleaning/Sootblowing lanes: none			Bolted Assembly	
41		- - -	SHOP Installed	SHOP Installed	SHOP Installed	SHOP Installed	
42							
43				FLUE GAS DUCTS			
44	Stack & Uptakes Design:			15° TRANSITION	DISCH. DUCT		
45	Quantity			One	One		
46	Type / Location	- - -		Full L / Conv	Self.Spt / Grade		
47	Length / Metal Outside Diameter (top)	ft/ ft		1.08 / n/ a	7 / 1.333		
48	Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 20		
49	Total Refractory Thickness	in		0.0	0.0		
50	Hot Face Temperature (design)	°F					
51	Hot Face Temperaure (calculated)	°F		447	447		
52	Hot Face Layer	in/ - - -		None	None		
53	Back-Up Layer No.1	in/ - - -					
54	Castable Reinforcement (SS Needles)						
55	Anchors / Tie Backs:	- - -					
56	Material	- - -					
57	Attachment	- - -					
58	Casing:						
59	Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36		
60	Corrosion Allowance	in		None	None		
61	Internal Coating	- - -		None	None		
62	External Temperature, Typical	°F		447	447		
63	Comments / Clarifications	- - -					
64							

Owner Ref.: H-741 THM Ref.: MJ17-265

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MECHANICAL / STRUCTURAL DESIGN BASIS

Refractory & Coatings Design:

Refractory Design	Per Std560: 180°F Avg. Casing Temperature @ Ambient Conditions of 0 MPH & 80°F		
Refractory Dryout	SHOP dryout = None // FIELD dryout is NOT required with the use of TC's AHR additive to Castable.		
Coating, Internal	None		
Coating, External	Base Coat:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface	
	Int. Coat:	None	
	Top Coat:	None	

Applicable Standards:

API	~~Std 560 (ISO 13705); Fired Heaters for ...~~	AISC	Specification for Design, ... Steel for Buildings
API	Std 530 (ISO 13704); Calc. of Heater Tube ...	AWS	D 1.1; Structural Welding Code
ASME	B31.3, Chemical Plant and ... Piping	ASTM	tube/ smls pipe/ fitting spec's noted herein
ASME	Sections I, II, VIII, IX; ASME B&PV Code	ASTM	refractories per C27, C155, C401 & C612
ASME	Section V; Non Destructive Examination	NFPA	NFPA 70; National Electrical Code

Wind Design:		Seismic Design:	
Spec. or Standard	ASCE 7-10	Spec. or Standard	ASCE 7-10
Velocity/ Imp. Factor	120 mph / 1	Risck Cat./Imp. Factor	III / 1.25
Site Exposure	"C"		
Physical Design:		**Site Design Basis:**	
Plot Limitations	None	Site Elevation	750 ft AMSL
Tube Limitations	None	Stack Design Temp.	90 °F
Firebox Pressure	Positive; approximately +1.0 inH2O	FG Discharge Elev.	20 ft AG
Ambient Temp's	-20 °F Min/ 60 °F Dsn/ 110 °F Max	Area Classification	Unclassified

MAJOR SUBSYSTEMS & ACCESSORIES

Major Services & Subsystems		Major Accessories:		
Process Design	INCLUDED in base pricing	Casing/ Tube Seals	4	TubeSox; Radiant & Conv.
Mechanical Design	INCLUDED in base pricing	Observation Doors	2	4 in Dia. w/ H.T. glass
Structural Design	INCLUDED in base pricing	Observation Doors	1	4 in Dia. w/ HT glass on Arch
Radiant Section	INCLUDED in base pricing	Access Doors	1	Std 24" x 24"
Convection Section	INCLUDED in base pricing	Expansion Joints	None	
Combustion Mgmt	INCLUDED in base pricing	Ladders & Platforms	Not Included	
Burner Piping	INCLUDED in base pricing	L&P Coating	N/A	
Forced Draft System	INCLUDED in base pricing			

Casing Penetrations			Pressure Part Penetrations		
Fbox Purge/ Snuff	None		Coil TSTC's, Radiant	None	
CA Temp/Pres	None		Coil TSTC's, Convection	None	
FG Temperature	2	1.5"NPS 3000# Coupling	Process TI conn's	3	1.5" NPS 900# RFWN
FG Pressure	2	1.5"NPS 3000# Coupling	Process PI conn's	1	1.5" NPS 900# RFWN
FG Comp. (Sample)	2	1.5"NPS 3000# Coupling	spare		
FG Sample	2	4"NPS 150# RFWN's	spare		
O2 Analyzer Port	None		spare		

Dampers

	FD Fan (blower) qty = 0	Uptake Ducts	Stack qty = 0
Function	Note:		Note:
Design	Fan inlet damper is inappropriate		Stack Damper (which provides draft
Materials	for forced draft SHO's where O2		control) is inappropriate for forced
Bearings	Control is provided by the CMS O2		draft SHO's where the combustion
Operator	Trim Module which controls the fan		conditions are controlled real-time
Positioner	(blower) motor's VFD/ VSD.		via the CMS.
Instruments			

Sootblowers:	Qty.	Type	Location	FG T	Material	Steam T & P	O.E.M. / Ref.
Lane 1:	None						
Lane 2 :	None						

Owner:	Unknown	Owner Ref.:	H-741	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	Rev
SHO Model:	SHO500	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for RADIANT COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Radiant Coil Design Basis:	units	**Variable Values**		**Comments**		
Design Pressure, P	psig	**1,095**		Design Pressure is per PO / Contract.		[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**763** /	**-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract		[b]
Design Allowances, Corrosion/ Erosion	in	0.0625 /	0.000	Allowances (both CA & EA) are per PO / Contract		[c]
Design Stress @ Design Temp, S	psi	**12,413**		Design Stress @ T.Dmax		[d]
Pipe/Tube Outside Diameter	in	**4.500**				[e]
Pipe/Tube Material Standard	ASME	SA106GrB		Max. Allowable Nonconcentricity, per ASTM:	12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless				[g]
Butt Weld Inspection	RT or Other	100 of 100%				[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 80 /	0.337	Tube Inside Radius (R.i), New =	1.913	
Actual Minimum Thickness, t.new / t.EOL	in	0.295 /	0.232	t.EOL = End of Life Thickness = t.new - (CA + EA)		

UG-27 Calculations:						
Circumferential Stress Calculations	---	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%			[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.178	UG-27(c) (1)&(2) Thickness Check:	0.18	= OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.054	UG-27(c) (1) Pressure Limit Check:	4,779	= OK!!	[c]
UG-27(c) (1) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[d]
Longitudinal Stress Calculations	---	0.85	Per UW-12, Circumferential JE of butt-welds is 85%			[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.097	UG-27(c) (2) Pressure Limit Check:	13,189	= OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.135				[g]
UG-27(c) (2) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[h]

Appendix 1, Para.1-1 Calculations:				[i]
Circumferential Stress Calculations	---		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	---		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Work this data sheet with Heater Datasheets and General Arrangement Drawings (latest versions).
i) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

THM

CONFIDENTIAL PROPERTY of ...
TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-265-COIL.VIIIds-Rev. 1

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Owner:	Unknown	Owner Ref.:	H-741	Ftnt & Rev
Purchaser:	UOPR	Purch. Ref.:	J463	
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	
SHO Model:	SHO500	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for CONVECTION COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Convection Coil Design Basis:	units	**Variable Values**		**Comments**		[i]
Design Pressure, P	psig	**1,095**		Design Pressure is per PO / Contract.		[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**650** /	**-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract		[b]
Design Allowances, Corrosion/ Erosion	in	0.0625 /	0.000	Allowances (both CA & EA) are per PO / Contract.		[c]
Design Stress @ Design Temp, S	psi	17,100		Design Stress @ T.Dmax		[d]
Pipe/Tube Outside Diameter	in	**4.500**				[e]
Pipe/Tube Material Standard	ASME	SA106GrB		Max. Allowable Nonconcentricity, per ASTM:	12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless				[g]
Butt Weld Inspection	RT or Other	100 of 100%				[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 80 /	0.337	Tube Inside Radius (R.i), New =	1.913	
Actual Minimum Thickness, t.new / t.EOL	in	0.295 /	0.232	t.EOL = End of Life Thickness = t.new - (CA + EA)		

UG-27 Calculations:						[i]
Circumferential Stress Calculations	---	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%			[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.127	UG-27(c) (1)&(2) Thickness Check:	0.18	= OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.105	UG-27(c) (1) Pressure Limit Check:	6,584	= OK!!	[c]
UG-27(c) (1) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[d]
Longitudinal Stress Calculations	---	0.85	Per UW-12, Circumferential JE of butt-welds is 85%			[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.071	UG-27(c) (2) Pressure Limit Check:	18,169	= OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.161				[g]
UG-27(c) (2) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[h]

Appendix 1, Para.1-1 Calculations:				[g]
Circumferential Stress Calculations:	---		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	---		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
i) These calculations are for the Convection Coil and for the Crossovers (between radaint and convection modules).
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

THM — CONFIDENTIAL PROPERTY of ... **TULSA HEATERS MIDSTREAM LLC**

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE — **FLUXED HEATER COIL**

ASME SECTION VIII - DIVISION 1 CALCS — **MJ17-265-COIL.VIIIds-Rev. 1** **Pg 2 of 2**

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-741	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	Rev
Burner OEM:	**Callidus Technologies, LLC**	OEM Ref.:	9020143	
SHO Model:	SHO500	Service:	Regen Gas Heater	
CMS Model:	CMS1500	Location:	Unknown @ 750 ft elevation	

GENERAL DESIGN CONDITIONS

General Application:			
Service	---	Regen Gas Heater	Regen Gas Heater
Operating Case	---	**Over-Design Case**	**Design Case**
Burner Type		Enhanced IFGR	Enhanced IFGR
Burner Quantity	---	1	1
Model & Size:	---	CUBL-3W	CUBL-3W
Flame Shape	cylindrical or flat	Cylindrical	Cylindrical
Applicable Fuel(s)	---	Fuel Gases pg. 2	Fuel Gases pg. 2
Location(s) / Firing Direction		Endwall Center	Endwall Center
Firing Orientation		Horizontal	Horizontal
BridgeWall Temperature, calc.	°F	1,649	1,526

Heat Release Performance:		MMBTU/hr	MMBTU/hr
Operating Case	---	Over-Design Case	Design Case
Max. Heat Release, per Burner	LHV Basis	9.20	6.93
Design Heat Release, per Burner	LHV Basis	8.37	6.30
Min. Heat Release, per Burner	LHV Basis	1.84	1.84
Turndown, minimum/ actual	max / min	5.00 / 5.00	5.00 / 5.00

Radiant Dimensions:	comments	ft / (in)
Casing Width / Height, Casing	face - face	8.00 / (96)
Casing Length, Casing to Casing	face - face	10.00 / (120)
Helical Coil CenterLine Diameter	CL - CL	6.50 / (78)
Helical Coil Inside Diameter	face - face	6.13 / (74)
Serpentine Coil CtrLine Dimensions	W / H	
Serpentine Coil Inside Dimensions	face - face	
Firebox Length, Refractory Faces	face - face	9.17 / (110)

Flame Dimensions:		ft / (in)
Burner CL elev., approx.	AG	4.50 / (54)
Flame Length, calc.	@ design HR	10.9 / (131)
Flame Dia., calc.	@ design HR	2.50 / (30)
Actual Clearances		ft / (in)
Burner - tube (tangential)	CL / Net	3.25 / (39)

Combustion Air (CA) Basis - All Fuel(s):		
CA Temperature, min.	-20	°F
CA Temperature, design	60	°F
CA Temperature, max.	110	°F
CA Pressure, Ambient	14.30	psia
CA Humidity, Design	50%	%RH

FG Draft, at Bridgewall	0.50	inH2O	(positive)
CA Pressure, at Burner	7.64	inH2O	(positive)
CA Pressure Drop, Design	7.10	inH2O	
CA Pressure Drop, Actual	t.b.q.	inH2O	

Emissions -	---	**Gaseous Fuel(s):**		**Liquid Fuel(s):** no
Design/ Guaranteed Emissions:	basis	3.0% O2, dry (LHV)		
NOx Emissions	LHV Basis	0.053	Lb/MMBTU	
SOx Emissions	LHV Basis	no quote	Lb/MMBTU	
CO Emissions	LHV Basis	0.041	Lb/MMBTU	
VOC Emissions	LHV Basis	0.019	Lb/MMBTU	
UHC Emissions	LHV Basis	0.007	Lb/MMBTU	
SPM10 Emissions	LHV Basis	0.014	Lb/MMBTU	
Noise Emissions	---	85	dBA @	

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

BURNER DATA SHEET
AES SYSTEMS of UNITS

SHO = Superior Quality, Flexibility, Dependability & Modularity

MJ17-265-BRNRds-Rev. 1

Owner Ref.: **H-741** THM Ref.: **MJ17-265**

Ftnt & Rev

GASEOUS FUEL(S) & PRODUCTS OF COMBUSTION

Fuel Gas Basis:		---	**Gas 1**	**Mol.Wt.**
Operating Mode		---	Over-Design Case	
Temperature, at Burner		°F	100	
Pressure, at Burner (available)		psig	75	
LHV (net HV), mass basis		AES units	20,426	BTU/ Lbm
LHV (net HV), volume basis		AES units	976	BTU/ scf
HHV (gross HV), mass basis		AES units	22,613	BTU/ Lbr
HHV (gross HV), volume basis		AES units	1,080	BTU/ scf
Molecular Weight (mass)		all units	18.13	x/ xmole

Fuel Gas Composition(s):	symbol	MW	**Gas 1**	**Mol.Wt.**
	H2	2.02	0.00%	mole %
	O2	32.00	0.00%	mole %
	N2 + Ar	28.15	1.00%	mole %
	CO	28.01	0.00%	mole %
	CO2	44.01	1.00%	mole %
	CH4	16.04	88.00%	mole %
	C2H6	30.07	8.00%	mole %
	C2H4	28.05	0.00%	mole %
	C3H8	44.10	2.00%	mole %
	C3H6	42.08	0.00%	mole %
	C4H10	58.12	0.00%	mole %
	C4H8	56.11	0.00%	mole %
	C5H12	72.15	0.00%	mole %
	C5H10	70.13	0.00%	mole %
	C6+	86.18	0.00%	mole %
	H2S	34.08	0.00%	mole %
	SO2	64.06	0.00%	mole %
	NH3	17.09	0.00%	mole %
	H2O	18.02	0.00%	mole %
	spare		0.00%	mole %

Products of Combustion @ Design:		**Gas 1**	**Mol.Wt.**
Excess Air Concentration	mole%	**15%**	mole%
Temperature, PoC at Bridgewall	°F	1,649	
Temperature, PoC at Burner	°F	1,450	
Temperature, PoC Acid Dew Point	°F	151	

<< ------- mass balance by TULSA HEATERS MIDSTREAM LLC ------- >>

Combustion Mass Balances:		MW	Lbm/ hr	
Fuel Flow Rates	mass in		410	
Comb. Air Flow Rates	mass in	28.96	7,736	
POC Mass Flow Rates (wet)	mass out	27.89	8,145	
POC Mass Flow Rates (dry)	mass out	29.91	7,251	
POC Component Flow Rates ...	O2	32.00	233	
	N2 + Ar	28.15	5,915	
	CO2	44.01	1,102	
	H2O	18.02	894	
			<< -------	vapor / solid concentrations are in ppmvd / ppmd, resp. ------- >>
	NOx	46.01	0.45	40 ppm
	SOx	64.06	0.00	0 ppm
	CO	28.01	0.34	50 ppm
	VOC	44.10	0.16	15 ppm
	UHC	16.04	0.06	15 ppm
	SPM		0.12	16 ppm

Ftnt & Rev

ADDITIONAL REQUIREMENTS

QA Requirements:

Performance Test @ shop	---	Not Required
CFD Model of Firebox	---	None
CFM of CA Ducting	---	None
Mill Certs, fuel wetted parts	---	Not Required
PMI, fuel wetted parts	---	Not Required

Fuel Wetted Components:

Oil Gun Model	---	None
Gun Tip / Atomizer Mat'ls	ASTM	None / None
Gas Risers Material	ASTM	t.b.d.
Gas Manifolds Mat'l	ASTM	Carbon Steel

Burner Pilot:

Burner Pilot:	model	by O.E.M.
Type	---	Self-Inspirating
Heat Release	BTU/ hr	> 90,000
Ignition Method	man.or elec.	Electric
Pilot Fuel Gas	---	Gas 1 Mol.Wt.
Pilot Detection	type or none	None
Fuel P, avail. @ pilot	psig	10 (5 -15 is OK)

Connections:

Primary Fuel Gas	sz & spec	by OEM & 150# A105 RF
Secondary Fuel Gas	sz & spec	None
Fuel Oil	sz & spec	None
Atomizing Media	sz & spec	None
Pilot Gas	sz & spec	by OEM & 150# A105 RF
Detector, Main Flame	sz & spec	None
Detector, Pilot Flame	sz & spec	by OEM - UV Scanner Mount
Sight Ports	sz & spec	None

Windbox or Plenum:

Individual windbox	yes or no	yes
Material Description	th x ASTM	12 ga. x A36
Common Plenum Depth	ft.	none
Refractory Description	th x type	1.00 in x Min.Wool
Refractory Anchors	ASTM	C.S. Expanded Metal
Register Type		none
Register Material	ASTM	C.S.
Leakage, guaranteed	wt%	< 5.0 % of Max HR Flow
Actuation	man., pneu.or elec.	manual

APPLICABLE SPECIFICATIONS & STANDARDS

TULSA HEATERS MIDSTREAM LLC Specifications:

a) Burner scope ...
  1) Pilot w/ Electric Ignition - Ignition Transformer is by others (CMS Supplier)
  2) UV Scanner is by others. Swivel scanner mount (by burner supplier) aimed at pilot and main flame when pilot off.
  3) Sight port(s) for viewing pilot and main flames.

b) Burner shall have 5:1 turndown; this capability shall NOT compromise flame size or performance.

c) External Coatings shall be as follows:

Prime:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
Intermediate:	None
Finish:	None

d) Burner is mounted and fired horizontally. Tile to be shop mounted in 304 SS case.

e) Even though job location/elevation is different, burner to be sized to range from sea level to 3500 ft and worst case air delta P reported.

Owner:	Unknown	Owner Ref.:	H-741	Ftnt & Rev
Purchaser:	UOPR	Purch. Ref.:	J463	
Heater OEM:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	
CMS OEM:	**International Custom Controls**	CMS Model:	CMS1500	

System Overview:

Design Philosophy	Meet or Exceed NFPA 85 with packaged Combustion Management System
Heater DHR	Heater Design Heat Release = 9 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
CMS DHR	CMS Design Heat Release = 15 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
No. of Burners	One Callidus CUBL-3W Burner per heater

THM Specs	Provided datasheets	Ambient P, Design	750 ft AMSL = 14.30 psia
THM P&ID	CMS1500 P&ID	Ambient T Range	-20 °F Minimum to 110 °F Maximum
Area Classification	Unclassified	Noise Limit	85 dBA @ 3 ft
Supply Power	**120V / 1 ph / 60 Hz**	Ind. Standard(s)	B31.3, NFPA 70 (NEC), **NFPA 85**
Supply Air	**80** psig	Customer Specs	**None**

Subsystem Design:

		Dsn P	Dsn T	NPS	Dsn V	End Con.[4]
Main Gas Train[3]	Double Block & Bleed SDVs with **ZSC's**	150 psig	150°F	1-1/2"	67	150# RF
Pilot Gas Train	Double Block & Bleed SDVs	150 psig	150°F	1/2"	11	150# RF
Instrument Air Hdr		125 psig	150°F	1"	- - -	150# RF
Main Oil Train	None					
Atom. Media Train	None					
Local Panel (LCP)	**NEMA 4** Enclosure for Controls, HMI, Pushbuttons & Lights				Z-Purge:	No
Other Panel(s)	**NEMA 7** Enclosure with 6kV Ignition Transformer & 7mm HiV IGN Cable					
Other Panel(s)	**None**					
Forced Draft Sys.	One FD Fan[1]; a) unlined ducting, b) CA controlled by **Damper**					

Minimum Pre-Purge Interlocks:

- ✔ Manual ESD Switch (pushbutton)
- ✔ SDVs FailSafe Positions
- ✔ Stack High Temperature
- ✔ Process High Temperature
- ✔ Gas Supply Low Pressure
- ✔ Gas to Burner High Pressure
- – Firebox High Pressure
- – Oil Supply Low Pressure
- – Atom.Media Low Pressure

Minimum Purge Interlocks:

- ✔ Minimum CA Flow

Gas / Oil Trains Overview:

- ✔ Pilot Double Block & Bleed SDVs
- ✔ Gas Train Dbl Block & Bleed SDVs
- ✔ Inlet Header Isolation Valve
- ✔ Inlet Header Sediment Trap w/ Cap
- ✔ Inlet Header Gas Strainer
- ✔ Inlet Header Pressure Regulator
- – Inlet Header Relief Valve
- – Oil Train Dbl Block & Bleed SDVs
- – Atom.Media dP Controls
- – Gas/ Oil Flow Element
- – Comb. Air Flow Element
- – Min. Fire PCV in Parallel w/ TCV

Local Panel Components Overview:

- ✔ **Slate Control Package**
- ✔ Touchscreen HMI
- – Remote Control Panel
- – Field Wiring schematic to connect LCP to J/B
- – LCP Weather/Sun Shield

Supporting Components:

- ✔ **Pilot Flame UV Detector**
- – **Main Flame UV Detector**
- ✔ CA Ducting to Burner(s)
- ✔ Flex Hoses at Brnr Terminals
- – Individual Burner SDVs
- ✔ **Fuel Train Only (no skid)**
- – O2 Analyzer
- ✔ Process TC (control loop)
- ✔ Process TC (shutdown)
- ✔ Process Pressure Gauge[2]
- ✔ Stack TC
- – Process Coil Relief

NOTES:

1. Forced draft fan supplied by THM
2. Process Pressure Gauge to be designed for 0-1095 psig
3. ZSC's only on block valves, not bleed.
4. Piping 2" and below to use threaded fittings, except end connections.
5. FAT required

rev.	date	description	by	appv'd
1	13-Nov-17	Rev'd Purch. Ref. No.	JDC	JF
0	19-Aug-17	Issued for Approval	JF	JDC

THM TULSA HEATERS MIDSTREAM

COMBUSTION MANAGEMENT SYSTEM
15 MMBTU/hr RATED HEAT RELEASE

CMS1500 DATA SHEET
MJ17-265-CMS1500ds- Rev. 1

Purch. Ref.: **H-741** THM Ref.: **MJ17-265**

Process Interlocks:

	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Process Flow	MLb/hr	FALL-300	7.6	None	20.8	116.2	- - -	
		Action:	S/D @ minimum flow to avoid "short circuiting" one or more coil passes					
Process Temperature	°F	TSHH-202	None	600	- - -	550	600	
		Action:	S/L @ maximum fluid temperature to avoid "overheating" the coil					
Heater Interlocks:								
Stack Temperature	°F	TSHH-201	None	700	377	483	- - -	
		Action:	S/D @ 700 F, which is indicative of an "out-of-control" fire in the heater					
CMS Interlocks:								
FG Train Pressure	psig	PSLL-101	10	None	- - -	- - -	150	
		Action:	S/D @ 10 psig, which is indicative of "inadequate" fuel gas supply					
FG Train Pressure	psig	PSHH-103	None	35	- - -	- - -	150	
		Action:	S/D @ 35 psig, which is indicative of a "failure" of PCV-100 &/or FG supply					
FD Fan Interlocks:								
FD Fan (blower) SP	inH2O	PSLL-107	0.20	None	0.46	7.6	11.4	
FDF turndown:	5.0	Action:	S/D @ 0.2 inH2O, which is indicative of a FD Fan (blower) "failure".					

Other permissives/interlocks in BMS Operations Manual (block valves, FCV, and flame signal).

CMS CONTROL COMPONENTS

Process Control:	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Remote T Setpoint	°F	TY-700	0	999	- - -	550	600	4 -20 mA INPUT
		Action:	4 -20 mA input corresponds to a temperature setpoint range of 0 -999 °F					
Process Temperature	°F	TT-203	0	999	- - -	550	600	4 -20 mA OUTPUT
		Action:	4 -20 mA output corresponds to a process temperature range of 0 -999 °F					
Main Gas Regulator	psig	PCV-100	- - -	- - -	- - -	35	150	Factory Set @ 35 psig
Pilot Gas Regulator	psig	PCV-105	- - -	- - -	- - -	10	150	Factory Set @ 10 psig
Inst. Air Regulator	psig	PCV-107	- - -	- - -	- - -	80	150	Factory Set @ 80 psig

CUSTOMER CONNECTIONS (TO DCS)

The following signals are sent to the customer's DCS from the control panel:

- Remote ESD
- Heater Run
- Low Process Flow
- High Stack Temperature
- High Process Temperature
- Burner Status

Owner:	Unknown	Heater Ref.:	H-741	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	Rev
Location:	Unknown	FDF OEM Ref.:	340802	
FD Fan OEM:	**Chicago Blower**	FDF Item No.:	BL-741	

General Application:						
FD Fan(s) Design Basis	mass.flow.%	115% of Design MASS Flows per API Standard 560				
Location(s)	- - -	@ Grade, adjacent to Burner Endwall (incorporated into Combustion Skid)				
Area Classification	NEC	Unclassified				
		AES Units				
Process Design Conditions:		**Heater Design**	**FDF Test Block**			
Mass Flow Rate/ % Htr Design	Lb/hr / kg/ hr	7,736 / 100%	8,900 / 115%			
Volumetric Flow/ % Htr Design	acfm / am3/ hr	1,800 / 100%	2,200 / 122%			
Density, @ Suction	as noted	0.074 Lb/ ft3	0.068 Lb/ ft3			
Design Allowances, Temp./ SP	°F / °C	- - - / - - -	130 °F / 149%			
Temperature @ Min / Suction / Design	°F / °C	-20 / 60 / 110				
Static Pressure @ Suction	as ntoed	-0.2 inH2O	-0.2 inH2O			
Site Elevation/ Atm. P	as ntoed	750 ftAMSL	14.30 psia			
Static Pressure Rise (min./ guar.)	inH2O	7.6 / **7.6**	11.4 / **11.4**			
Fan Speed (allowable/ actual)	RPM	3,600 / 3,525	3,600 / 3,525			
Sound Pressure (allowable/ guar.)	dBA	< 85 / < 85	< 85 / < 85			
Relative Humidity	%	50%				
Fan Mechanical Design:	tag // OEM	**BL-741 // CHICAGO BLOWER Corp.**				
OEM Reference	CMS // FD Fan	International Custom Controls // 340802				1
OEM Model &/or Type-Size	per OEM	D/36A (SQAD)				
Arrangement	- - -	Arrangement 4 (direct drive)				
Brake Power, Design/ Test Block (calc.)	HP	10.0 / 10.0				
Temperature, Mechanical Design	°F	135 °F Mechanical Design				
Casing Description / Materials	- - -	"Square" pattern / CS				
Rotor Description / Materials	- - -	Airfoil Blades / CS				
Shaft Description / Materials	- - -	None - Arrangement 4				
Bearings Description / Materials	- - -	None - Arrangement 4				
Noise Abatement Provisions / SPL	- - -	85 dBA				
External Coatings / Surface Prep.	- - -	OEM's Std Multiple Coat System				
Purchase Specifications	- - -	OEM's Std Industrial Quality Design				
Fan Control Design:	tag // OEM	**VSD-741 / by OTHERS**				
VFD Description	- - -	by Others / Owner				
VFD Rating	- - -	- - -				
Damper Actuator Description	- - -	- - -				
Damper Actuator Operation	- - -	- - -				
Fan Motor Design:	tag // OEM	**BM-741 / TECO-WESTINGHOUSE**				
OEM Model &/or Type-Size	- - -	Catalog EP0102 / AEHH8N				1
VFD Service / speed range	- - -	YES / 3 - 60 Hz or 180 - 3,600 rpm				
Motor Type / Frame Size	- - -	NEMA TEFC / 215T				
Rated Power w/ SF @ Speed	NEMA	10 HP w/ 1.15 SF @ 40°C				
Nameplate Input Power	V/ Hz/ ph	**460V / 60 Hz / 3 ph**				
Typical Performance	- - -	89.5- 91.0 % FL Eff'y @ 89.5 % FL PF				
Insulation Description	- - -	Class F / B Rise				
External Coatings & Surface Prep.	- - -	OEM's Std Multiple Coat System				
Purchase Specifications	- - -	None				

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FD FAN DATA SHEET

AES & cgs or SI SYSTEMS of UNITS

MJ17-265-FDFANds-Rev. 1

Owner:	Unknown	Owner Ref.:	H-781
Purchaser:	UOPR	Purchaser Ref.:	J463
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266
Service:	Heat Medium Heater	Project:	200 MMscfd Cryo Plant
Quantity:	1	Location:	Unknown
SHO Duty:	17.55 MMBTU/ hr	SHO Model:	SHO1750
CMS Release:	22.30 MMBTU/ hr	CMS Model:	CMS2500
SHOS Flow:	650 USgpm @ 137 ft TDH	SHOS.Model:	SHOS660

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PROCESS DESIGN CONDITIONS

Heater Section	---	Radiant / Convection	Radiant / Convection
Operating Case	---	Over-Design Case	Design Case
Service	---	Heat Medium Hea	Heat Medium Hea
Heat Absorption (R/C)	MMBTU/ hr	11.82 / 5.72	10.88 / 5.07
Process Fluid	---	Therminol 55	Therminol 55
Process Mass Flow Rate, Total	Lb/ hr	267,775	267,775
Process Bulk Velocity (calc. R/C)	ft/ s	9 / 8	9 / 8
Process Mass Velocity (calc. R/C)	Lb/ s ft2	421 / 421	421 / 421
Coking Allowance (dP calcs)	in		
Pressure Drop, Clean (allow. / calc.)	psi	20 / 21	20 / 21
Pressure Drop, Fouled (allow. / calc.)	psi		
Average Heat Flux (allowable)	BTU/ hr ft2	13,000	13,000
Average Heat Flux (calculated)	BTU/ hr ft2	11,560	10,640
Maximum Heat Flux (allowable)	BTU/ hr ft2		
Maximum Heat Flux (calc. R/C)	BTU/ hr ft2	20,600 / 32,070	18,900 / 29,070
Fouling Factor, Internal	hr ft2 °F/ BTU	0.002	0.002
Corrosion or Erosion Characteristics	---		
Max. Film Temperature (allow. / calc.)	°F	650 / 423	650 / 413
Inlet Conditions:			
Temperature	°F	195	195
Pressure	psig	60	60
Mass Flow Rate, Liquid	Lb/ hr	267,775	267,775
Mass Flow Rate, Vapor	Lb/ hr	0	0
Weight Percent, Liquid / Vapor	wt%	100% / 0%	100% / 0%
Density, Liquid / Vapor	Lb/ ft3	51.30 / 0.00	51.30 / 0.00
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	--- / 0.0	--- / 0.0
Viscosity, Liquid / Vapor	cp	3.3101 / 0.000	3.310 / 0.000
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.518 / 0.000	0.518 / 0.000
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.0693 / 0.000	0.069 / 0.000
Outlet Conditions:			
Temperature	°F	305	305
Pressure	psig	41	41
Mass Flow Rate, Liquid	Lb/ hr	267,775	267,775
Mass Flow Rate, Vapor	Lb/ hr	0	0
Weight Percent, Liquid / Vapor	wt%	100% / 0%	100% / 0%
Density, Liquid / Vapor	Lb/ ft3	49.00 / 0.00	49.00 / 0.00
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	--- / 0.0	--- / 0.0
Viscosity, Liquid / Vapor	cp	1.311 / 0.000	1.311 / 0.000
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.565 / 0.000	0.565 / 0.000
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.066 / 0.000	0.0656 / 0.000

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

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COMBUSTION DESIGN CONDITIONS

Overall Performance:

Operating Case	---	Over-Design Case	Design Case		
Service	---	Heat Medium Hea	Heat Medium Hea		
Excess Air	mol%	15.0%	15.0%		
Calculated Heat Release (LHV)	MMBTU/ hr	20.28	18.22		
Guaranteed Efficiency	HR%	84.5%	85.6%		
Calculated Efficiency	HR%	86.5%	87.6%		
Radiation Loss	HR%	3.00%	3.00%		
Flow Rate, Combustion Gen./ Imp.	Lb/ hr	19,739	17,736		
Flue Gas Temp. Leaving (R/C)	°F	1,452 / 468	1,402 / 429		
Flue Gas Mass Velocity	Lb/ sec ft2	0.472	0.424		

Fuel(s) Data:

		Gas 1			
		Mol.Wt.			
LHV	BTU/ scf	976			
LHV	BTU/ Lb	20,426			
P @ Burner	psig	75			
T @ Burner	°F	100			
MW	Lb/ Lbmole	18.13			
m @ ??? °F	cp	---			
m @ ??? °F	cp	---			
Atomizing Media		---			
Atom. Media P & T		---			

Components:

N	wt%	---			
S	wt%	---			
Ash	wt%	---			
Ni	ppm	---			
Va	ppm	---			
Na	ppm	---			
Fe	ppm	---			
H2	mol%	0.0%			
O2	mol%	0.0%			
N2 + Ar	mol%	1.0%			
CO	mol%	0.0%			
CO2	mol%	1.0%			
CH4	mol%	88.0%			
C2H6	mol%	8.0%			
C2H4	mol%	0.0%			
C3H8	mol%	2.0%			
C3H6	mol%	0.0%			
C4H10	mol%	0.0%			
C4H8	mol%	0.0%			
C5H12	mol%	0.0%			
C5H10	mol%	0.0%			
C6+	mol%	0.0%			
H2S	ppmv	0.0%			
SO2	mol%	0.0%			
NH3	mol%	0.0%			
H2O	mol%	0.0%			
spare	mol%	0.0%			

Blower/Fan Peformance:

Volumetric Flow	acfm	4,300
Rated Power	HP	15
Fan Speed	RPM	3,600
Sound Pressure	dBA	< 85
Area Classification	NEC	Unclassified

Burner Design:

OEM	---	Callidus Technologies, LLC	
Type	---	Enhanced IFGR	ULTRA Low NOx
Quantities	---	1	Burner
Model No.	---	CUBL-5W	Cylindrical
Windbox	---	yes ...	
Location	---	EndWall Center ...	Horizontally Fired

Pilot Design:

Type / Model		Self-Inspirating /	by O.E.M.
Ignition	---	Electric	requires elec.ign.system
Heat Release	--	> 90000 BTU/ hr on ...	Gas 1

Burner Performance:

Minimum Heat Release	MMBTU/ hr	4.46
Design Heat Release	MMBTU/ hr	20.28
Maximum Heat Release	MMBTU/ hr	22.30
Burner Turndown	Max:Min	5.00
Volumetric Ht. Release	BTU/ hr ft3	10,034
Pressure @ Arch	inH2O	0.60
Pressure @ Burner	inH2O	7.75
Combustion Air T @ Burner	°F	60
Flue Gas T @ Burner	°F	1,260

Guaranteed Emissions:

Basis of Guarantee	---	3.0% O2,	dry (LHV)
NOx Emissions	Lb/MMBTU	0.053	40 ppm
SOx Emissions	Lb/MMBTU	no quote	
CO Emissions	Lb/MMBTU	0.041	50 ppm
VOC Emissions	Lb/MMBTU	0.019	15 ppm
UHC Emissions	Lb/MMBTU	0.007	15 ppm
SPM10 Emissions	Lb/MMBTU	0.014	16 ppm
Noise Emissions	dBA @ 3ft	85	

Net Flame Clearances:

Est. Flame Size	approx. 19.7 ft L x 3.5 ft Diameter
Hor Clearance	1 ft NET Tube Clearance
Vert. Clearance	1 ft NET Tube Clearance
Axial Clearance	1.45 ft NET Refractory Clearance (to Arch hot face)

Nominal Flame Clearances:

from burner CL ...		Vertical	Horizontal
to Tube CL, API	ft	10.61	7.08
to Tube CL, calc.	ft	4.50	4.50
to Refrac., calc.	ft	n / a	21.17

			RADIANT	SHIELD	CONVECTION	Ftnt & Rev
1	PRESSURE PARTS DESIGN					
2						
3	Coil Design:		RADIANT	SHIELD	CONVECTION	
4	Service		Heat Medium Hea	Heat Medium Hea	Heat Medium Heater	
5	Design Basis for Tube Temperature		API 530	API 530	API 530	
6	Design Basis for Tube Wall Thickness		ASME Sec. VIII-1	ASME Sec. VIII-1	ASME Sec. VIII-1	
7	Design Life	hr	100,000	100,000	100,000	
8	Design Pressure (elastic / rupture)	psig	150 /	150 /	150 /	
9	Design Fluid Temperature	°F	305	305	305	
10	Design Temperature Allowance	°F	29	29	29	
11	Design Corrosion Allowance (tubes/fittings)	in	0.063 / 0.063	0.063 / 0.063	0.063 / 0.063	
12						
13	Maximum Tube Temperature (clean)	°F	440			
14	Maximum Tube Temperature (fouled)	°F	486	389	582	
15	Design Tube Temperature	°F	515	611	611	
16	Inside Film Coefficient	BTU/ hr ft2 °F	195	141	141	
17	Weld Inspection	RT or Other	100 of 100%	100 of 100%	100 of 100%	
18	Weld Heat Treatment	s.rel., t.stab. or none	None	None	None	
19	Hydrostatic Test Pressure	psig	per API	per API	per API	
20						
21	Coil Arrangement:		Horizontal	Horizontal	Horizontal	
22	Coil Type	- - -	Helical	Serpentine	Serpentine	
23	Tube Material (pipe or tube spec)	ASTM	SA106GrB	SA106GrB	SA106GrB	
24	Supplementary Mfg Requirements	ASTM	None	None	None	
25	Tube Outside Diameter	in	4.500	4.500	4.500	
26	Tube Wall Thickness (aw / mw)	in	0.237 / 0.207	0.237 / 0.207	0.237 / 0.207	
27	Number of Cells (radiant or convection)	- - -	1	1	1	
28	Number of Flow Passes (total / cell)	- - -	2 / 2	2 / 2	2 / 2	
29	Number of Tubes per Row (total / cell)	- - -		4 / 4	4 / 4	
30	Overall Tube (1 turn in radiant) Length	ft	28.27	11.54	11.54	
31	Effective Tube Length / Helix Diameter	ft	28.27 / 9.00	9.96	9.96	
32	Number of Turns or Tubes (total / pass)		30.7 / 15.3	4.0 / 4.0	0.0 / 0.0	
33	Total Exposed Surface	ft2	1,023	47	0	
34	Number of Ext.Surf. Tubes (total / cell)	- - -	0 / 0.0	0 / 0.0	20 / 20.0	
35	Total Exposed Surface	ft2	0	0	2,940	
36	Tube Spacing (horiz. / tube centers)	in	- - - / 8.00	8.00 / 8.00	8.00 / 8.00	
37	Tube Spacing (horiz. to refractory)	in	6.00	4.00	4.00	
38						
39	Coil Fittings:		Heat Medium Hea	Heat Medium Hea	Heat Medium Heater	
40	Fitting Type	- - -	SR 90° Elbows	SR 180° U-Bends	SR 180° U-Bends	
41	Fitting Material	ASTM	SA234 WPB	SA234 WPB	SA234 WPB	
42	Supplementary Mfg Requirements	ASTM	None	None	None	
43	Fitting Outside Diameter	in	4.500	4.500	4.500	
44	Fitting Wall Thickness (aw / mw)	in	0.237 / 0.207	0.237 / 0.207	0.237 / 0.207	
45	Fitting Location	internal or external	Internal	External	External	
46	Tube Attachment	welded or rolled	Welded	Welded	Welded	
47						
48	Coil Terminals:		Outlet		Inlet	
49	Terminal Type	beveled or flanged	Flanged		Flanged	
50	Flange Material	ASTM	SA105		SA105	
51	Supplementary Mfg Requirements	ASTM	None		None	
52	Flange Size and Rating	NPS/ ASME	4" NPS / 300#		4" NPS / 300#	
53	Flange Type	RFWN or RTJ	RFWN		RFWN	
54	Location	- - -	Burner Endwall		Terminal End	
55						
56	Extended Surface:			CONVECTION	CONVECTION	
57	Service	- - -		Heat Medium Hea	Heat Medium Heater	
58	Fin or Stud Row Number	starting @ bottom		No.1 / No.2-3	No.4-5 /	
59	Ext. Surface Type	seg.fins, solid fins, studs		HF Seg. Fins	HF Seg. Fins	
60	Fin/Stud Material	- - -		C.S. / C.S.	C.S. /	
61	Fin/Stud Height	in		0.75 / 1.00	1.00 /	
62	Fin/Stud Thickness	in		0.06 / 0.06	0.06 /	
63	Fin/Stud Density	fin/ in		5.00 / 5.00	5.00 /	
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Owner Ref.: H-781 THM Ref.: MJ17-266

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PRESSURE PARTS DESIGN (continued)

			RADIANT	SHIELD	CONVECTION	
Crossovers:						
Type, location / connections	---		External	/ Flanged	None	
Tube / Fittings Material	ASTM		SA106GrB	/ SA234 WPB		
Tube & Fitting OD / Thickness (aw)	in		4.500	/ 0.237		

Inlet Manifold(s):	type			Simple LOG	
Location	---			Top - Term. End	
Design Basis for Manifold Thickness	---			ASME B31.3	
Design Conditions (temp./press.)	°F/ psig			611 / 150	
Pipe Material	ASTM			SA106GrB	
Fittings Material	ASTM			SA234 WPB	
Flange Material / Style	ASTM			SA105 / RFWN	
Outside Diameters, each Branch	in			8" NPS	
Wall Thickness(es); aw ~~or mw~~	in			SCH40 (0.322)	
End Types (terminal/ dead)	beveled or flanged			Flanged / W.Cap	
Manifold Terminal Type	NPS/ ASME			8" NPS / 300# Flg	
Coil Connection Type	extrusion, olet, etc.			Weld-O-Let	
Coil Terminal Type	NPS/ ASME			4" NPS / 300# Flg	

Outlet Manifold(s):	type	Simple LOG	
Location	---	Burner Endwall	
Design Basis for Manifold Thickness	---	ASME B31.3	
Design Conditions (temp./press.)	°F/ psig	515 / 150	
Pipe Material	ASTM	SA106GrB	
Fittings Material	ASTM	SA234 WPB	
Flange Material / Style	ASTM	SA105 / RFWN	
Outside Diameters, each Branch	in	8" NPS	
Wall Thickness(es); aw ~~or mw~~	in	SCH40 (0.322)	
End Types (terminal/ dead)	beveled or flanged	Flanged / W.Cap	
Manifold Terminal Type	NPS/ ASME	8" NPS / 300# Flg	
Coil Connection Type	extrusion, olet, etc.	Weld-O-Let	
Coil Terminal Type	NPS/ ASME	4" NPS / 300# Flg	

COIL & MANIFOLD SUPPORTS DESIGN

		RADIANT	SHIELD	CONVECTION	
Tube Supports:					
Service		Heat Medium Hea	Heat Medium Hea	Heat Medium Heater	
Location	Top, Bottom, Ends	Bottom	Ends	Ends	
Support Type	casting, tubesht, spring, etc.	SS Pipe Rail	Welded Tbsheets	Welded Tbsheets	
Support Thicknesses	in	SCH40	0.375	0.375	
Support Materials	ASTM	A240 T304	A36 CS	A36 CS	
Support Temperatures (calc./ design)	°F / °F	840 / 1,030	536 / 690	536 / 690	
TbSht Ferrules Thickness/Materials	in/ ASTM	--- / ---	14 ga. / 304 SS	14 ga. / 304 SS	
Refractory & Anchor Materials & Types		none	per refrac. section	per refrac. section	
Intermediate Guides & Supports:		None	None	None	
Location	---				
Guide/ Support Type	casting, spring, etc.				
Material	ASTM				
Spacing, average	ft				
Tube Guides:	Top, Bottom, Ends	None	None	None	
Material	ASTM				
Manifold Supports:		Outlet Manifold		Intlet Manifold	
Material	ASTM	A36		N/A	
Materials Design & Supply	---	by THM			
Location	Top, Bottom, Ends	Burner Endwall			
Support Type	roller, shoe, spring, etc.	Simple Shelf			
Number of Supports	---	One (1)			

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CASING / REFRACTORY SYSTEMS DESIGN

No.	Item	Units				
1						
2						
3			BURNER		SHIELDED	ARCH
4	Radiant Section Design:		ENDWALL		SIDEWALLS	ENDWALL
5	Total Refractory Thickness	in	5.0		3.0	5.0
6	Hot Face Temperature (design)	°F	2,000		2,000	2,000
7	Hot Face Temperaure (calculated)	°F	1,452		840	1,452
8	Hot Face Layer	in/ - - -	1/ 8# CF Blanket		1/ 8# CF Blanket	1/ 8# CF Blanket
9	Back-Up Layer No.1	in/ - - -	1/ 8# CF Blanket		2/ 6# CF Blanket	1/ 8# CF Blanket
10	Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 6# CF Blanket
11	Foil Vapor Barrier	in/ - - -	None		None	None
12	Castable Reinforcement (SS Needles)	wt%	None		None	None
13	Anchors / Tie Backs:	- - -	Pins & Clips		Pins & Clips	Pins & Clips
14	Material	- - -	310 S.S.		304 S.S.	310 S.S.
15	Attachment	- - -	Welded		Welded	Welded
16	Casing:					
17	Material	in/ ASTM	0.1875 / A36		0.1345 / A36	0.1875 / A36
18	Internal Coating	- - -	None		None	None
19	External Temperature, Typical	°F	180		180	180
20	Comments / Clarifications	- - -	w/ cfb wraps		w/o cfb wraps	w/ cfb wraps
21			SHOP Installed		SHOP Installed	SHOP Installed
22						
23			SIDEWALLS		ENDWALLS	
24	Convection Section Design:		SHIELD	FINNED	TUBESHEETS	HEADER BOXES
25	Total Refractory Thickness	in	3.0	3.0	3.0	2.0
26	Hot Face Temperature (design)	°F	2,000	2,000	2,200	2,000
27	Hot Face Temperaure (calculated)	°F	960	960	960	650
28	Hot Face Layer	in/ - - -	1/ 8# CF Blanket	1/ 8# CF Blanket	3/ Sparlite HS	1/ 8# CF Blanket
29	Back-Up Layer No.1	in/ - - -	2/ 6# CF Blanket	2/ 6# CF Blanket	None	1/ 8# CF Blanket
30	Back-Up Layer No.2	in/ - - -	None	None	None	None
31	Foil Vapor Barrier	in/ - - -	None	None	None	None
32	Castable Reinforcement (SS Needles)	wt%	None	None	None	None
33	Anchors / Tie Backs:	- - -	Pins & Clips	Pins & Clips	Bullhorns	Pins & Clips
34	Material	- - -	310 S.S.	304 S.S.	304 S.S.	304 S.S.
35	Attachment	- - -	Welded	Welded	Welded	Welded
36	Casing:					
37	Material	in/ ASTM	0.1345 / A36	0.1345 / A36		0.1345 / A36
38	Internal Coating	- - -	None	None	None	None
39	External Temperature, Typical	°F	180	180		180
40	Comments / Clarifications	- - -	Cleaning/Sootblowing lanes: none			Bolted Assembly
41		- - -	SHOP Installed	SHOP Installed	SHOP Installed	SHOP Installed
42						
43				FLUE GAS DUCTS		
44	Stack & Uptakes Design:			15° TRANSITION	DISCH. DUCT	
45	Quantity			One	One	
46	Type / Location	- - -		Full L / Conv	Self.Spt / Grade	
47	Length / Metal Outside Diameter (top)	ft/ ft		1.41 / n/ a	7 / 2.333	
48	Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 24	
49	Total Refractory Thickness	in		0.0	0.0	
50	Hot Face Temperature (design)	°F				
51	Hot Face Temperaure (calculated)	°F		468	468	
52	Hot Face Layer	in/ - - -		None	None	
53	Back-Up Layer No.1	in/ - - -				
54	Castable Reinforcement (SS Needles)					
55	Anchors / Tie Backs:	- - -				
56	Material	- - -				
57	Attachment	- - -				
58	Casing:					
59	Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36	
60	Corrosion Allowance	in		None	None	
61	Internal Coating	- - -		None	None	
62	External Temperature, Typical	°F		468	468	
63	Comments / Clarifications	- - -				
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MECHANICAL / STRUCTURAL DESIGN BASIS

Refractory & Coatings Design:

Refractory Design	Per Std560: 180°F Avg. Casing Temperature @ Ambient Conditions of 0 MPH & 80°F	
Refractory Dryout	SHOP dryout = None // FIELD dryout is NOT required with the use of TC's AHR additive to Castable.	
Coating, Internal	None	
Coating, External	Base Coat:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
	Int. Coat:	None
	Top Coat:	None

Applicable Standards:

API	~~Std 560 (ISO 13705); Fired Heaters for ...~~	AISC	Specification for Design, ... Steel for Buildings
API	Std 530 (ISO 13704); Calc. of Heater Tube ...	AWS	D 1.1; Structural Welding Code
ASME	B31.3, Chemical Plant and ... Piping	ASTM	tube/ smls pipe/ fitting spec's noted herein
ASME	Sections I, II, VIII, IX; ASME B&PV Code	ASTM	refractories per C27, C155, C401 & C612
ASME	Section V; Non Destructive Examination	NFPA	NFPA 70; National Electrical Code

Wind Design:		**Seismic Design:**	
Spec. or Standard	ASCE 7-10	Spec. or Standard	ASCE 7-10
Velocity/ Imp. Factor	120 mph / 1	Risck Cat./Imp. Factor	III / 1.25
Site Exposure	"C"		
Physical Design:		**Site Design Basis:**	
Plot Limitations	None	Site Elevation	750 ft AMSL
Tube Limitations	None	Stack Design Temp.	90 °F
Firebox Pressure	Positive; approximately +1.0 inH2O	FG Discharge Elev.	24 ft AG
Ambient Temp's	-20 °F Min/ 60 °F Dsn/ 110 °F Max	Area Classification	Unclassified

MAJOR SUBSYSTEMS & ACCESSORIES

Major Services & Subsystems		**Major Accessories:**		
Process Design	INCLUDED in base pricing	Casing/ Tube Seals	8	TubeSox; Radiant & Conv.
Mechanical Design	INCLUDED in base pricing	Observation Doors	2	4 in Dia. w/ H.T. glass
Structural Design	INCLUDED in base pricing	Observation Doors	1	4 in Dia. w/ HT glass on Arch
Radiant Section	INCLUDED in base pricing	Access Doors	1	Std 24" x 24"
Convection Section	INCLUDED in base pricing	Expansion Joints	None	
Combustion Mgmt	INCLUDED in base pricing	Ladders & Platforms	Not Included	
Burner Piping	INCLUDED in base pricing	L&P Coating	N/A	
Forced Draft System	INCLUDED in base pricing			

Casing Penetrations			**Pressure Part Penetrations**		
Fbox Purge/ Snuff	None		Coil TSTC's, Radiant	None	
CA Temp/Pres	None		Coil TSTC's, Convection	None	
FG Temperature	2	1.5"NPS 3000# Coupling	Process TI conn's	3	1.5" NPS 300# RFWN
FG Pressure	2	1.5"NPS 3000# Coupling	Process PI conn's	1	1.5" NPS 300# RFWN
FG Comp. (Sample)	2	1.5"NPS 3000# Coupling	spare		
FG Sample	2	4"NPS 150# RFWN's	spare		
O2 Analyzer Port	None		spare		

Dampers

	FD Fan (blower) qty = 0	Uptake Ducts	Stack qty = 0
Function	Note:		Note:
Design	Fan inlet damper is inappropriate		Stack Damper (which provides draft
Materials	for forced draft SHO's where O2		control) is inappropriate for forced
Bearings	Control is provided by the CMS O2		draft SHO's where the combustion
Operator	Trim Module which controls the fan		conditions are controlled real-time
Positioner	(blower) motor's VFD/ VSD.		via the CMS.
Instruments			

Sootblowers:	Qty.	Type	Location	FG T	Material	Steam T & P	O.E.M. / Ref.
Lane 1:	None						
Lane 2 :	None						

Owner:	Unknown	Owner Ref.:	H-781	Ftnt & Rev
Purchaser:	UOPR	Purch. Ref.:	J463	
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	
SHO Model:	SHO1750	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for RADIANT COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Radiant Coil Design Basis:	units	**Variable Values**		**Comments**		
Design Pressure, P	psig	**150**		Design Pressure is per PO / Contract.		[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**515** /	**-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract		[b]
Design Allowances, Corrosion/ Erosion	in	0.063 /	0.000	Allowances (both CA & EA) are per PO / Contract		[c]
Design Stress @ Design Temp, S	psi	**17,100**		Design Stress @ T.Dmax		[d]
Pipe/Tube Outside Diameter	in	**4.500**				[e]
Pipe/Tube Material Standard	ASME	SA106GrB		Max. Allowable Nonconcentricity, per ASTM:	12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless				[g]
Butt Weld Inspection	RT or Other	100 of 100%				[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 40 /	0.237	Tube Inside Radius (R.i), New =	2.013	
Actual Minimum Thickness, t.new / t.EOL	in	0.207 /	0.145	t.EOL = End of Life Thickness = t.new - (CA + EA)		

UG-27 Calculations:						
Circumferential Stress Calculations	---	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%			[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.018	UG-27(c) (1)&(2) Thickness Check:	0.12	= OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.127	UG-27(c) (1) Pressure Limit Check:	6,584	= OK!!	[c]
UG-27(c) (1) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[d]
Longitudinal Stress Calculations	---	0.85	Per UW-12, Circumferential JE of butt-welds is 85%			[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.010	UG-27(c) (2) Pressure Limit Check:	18,169	= OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.135				[g]
UG-27(c) (2) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[h]

Appendix 1, Para.1-1 Calculations:				[i]
Circumferential Stress Calculations	---		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	---		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Work this data sheet with Heater Datasheets and General Arrangement Drawings (latest versions).
i) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

THM — CONFIDENTIAL PROPERTY of ... TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-266-COIL.VIIIds-Rev. 1

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-781	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	Rev
SHO Model:	SHO1750	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for CONVECTION COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Convection Coil Design Basis:	units	Variable Values	Comments	[i]
Design Pressure, P	psig	**150**	Design Pressure is per PO / Contract.	[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**611** / **-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract	[b]
Design Allowances, Corrosion/ Erosion	in	0.063 / 0.000	Allowances (both CA & EA) are per PO / Contract.	[c]
Design Stress @ Design Temp, S	psi	17,100	Design Stress @ T.Dmax	[d]
Pipe/Tube Outside Diameter	in	**4.500**		[e]
Pipe/Tube Material Standard	ASME	SA106GrB	Max. Allowable Nonconcentricity, per ASTM: 12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless		[g]
Butt Weld Inspection	RT or Other	100 of 100%		[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 40 / 0.237	Tube Inside Radius (R.i), New = 2.013	
Actual Minimum Thickness, t.new / t.EOL	in	0.207 / 0.145	t.EOL = End of Life Thickness = t.new - (CA + EA)	

UG-27 Calculations:				[i]
Circumferential Stress Calculations	---	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.018	UG-27(c) (1)&(2) Thickness Check: 0.12 = OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.127	UG-27(c) (1) Pressure Limit Check: 6,584 = OK!!	[c]
UG-27(c) (1) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]
Longitudinal Stress Calculations	---	0.85	Per UW-12, Circumferential JE of butt-welds is 85%	[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.010	UG-27(c) (2) Pressure Limit Check: 18,169 = OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.135		[g]
UG-27(c) (2) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[h]

Appendix 1, Para.1-1 Calculations:				[g]
Circumferential Stress Calculations:	---		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	---		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
i) These calculations are for the Convection Coil and for the Crossovers (between radaint and convection modules).
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

THM

CONFIDENTIAL PROPERTY of ...
TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-266-COIL.VIIIds-Rev. 1

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-781	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	Rev
Burner OEM:	**Callidus Technologies, LLC**	OEM Ref.:	9020130	
SHO Model:	SHO1750	Service:	Heat Medium Heater	
CMS Model:	CMS2500	Location:	Unknown @ 750 ft elevation	

GENERAL DESIGN CONDITIONS

General Application:			
Service	---	Heat Medium Heater	Heat Medium Heater
Operating Case	---	**Over-Design Case**	**Design Case**
Burner Type		Enhanced IFGR	Enhanced IFGR
Burner Quantity	---	1	1
Model & Size:	---	CUBL-5W	CUBL-5W
Flame Shape	cylindrical or flat	Cylindrical	Cylindrical
Applicable Fuel(s)	---	Fuel Gases pg. 2	Fuel Gases pg. 2
Location(s) / Firing Direction		Endwall Center	Endwall Center
Firing Orientation		Horizontal	Horizontal
BridgeWall Temperature, calc.	°F	1,452	1,402

Heat Release Performance:		MMBTU/hr	MMBTU/hr
Operating Case	---	Over-Design Case	Design Case
Max. Heat Release, per Burner	LHV Basis	22.30	20.04
Design Heat Release, per Burner	LHV Basis	20.28	18.22
Min. Heat Release, per Burner	LHV Basis	4.46	4.46
Turndown, minimum/ actual	max / min	5.00 / 5.00	5.00 / 5.00

Radiant Dimensions:	comments	ft / (in)	**Flame Dimensions:**		ft / (in)
Casing Width / Height, Casing	face - face	10.50 / (126)	Burner CL elev., approx.	AG	5.75 / (69)
Casing Length, Casing to Casing	face - face	22.00 / (264)	Flame Length, calc.	@ design HR	19.7 / (237)
Helical Coil CenterLine Diameter	CL - CL	9.00 / (108)	Flame Dia., calc.	@ design HR	3.50 / (42)
Helical Coil Inside Diameter	face - face	8.63 / (104)			
Serpentine Coil CtrLine Dimensions	W / H		**Actual Clearances**		ft / (in)
Serpentine Coil Inside Dimensions	face - face		Burner - tube (tangential)	CL / Net	4.50 / (54)
Firebox Length, Refractory Faces	face - face	21.17 / (254)			

Combustion Air (CA) Basis - All Fuel(s):						
CA Temperature, min.	-20	°F	FG Draft, at Bridgewall	0.60	inH2O	(positive)
CA Temperature, design	60	°F	CA Pressure, at Burner	7.75	inH2O	(positive)
CA Temperature, max.	110	°F	CA Pressure Drop, Design	7.10	inH2O	
CA Pressure, Ambient	14.30	psia	CA Pressure Drop, Actual	t.b.q.	inH2O	
CA Humidity, Design	50%	%RH				

Emissions -	---	**Gaseous Fuel(s):**		**Liquid Fuel(s):**	no
Design/ Guaranteed Emissions:	basis	3.0% O2, dry (LHV)			
NOx Emissions	LHV Basis	0.053	Lb/MMBTU		
SOx Emissions	LHV Basis	no quote	Lb/MMBTU		
CO Emissions	LHV Basis	0.041	Lb/MMBTU		
VOC Emissions	LHV Basis	0.019	Lb/MMBTU		
UHC Emissions	LHV Basis	0.007	Lb/MMBTU		
SPM10 Emissions	LHV Basis	0.014	Lb/MMBTU		
Noise Emissions	---	85	dBA @		

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

BURNER DATA SHEET
AES SYSTEMS of UNITS

SHO = Superior Quality, Flexibility, Dependability & Modularity

MJ17-266-BRNRds-Rev. 1

Owner Ref.: **H-781** THM Ref.: **MJ17-266**

Ftnt & Rev

GASEOUS FUEL(S) & PRODUCTS OF COMBUSTION

Fuel Gas Basis:	---	**Gas 1**	**Mol.Wt.**			
Operating Mode	---	Over-Design Case				
Temperature, at Burner	°F	100				
Pressure, at Burner (available)	psig	75				
LHV (net HV), mass basis	AES units	20,426	BTU/ Lbm			
LHV (net HV), volume basis	AES units	976	BTU/ scf			
HHV (gross HV), mass basis	AES units	22,613	BTU/ Lbr			
HHV (gross HV), volume basis	AES units	1,080	BTU/ scf			
Molecular Weight (mass)	all units	18.13	x/ xmole			

Fuel Gas Composition(s):	symbol	MW	**Gas 1**	**Mol.Wt.**			
	H2	2.02	0.00%	mole %			
	O2	32.00	0.00%	mole %			
	N2 + Ar	28.15	1.00%	mole %			
	CO	28.01	0.00%	mole %			
	CO2	44.01	1.00%	mole %			
	CH4	16.04	88.00%	mole %			
	C2H6	30.07	8.00%	mole %			
	C2H4	28.05	0.00%	mole %			
	C3H8	44.10	2.00%	mole %			
	C3H6	42.08	0.00%	mole %			
	C4H10	58.12	0.00%	mole %			
	C4H8	56.11	0.00%	mole %			
	C5H12	72.15	0.00%	mole %			
	C5H10	70.13	0.00%	mole %			
	C6+	86.18	0.00%	mole %			
	H2S	34.08	0.00%	mole %			
	SO2	64.06	0.00%	mole %			
	NH3	17.09	0.00%	mole %			
	H2O	18.02	0.00%	mole %			
	spare		0.00%	mole %			

Products of Combustion @ Design:		**Gas 1**	**Mol.Wt.**			
Excess Air Concentration	mole%	**15%**	mole%			
Temperature, PoC at Bridgewall	°F	1,452				
Temperature, PoC at Burner	°F	1,260				
Temperature, PoC Acid Dew Point	°F	151				

<< ------- mass balance by TULSA HEATERS MIDSTREAM LLC ------- >>

Combustion Mass Balances:		MW	Lbm/ hr				
Fuel Flow Rates	mass in		993				
Comb. Air Flow Rates	mass in	28.96	18,747				
POC Mass Flow Rates (wet)	mass out	27.89	19,739				
POC Mass Flow Rates (dry)	mass out	29.91	17,573				
POC Component Flow Rates ...	O2	32.00	564				
	N2 + Ar	28.15	14,335				
	CO2	44.01	2,671				
	H2O	18.02	2,166				
			<< -------	vapor / solid concentrations are in ppmvd / ppmd, resp.			------- >>
	NOx	46.01	1.08	40 ppm			
	SOx	64.06	0.00	0 ppm			
	CO	28.01	0.82	50 ppm			
	VOC	44.10	0.39	15 ppm			
	UHC	16.04	0.14	15 ppm			
	SPM		0.28	16 ppm			

Ftnt & Rev

ADDITIONAL REQUIREMENTS

QA Requirements:		
Performance Test @ shop	---	Not Required
CFD Model of Firebox	---	None
CFM of CA Ducting	---	None
Mill Certs, fuel wetted parts	---	Not Required
PMI, fuel wetted parts	---	Not Required
Fuel Wetted Components:		
Oil Gun Model	---	None
Gun Tip / Atomizer Mat'ls	ASTM	None / None
Gas Risers Material	ASTM	t.b.d.
Gas Manifolds Mat'l	ASTM	Carbon Steel
Burner Pilot:	model	by O.E.M.
Type	---	Self-Inspirating
Heat Release	BTU/ hr	> 90,000
Ignition Method	man.or elec.	Electric
Pilot Fuel Gas	---	Gas 1 Mol.Wt.
Pilot Detection	type or none	None
Fuel P, avail. @ pilot	psig	10 (5 -15 is OK)

Connections:		
Primary Fuel Gas	sz & spec	by OEM & 150# A105 RF
Secondary Fuel Gas	sz & spec	None
Fuel Oil	sz & spec	None
Atomizing Media	sz & spec	None
Pilot Gas	sz & spec	by OEM & 150# A105 RF
Detector, Main Flame	sz & spec	None
Detector, Pilot Flame	sz & spec	by OEM - UV Scanner Mount
Sight Ports	sz & spec	None
Windbox or Plenum:		
Individual windbox	yes or no	yes
Material Description	th x ASTM	12 ga. x A36
Common Plenum Depth	ft.	none
Refractory Description	th x type	1.00 in x Min.Wool
Refractory Anchors	ASTM	C.S. Expanded Metal
Register Type		none
Register Material	ASTM	C.S.
Leakage, guaranteed	wt%	< 5.0 % of Max HR Flow
Actuation	man., pneu.or elec.	manual

APPLICABLE SPECIFICATIONS & STANDARDS

TULSA HEATERS MIDSTREAM LLC Specifications:

a) Burner scope ...
  1) Pilot w/ Electric Ignition - Ignition Transformer is by others (CMS Supplier)
  2) UV Scanner is by others. Swivel scanner mount (by burner supplier) aimed at pilot and main flame when pilot off.
  3) Sight port(s) for viewing pilot and main flames.

b) Burner shall have 5:1 turndown; this capability shall NOT compromise flame size or performance.

c) External Coatings shall be as follows:

Prime:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
Intermediate:	None
Finish:	None

d) Burner is mounted and fired horizontally. Tile to be shop mounted in 304 SS case.

e) Even though job location/elevation is different, burner to be sized to range from sea level to 3500 ft and worst case air delta P reported.

Owner:	Unknown	Owner Ref.:	H-781	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Heater OEM:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	Rev
CMS OEM:	**International Custom Controls**	CMS Model:	CMS2500	

System Overview:

Design Philosophy	Meet or Exceed NFPA 85 with packaged Combustion Management System
Heater DHR	Heater Design Heat Release = 22 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
CMS DHR	CMS Design Heat Release = 25 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
No. of Burners	One Callidus CUBL-5W Burner per heater

THM Specs	Provided datasheets	Ambient P, Design	750 ft AMSL = 14.30 psia
THM P&ID	CMS2500 P&ID	Ambient T Range	-20 °F Minimum to 110 °F Maximum
Area Classification	Unclassified	Noise Limit	85 dBA @ 3 ft
Supply Power	**120V / 1 ph / 60 Hz**	Ind. Standard(s)	B31.3, NFPA 70 (NEC), **NFPA 85**
Supply Air	**80 psig**	Customer Specs	**None**

Subsystem Design:		Dsn P	Dsn T	NPS	Dsn V	End Con.[4]
Main Gas Train[3]	Double Block & Bleed SDVs with **ZSC's**	150 psig	150°F	2"	67	150# RF
Pilot Gas Train	Double Block & Bleed SDVs	150 psig	150°F	1/2"	11	150# RF
Instrument Air Hdr		125 psig	150°F	1"	- - -	150# RF
Main Oil Train	None					
Atom. Media Train	None					
Local Panel (LCP)	**NEMA 4** Enclosure for Controls, HMI, Pushbuttons & Lights				Z-Purge:	**No**
Other Panel(s)	**NEMA 7** Enclosure with 6kV Ignition Transformer & 7mm HiV IGN Cable					
Other Panel(s)	**None**					
Forced Draft Sys.	One FD Fan[1]; a) unlined ducting, b) CA controlled by **Damper**					

Minimum Pre-Purge Interlocks:

- ✓ Manual ESD Switch (pushbutton)
- ✓ SDVs FailSafe Positions
- ✓ Stack High Temperature
- ✓ Process High Temperature
- ✓ Gas Supply Low Pressure
- ✓ Gas to Burner High Pressure
- – Firebox High Pressure
- – Oil Supply Low Pressure
- – Atom.Media Low Pressure

Minimum Purge Interlocks:

- ✓ Minimum CA Flow

Gas / Oil Trains Overview:

- ✓ Pilot Double Block & Bleed SDVs
- ✓ Gas Train Dbl Block & Bleed SDVs
- ✓ Inlet Header Isolation Valve
- ✓ Inlet Header Sediment Trap w/ Cap
- ✓ Inlet Header Gas Strainer
- ✓ Inlet Header Pressure Regulator
- – Inlet Header Relief Valve
- – Oil Train Dbl Block & Bleed SDVs
- – Atom.Media dP Controls
- – Gas/ Oil Flow Element
- – Comb. Air Flow Element
- – Min. Fire PCV in Parallel w/ TCV

Local Panel Components Overview:

- ✓ **Slate Control Package**
- ✓ Touchscreen HMI
- – Remote Control Panel
- – Field Wiring schematic to connect LCP to J/B
- – LCP Weather/Sun Shield

Supporting Components:

- ✓ **Pilot Flame UV Detector**
- – **Main Flame UV Detector**
- ✓ CA Ducting to Burner(s)
- ✓ Flex Hoses at Brnr Terminals
- – Individual Burner SDVs
- ✓ **Fuel Train Only (no skid)**
- – O2 Analyzer
- ✓ Process TC (control loop)
- ✓ Process TC (shutdown)
- ✓ Process Pressure Gauge[2]
- ✓ Stack TC
- – Process Coil Relief

NOTES:

1. Forced draft fan supplied by THM
2. Process Pressure Gauge to be designed for 0-150 psig
3. ZSC's only on block valves, not bleed.
4. Piping 2" and below to use threaded fittings, except end connections.
5. FAT required

rev.	date	description	by	appv'd
1	13-Nov-17	Rev'd Purch. Ref. No.	JDC	JF
0	19-Aug-17	Issued for Approval	JF	JDC

THM TULSA HEATERS MIDSTREAM

COMBUSTION MANAGEMENT SYSTEM

25 MMBTU/hr RATED HEAT RELEASE

CMS2500 DATA SHEET

MJ17-266-CMS2500ds- Rev. 1

Purch. Ref.: **H-781** THM Ref.: **MJ17-266**

	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Process Interlocks:								
Process Flow	MLb/hr	FALL-300	105.1	None	116.2	267.8	- - -	
		Action:	S/D @ minimum flow to avoid "short circuiting" one or more coil passes					
Process Temperature	°F	TSHH-202	None	355	- - -	305	355	
		Action:	S/D @ maximum fluid temperature to avoid "overheating" the coil					
Heater Interlocks:								
Stack Temperature	°F	TSHH-201	None	700	429	483	- - -	
		Action:	S/D @ 700 F, which is indicative of an "out-of-control" fire in the heater					
CMS Interlocks:								
FG Train Pressure	psig	PSLL-101	10	None	- - -	- - -	150	
		Action:	S/D @ 10 psig, which is indicative of "inadequate" fuel gas supply					
FG Train Pressure	psig	PSHH-103	None	35	- - -	- - -	150	
		Action:	S/D @ 35 psig, which is indicative of a "failure" of PCV-100 &/or FG supply					
FD Fan Interlocks:								
FD Fan (blower) SP	inH2O	PSLL-107	0.20	None	0.47	7.8	11.8	
FDF turndown:	5.0	Action:	S/D @ 0.2 inH2O, which is indicative of a FD Fan (blower) "failure".					

Other permissives/interlocks in BMS Operations Manual (block valves, FCV, and flame signal).

CMS CONTROL COMPONENTS

	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Process Control:								
Remote T Setpoint	°F	TY-700	0	999	- - -	305	355	4 -20 mA INPUT
		Action:	4 -20 mA input corresponds to a temperature setpoint range of 0 -999 °F					
Process Temperature	°F	TT-203	0	999	- - -	305	355	4 -20 mA OUTPUT
		Action:	4 -20 mA output corresponds to a process temperature range of 0 -999 °F					
Main Gas Regulator	psig	PCV-100	- - -	- - -	- - -	35	150	Factory Set @ 35 psig
Pilot Gas Regulator	psig	PCV-105	- - -	- - -	- - -	10	150	Factory Set @ 10 psig
Inst. Air Regulator	psig	PCV-107	- - -	- - -	- - -	80	150	Factory Set @ 80 psig

CUSTOMER CONNECTIONS (TO DCS)

The following signals are sent to the customer's DCS from the control panel:

- Remote ESD
- Heater Run
- Low Process Flow
- High Stack Temperature
- High Process Temperature
- Burner Status

Owner:	Unknown	Heater Ref.:	H-781	
Purchaser:	UOPR	Purch. Ref.:	J463	Ftnt
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	&
Location:	Unknown	FDF OEM Ref.:	340829	Rev
FD Fan OEM:	**Chicago Blower**	FDF Item No.:	BL-781	

				Ftnt & Rev
General Application:				
FD Fan(s) Design Basis	mass.flow.%	115% of Design MASS Flows per API Standard 560		
Location(s)	---	@ Grade, adjacent to Burner Endwall (incorporated into Combustion Skid)		
Area Classification	NEC	Unclassified		
		AES Units		
Process Design Conditions:		**Heater Design**	**FDF Test Block**	
Mass Flow Rate/ % Htr Design	Lb/hr / kg/ hr	18,747 / 100%	21,560 / 115%	
Volumetric Flow/ % Htr Design	acfm / am3/ hr	4,300 / 100%	5,300 / 123%	
Density, @ Suction	as noted	0.074 Lb/ ft3	0.068 Lb/ ft3	
Design Allowances, Temp./ SP	°F / °C	--- / ---	130 °F / 152%	
Temperature @ Min / Suction / Design	°F / °C	-20 / 60 / 110		
Static Pressure @ Suction	as ntoed	-0.2 inH2O	-0.2 inH2O	
Site Elevation/ Atm. P	as ntoed	750 ftAMSL	14.30 psia	
Static Pressure Rise (min./ guar.)	inH2O	7.8 / **7.8**	11.8 / **11.8**	
Fan Speed (allowable/ actual)	RPM	3,600 / 3,525	3,600 / 3,525	
Sound Pressure (allowable/ guar.)	dBA	< 85 / < 85	< 85 / < 85	
Relative Humidity	%	50%		
Fan Mechanical Design:	tag // OEM	**BL-781 // CHICAGO BLOWER Corp.**		
OEM Reference	CMS // FD Fan	International Custom Controls // 340829		1
OEM Model &/or Type-Size	per OEM	D/36A (SQAD)		
Arrangement	---	Arrangement 4 (direct drive)		
Brake Power, Design/ Test Block (calc.)	HP	15.0 / 20.0		
Temperature, Mechanical Design	°F	135 °F Mechanical Design		
Casing Description / Materials	---	"Square" pattern / CS		
Rotor Description / Materials	---	Airfoil Blades / CS		
Shaft Description / Materials	---	None - Arrangement 4		
Bearings Description / Materials	---	None - Arrangement 4		
Noise Abatement Provisions / SPL	---	85 dBA		
External Coatings / Surface Prep.	---	OEM's Std Multiple Coat System		
Purchase Specifications	---	OEM's Std Industrial Quality Design		
Fan Control Design:	tag // OEM	**VSD-781 / by OTHERS**		
VFD Description	---	by Others / Owner		
VFD Rating	---	---		
Damper Actuator Description	---	---		
Damper Actuator Operation	---	---		
Fan Motor Design:	tag // OEM	**BM-781 / TECO-WESTINGHOUSE**		
OEM Model &/or Type-Size	---	Catalog EP0202 / AEHH8N		1
VFD Service / speed range	---	YES / 3 - 60 Hz or 180 - 3,600 rpm		
Motor Type / Frame Size	---	NEMA TEFC / 256T		
Rated Power w/ SF @ Speed	NEMA	20 HP w/ 1.15 SF @ 40°C		
Nameplate Input Power	V/ Hz/ ph	**460V / 60 Hz / 3 ph**		
Typical Performance	---	91.0- 92.4 % FL Eff'y @ 92.5 % FL PF		1
Insulation Description	---	Class F / B Rise		
External Coatings & Surface Prep.	---	OEM's Std Multiple Coat System		
Purchase Specifications	---	None		

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
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THM TULSA HEATERS MIDSTREAM

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FD FAN DATA SHEET

AES & cgs or SI SYSTEMS of UNITS

MJ17-266-FDFANds-Rev. 1

Datasheet 111-9
12/23/2014

Eclipse Winnox Burners

Model WX0850

Version 2

Parameter		Specifications	
Blower Type		**Packaged Blower**	**Remote Blower**
Maximum Input, Btu/h (kW)[1]	Chamber Pressure "w.c. (mbar)	Nominal (60Hz)	Pressure at Air Inlet 1.5 psig (100 mbar)
For chamber pressures outside the given range or for varying chamber pressure conditions, contact Eclipse, Inc.	-5.0 (-12.5)	9,700,000 (2840)	13,600,000 (3985)
	-3.0 (-7.5)	9,200,000 (2694)	13,200,000 (3868)
	0.0	8,500,000 (2490)	12,500,000 (3660)
	1.0 (2.5)	8,200,000 (2416)	12,200,000 (3575)
	2.0 (5.0)	7,980,000 (2337)	12,000,000 (3516)
Minimum Input, Btu/h (kW) *For lower inputs, contact Eclipse, Inc.*	Natural Gas	500,000 (146)	500,000 (146)
	Propane, Butane	600,000 (175)	600,000 (175)
Main Gas Inlet Pressure, "w.c. (mbar)[2] *Fuel pressure at ratio regulator inlet*	Maximum	82 (207)	110 (273)
	Minimum	27.7 (69)	55.4 (138)
Maximum Chamber Temperature, °F (°C) *Maximum tube temperatures should be reduced 150°F (66°C) when using propane or butane.*		Standard combustion tube: 1300 (704) High temperature combustion tube: 1400 (760) Refractory plug: 1800 (982)[3]	
High Fire Visible Flame Length, inches (mm) *Measured from the outlet end of the combustor*	Alloy Tube	Flame is inside tube at all times.	
% Excess Air at High Fire		40% - 70%	
Piping		NPT or BSP/DN Flange connections available.	
Flame Detection		Flame rod or UV scanner.	
Fuels[4] *For any other mixed gas, contact Eclipse, Inc.*		Natural gas, Propane, Butane	
Blower Motor Power, Hp		15	-
Weight, lbs (kg)[5]		1435 (651)	1135 (515)
Approvals		АИ30	

[1] Maximum inputs for packaged blower versions are given for the standard combustion air blower without an inlet air filter.
[2] For proper performance, this pressure must be kept constant across the burner operating range.
[3] See page 3 of this datasheet and the "Refractory Plug" section of Installation Guide 111.
[4] See Design Guide 111 for more information about typical fuel composition and properties.
[5] All weights are approximate.

- All inputs are based on gross calorific values and standard conditions: one atmosphere, 70°F (21°C).
- All information is based on laboratory testing. Different chamber size and conditions will affect data.
- Eclipse reserves the right to change the construction and/or configurations of our products at any time without being obliged to adjust earlier supplies accordingly.

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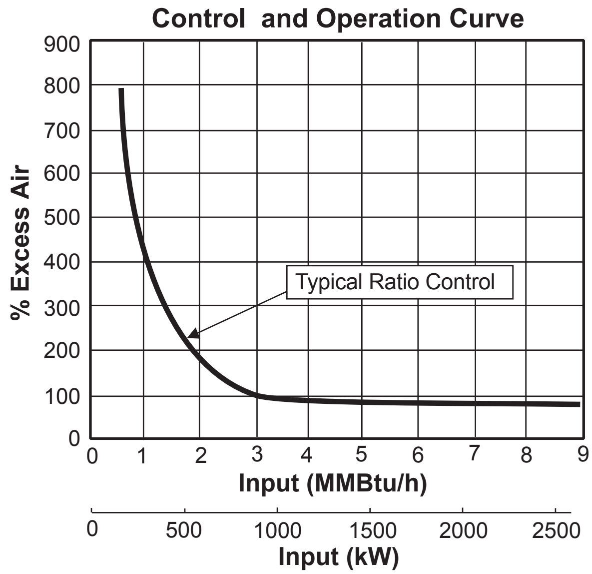
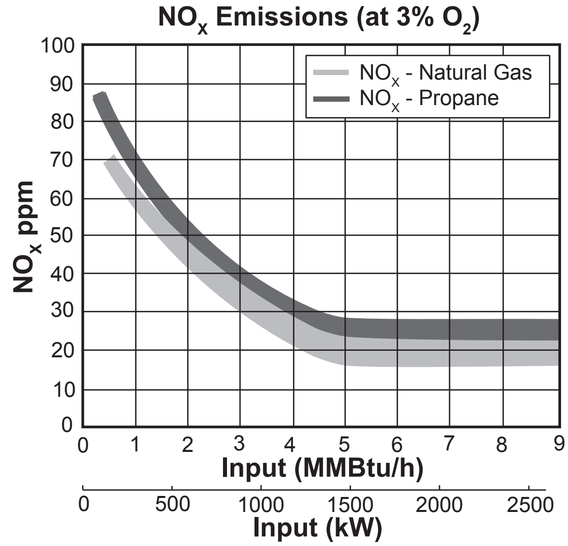
Innovative Thermal Solutions





Fuel/Input Measurement

System design must include fuel flow measurement upstream of the burner. Eclipse recommends its 12-5 FOM (Fuel Orifice Meter) assembly number 302050-5 for natural gas. See Bulletin 930 for details.

Secondary By-Pass Fuel Setting:

Fuel	∆P "w.c. (mbar)*
Natural Gas	4.0 (10.0)
Propane	4.0 (10.0)
Butane	4.0 (10.0)

*Measured between Tap “E” and the chamber @ low fire.

<u>NOTE:</u> Input at low fire changes with ratio regulator adjustment.

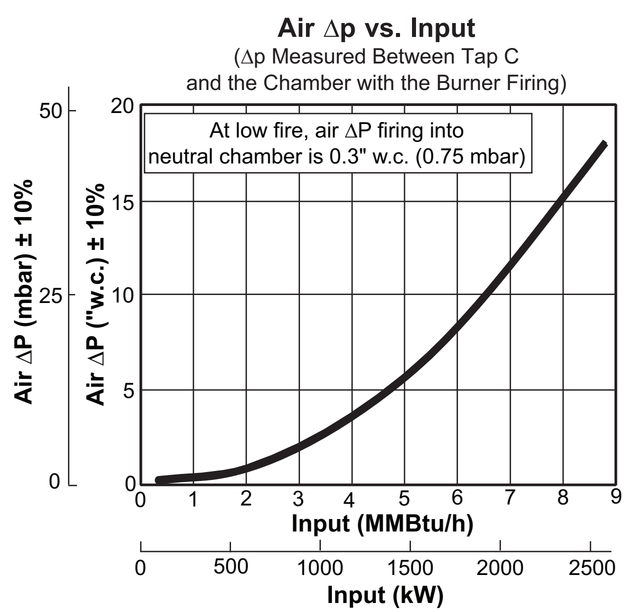
NO_x emission data is given for:

- Ambient combustion air (~70°F, 21°C)
- Less than 1000°F (540°C) firing chamber
- Minimal process air velocity
- Low fire input adjusted to 500,000 BTU/hr (88 kW)
- Neutral chamber pressure

Emissions are influenced by:

- Chamber conditions
- Fuel type
- Firing rate
- Ratio regulator adjustments
- Combustion air temperature
- Excess air

CO emission is largely influenced by chamber conditions. Contact your local Eclipse representative for an estimate of CO emission on your application.



FABER
Burner Company

Burner Data Sheet

FBC CONTRACT NUMBER:	15018
PURCHASER:	Heatec
PURCHASE ORDER NUMBER:	T3174F
USER:	UOP Russell
LOCATION:	Unknown
SCOPE OF EQUIPMENT:	1-WB-16-SG Low Nox "Bare" Package Burner for firing NG in a Heatec horizontally fired heater. Same as Faber 15010 & Heatec 14-148
NUMBER OF UNITS:	1
INSURANCE:	NFPA 87, IRI, FM
SPECIFICATION:	Faber Burner Company Proposal #7415106-1 dated April 21, 2015
PROJECT ENGINEER:	KRP

REVISION:	00
REVISION DATE:	
DATE ISSUED:	4/30/2015

JOB SPECIFICATIONS:

A. PROCESS HEATER DATA

MANUFACTURER:	HEATEC	
MODEL:	8010-40D	
FURNACE DIMENSIONS:	70" Dia x 237" L	
HEAT INPUT:	23.65	MMBTU/HR AT 100% MCR
FLUID TEMPERATURE:	305	°F
FURNACE PRESSURE:	1.00	INWC WITHOUT FGR

B. SITE CONDITIONS:

ELEVATION:	1,300	FASL
LOCATION:	UNKNOWN	
TYPE:	OUTDOOR	
MAXIMUM AMBIENT TEMPERATURE:	110	°F
ELECTRICAL NEMA RATING:	4	
AREA CLASSIFICATION:	NOT CLASSIFIED	

C. UTILITIES:

FAN / INPUT POWER:	480 VOLTS, 3 PHASE, 60 HZ. 27 FLA REQUIRED.
CONTROL / INSTRUMENT POWER:	120 VOLTS, 1 PHASE, 60 HERTZ

D. CONTROL DATA:

BURNER MANAGEMENT SYSTEM PROVIDED BY:	OTHERS
BURNER MANAGEMENT SYSTEM:	FIREYE
COMBUSTION CONTROL SYSTEM PROVIDED BY:	OTHERS
COMBUSTION CONTROL SYSTEM:	UNKNOWN
TYPE OF CONTROL:	PARALLEL POSITIONING
NOTES:	HEATEC TO PROVIDE WEY-5000 ACTUATORS FOR MOUNTING

E. FORCED DRAFT FAN DESIGN DATA:

MAXIMUM COMBUSTION AIR REQUIRED:	6,625	ACFM	22,845 LB/HR
COMBUSTION AIR TEMPERATURE:	110	°F	
MAXIMUM FD FAN OUTLET PRESSURE:	7.0	INWC	

F. **BURNER DATA**

MAXIMUM BURNER PRESSURE DROP:	3.3	INWC	
TOTAL STACK GAS FLOW AT MCL - NATURAL GAS:	5,085	ACFM	23,930 LB/HR

G. **MAIN GAS DATA:**

MAIN GAS TYPE:		NATURAL GAS	
HEATING VALUE:		1,000	BTU/SCF
SPECIFIC GRAVITY (AIR = 1.00):		0.60	
GAS TEMPERATURE:		60	°F
ALL VALUES BELOW ARE AT MCR			
DESIGN HEAT INPUT:		23.65	MMBTU/HR
GAS FLOW RATE:		23,650	SCFH
DESIGN EXCESS AIR TO BURNER:		32	%
FRESH AIR TO BURNER:		22,845	LB/HR
DESIGN TURNDOWN:		7:1	
BURNER DRAFT LOSS:		3.3	INWC
PRESSURE AT BURNER:	MAIN	4.8	PSIG
	STAGED	6.0	PSIG
SUPPLY PRESSURE REGULATED BY:		OTHERS	
GAS PRESSURE AVAILABLE:		20.0	PSIG

H. **GAS COMPOSITION:**

	% BY VOLUME
METHANE	90.00
ETHANE	5.00
CARBON DIOXIDE	0.00
NITROGEN	5.00

I. **PILOT GAS FUEL DATA:**

PRIMARY PILOT FUEL:	NATURAL GAS	
HEAT INPUT:	0.63	MMBTU/HR
FUEL FLOW:	630	SCFH
PRESSURE AT IGNITOR:	1.0	PSIG
SUPPLY PRESSURE REGULATED BY:	OTHERS	
SUPPLY PRESSURE TO PILOT:	1-2	PSIG

J. **EMISSION GUARANTEES:**

NOT TO EXCEED:
NATURAL GAS:

NOX	40	PPM
	0.048	LB/MMBTU
CO	50	PPM
	0.037	LB/MMBTU

EMISSION TEST CONDITIONS

FOR A VALID GUARANTEE TEST, THE FOLLOWING CONDITIONS MUST BE MET:

1. Emission guarantees are based upon the data in the design conditions above and are for the firing of natural gas only.
2. Guarantees are from 25% to 100% heater MCR (maximum continuous rating) only.
3. Heater meets (min.) construction requirements for furnace sidewall integrity and seals at the drums and front wall. CO emission stated above is provided furnace leakage (bypassing of flue gas) does not contribute more than .015 lb/MMBTU to the total CO emissions.
4. Emission guarantees exclude background emissions present in the air or fuel used for combustion.
5. Samples for VOC test will be taken at the rear of the furnace only.
6. FABER field service must do the initial burner adjustments and must be present during testing for optimization of the equipment supplied.
7. Emission testing must be conducted within the warranty period. Upon obtaining the guaranteed emissions, as described above, the equipment shall be considered accepted.

K. **LIMIT SWITCH SETPOINTS:**

		TRIP SETPOINT		DIRECTION
FDP	FAN DIFFERENTIAL PRESSURE	FIELD SET		DECREASING
HSP	HIGH SUCTION PRESSURE	FIELD SET		INCREASING
LFA	LOW FIRE AIR	7	%	FIELD SET AS REQ'D
LFG-1	LOW FIRE MAIN GAS	10	%	FIELD SET AS REQ'D
LFG-2	LOW FIRE STAGED GAS	10	%	FIELD SET AS REQ'D

L. **TORQUE REQUIREMENTS**

GVA-1	MAIN GAS VALVE ACTUATOR	20 in-lb
GVA-2	STAGED GAS VALVE ACTUATOR	65 in-lb
ADA	AIR DAMPER ACTUATOR	241 in-lb

M. **PAINTING SPECIFICATION:**

PREPARATION:

EXTERNAL STEEL	SSPC-SP3
PIPING / FITTINGS	SSPC-SP1
ELECTRICAL PANELS	MANUFACTURER'S STANDARD
INSTRUMENTS	MANUFACTURER'S STANDARD
CONDUIT	MANUFACTURER'S STANDARD

PRIMER AND PAINT:

ALL UNPRIMED COMPONENTS ARE PRIMED WITH (1) ONE COAT OF PRIMER.
ALL UNPAINTED COMPONENTS ARE PAINTED WITH (2) TWO COATS OF STEEL-IT
STEEL-IT IS INDUSTRIAL GRADE STAINLESS STEEL IMPREGNATED URETHANE BASED PAINT.

N. **SPECIFICATION FOR PIPING AND FITTINGS:**

WELDING: STANDARD

MAIN GAS TRAIN:	SCHEDULE 40 ASTM A 106 GRADE B PIPE WITH CLASS 3000 FITTINGS.
PILOT GAS TRAIN:	1/2" NPT STAINLESS STEEL FLEX HOSE
SWITCHES AND GAUGES:	3/8" STAINLESS STEEL TUBING WITH STAINLESS STEEL TUBE FITTINGS.

O. **SUBMITTAL DOCUMENTATION**

DOCUMENT FORMAT:	ELECTRONIC
NUMBER OF DRAWING SETS:	1
NUMBER OF DATA SHEETS:	1
MECHANICAL BILL OF MATERIAL:	1
FAN CURVE:	1
MOTOR DATA SHEETS:	1
DWG DRAWINGS ON THE WEBSITE:	1
STEP FILE ON THE WEBSITE:	1

NOTES: FOR INFORMATION ONLY. RELEASE WITH ORDER. SAME AS FABER 15010

P. **AS-BUILT DOCUMENTATION**

DOCUMENT FORMAT:	HARDCOPY AND ELECTRONIC
NUMBER OF DRAWING SETS:	2
NUMBER OF DATA SHEETS:	2
NUMBER OF O&M MANUALS:	2
DRAWING SIZE:	B
MECHANICAL BILL OF MATERIAL:	2
DWG DRAWINGS ON THE WEBSITE:	1
STEP FILE ON THE WEBSITE:	1
CD:	1

Q. **JOB DRAWINGS**

BURNER GENERAL ARRANGEMENT:	25-01-01-01
BURNER THROAT INSTALLATION DETAIL:	25-01-01-10
PIPING SCHEMATIC:	25-60-01-01

Owner:	Unknown		Owner Ref.:	H-741	Ftnt
Purchaser:	UOPR		Purchaser Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC		THM Ref.:	MJ17-265	Rev
Service:	Regen Gas Heater		Project:	200 MMscfd Cryo Plant	
Quantity:	1		Location:	Unknown	
SHO Duty:	7.29	MMBTU/ hr	SHO Model:	SHO500	
CMS Release:	9.20	MMBTU/ hr	CMS Model:	CMS1500	

PROCESS DESIGN CONDITIONS

Heater Section	- - -	Radiant / Convection	Radiant / Convection		
Operating Case	- - -	Over-Design Case	Design Case		
Service	- - -	Regen Gas Heater	Regen Gas Heater		
Heat Absorption (R/C)	MMBTU/ hr	4.36 / 2.93	3.52 / 2.08		
Process Fluid	- - -	Gas	Gas		
Process Mass Flow Rate, Total	Lb/ hr	22,924	20,840		
Process Bulk Velocity (calc. R/C)	ft/ s	42 / 21	39 / 19		
Process Mass Velocity (calc. R/C)	Lb/ s ft2	80 / 80	73 / 73		
Coking Allowance (dP calcs)	in				
Pressure Drop, Clean (allow. / calc.)	psi	10 / 7	10 / 6		
Pressure Drop, Fouled (allow. / calc.)	psi				
Average Heat Flux (allowable)	BTU/ hr ft2	13,000	13,000		
Average Heat Flux (calculated)	BTU/ hr ft2	15,410	12,460		
Maximum Heat Flux (allowable)	BTU/ hr ft2				
Maximum Heat Flux (calc. R/C)	BTU/ hr ft2	27,400 / 31,140	22,200 / 23,990		
Fouling Factor, Internal	hr ft2 °F/ BTU	0.001	0.001		
Corrosion or Erosion Characteristics	- - -				
Max. Film Temperature (allow. / calc.)	°F	650 / 669	650 / 654		
Inlet Conditions:					
Temperature	°F	75	135		
Pressure	psig	934	934		
Mass Flow Rate, Liquid	Lb/ hr	0	0		
Mass Flow Rate, Vapor	Lb/ hr	22,924	20,840		
Weight Percent, Liquid / Vapor	wt%	0% / 100%	0% / 100%		
Density, Liquid / Vapor	Lb/ ft3	0.00 / 3.82	0.00 / 3.82		
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	- - - / 21.6	- - - / 21.6		
Viscosity, Liquid / Vapor	cp	0.0001 / 0.014	0.001 / 0.014		
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0 / 0.617	0.000 / 0.617		
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0 / 0.023	0.000 / 0.023		
Outlet Conditions:					
Temperature	°F	550	550		
Pressure	psig	928	929		
Mass Flow Rate, Liquid	Lb/ hr	0	0		
Mass Flow Rate, Vapor	Lb/ hr	22,924	20,840		
Weight Percent, Liquid / Vapor	wt%	0% / 100%	0% / 100%		
Density, Liquid / Vapor	Lb/ ft3	0.00 / 1.88	0.00 / 1.88		
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	- - - / 21.6	- - - / 21.6		
Viscosity, Liquid / Vapor	cp	0.000 / 0.020	0.0001 / 0.020		
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.000 / 0.719	0 / 0.719		
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.000 / 0.042	0 / 0.042		

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TULSA HEATERS MIDSTREAM

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FIRED HEATER DATA SHEET

AMERICAN ENGINEERING SYSTEM of UNITS

MJ17-265-HTRds- Rev. 1

Ftnt & Rev

COMBUSTION DESIGN CONDITIONS

Overall Performance:

Operating Case	- - -	Over-Design Case	Design Case		
Service	- - -	Regen Gas Heate	Regen Gas Heate		
Excess Air	mol%	15.0%	15.0%		
Calculated Heat Release (LHV)	MMBTU/ hr	8.37	6.30		
Guaranteed Efficiency	HR%	83.1%	85.0%		
Calculated Efficiency	HR%	87.1%	89.0%		
Radiation Loss	HR%	3.00%	3.00%		
Flow Rate, Combustion Gen./ Imp.	Lb/ hr	8,145	6,130		
Flue Gas Temp. Leaving (R/C)	°F	1,649 / 447	1,526 / 377		
Flue Gas Mass Velocity	Lb/ sec ft2	0.260	0.196		

Fuel(s) Data:

		Gas 1			
		Mol.Wt.			
LHV	BTU/ scf	976			
LHV	BTU/ Lb	20,426			
P @ Burner	psig	75			
T @ Burner	°F	100			
MW	Lb/ Lbmole	18.13			
m @ ??? °F	cp	- - -			
m @ ??? °F	cp	- - -			
Atomizing Media		- - -			
Atom. Media P & T		- - -			

Components:

N	wt%	- - -			
S	wt%	- - -			
Ash	wt%	- - -			
Ni	ppm	- - -			
Va	ppm	- - -			
Na	ppm	- - -			
Fe	ppm	- - -			
H2	mol%	0.0%			
O2	mol%	0.0%			
N2 + Ar	mol%	1.0%			
CO	mol%	0.0%			
CO2	mol%	1.0%			
CH4	mol%	88.0%			
C2H6	mol%	8.0%			
C2H4	mol%	0.0%			
C3H8	mol%	2.0%			
C3H6	mol%	0.0%			
C4H10	mol%	0.0%			
C4H8	mol%	0.0%			
C5H12	mol%	0.0%			
C5H10	mol%	0.0%			
C6+	mol%	0.0%			
H2S	ppmv	0.0%			
SO2	mol%	0.0%			
NH3	mol%	0.0%			
H2O	mol%	0.0%			
spare	mol%	0.0%			

Blower/Fan Peformance:

Volumetric Flow	acfm	1,800
Rated Power	HP	10
Fan Speed	RPM	3,600
Sound Pressure	dBA	< 85
Area Classification	NEC	Unclassified

Burner Design:

OEM	- - -	Callidus Technologies, LLC	
Type	- - -	Enhanced IFGR	ULTRA Low NOx
Quantities	- - -	1	Burner
Model No.	- - -	CUBL-3W	Cylindrical
Windbox	- - -	yes ...	
Location	- - -	EndWall Center ...	Horizontally Fired

Pilot Design:

Type / Model		Self-Inspirating /	by O.E.M.
Ignition	- - -	Electric	requires elec.ign.system
Heat Release	- - -	> 90000 BTU/ hr on ...	Gas 1

Burner Performance:

Minimum Heat Release	MMBTU/ hr	1.84
Design Heat Release	MMBTU/ hr	8.37
Maximum Heat Release	MMBTU/ hr	9.20
Burner Turndown	Max:Min	5.00
Volumetric Ht. Release	BTU/ hr ft3	17,106
Pressure @ Arch	inH2O	0.50
Pressure @ Burner	inH2O	7.64
Combustion Air T @ Burner	°F	60
Flue Gas T @ Burner	°F	1,450

Guaranteed Emissions:

Basis of Guarantee	- - -	3.0% O2,	dry (LHV)
NOx Emissions	Lb/MMBTU	0.053	40 ppm
SOx Emissions	Lb/MMBTU	no quote	
CO Emissions	Lb/MMBTU	0.041	50 ppm
VOC Emissions	Lb/MMBTU	0.019	15 ppm
UHC Emissions	Lb/MMBTU	0.007	15 ppm
SPM10 Emissions	Lb/MMBTU	0.014	16 ppm
Noise Emissions	dBA @ 3ft	85	

Net Flame Clearances:

Est. Flame Size	approx. 10.9 ft L x 2.5 ft Diameter
Hor Clearance	0.75 ft NET Tube Clearance
Vert. Clearance	0.75 ft NET Tube Clearance
Axial Clearance	-1.77 ft NET Refractory Clearance (to Arch hot face)

Nominal Flame Clearances:

from burner CL ...		Vertical	Horizontal
to Tube CL, API	ft	5.70	3.80
to Tube CL, calc.	ft	3.25	3.25
to Refrac., calc.	ft	n / a	9.17

PRESSURE PARTS DESIGN

			RADIANT	SHIELD	CONVECTION	Ftnt & Rev
1	PRESSURE PARTS DESIGN					
2						
3	Coil Design:		RADIANT	SHIELD	CONVECTION	
4	Service		Regen Gas Heate	Regen Gas Heate	Regen Gas Heater	
5	Design Basis for Tube Temperature		API 530	API 530	API 530	
6	Design Basis for Tube Wall Thickness		ASME Sec. VIII-1	ASME Sec. VIII-1	ASME Sec. VIII-1	
7	Design Life	hr	100,000	100,000	100,000	
8	Design Pressure (elastic / rupture)	psig	1,095 /	1,095 /	1,095 /	
9	Design Fluid Temperature	°F	550	550	550	
10	Design Temperature Allowance	°F	29	29	29	
11	Design Corrosion Allowance (tubes/fittings)	in	0.0625 / 0.0625	0.0625 / 0.0625	0.0625 / 0.0625	
12						
13	Maximum Tube Temperature (clean)	°F	702			
14	Maximum Tube Temperature (fouled)	°F	734	372	475	
15	Design Tube Temperature	°F	763	650	650	
16	Inside Film Coefficient	BTU/ hr ft2 °F	271	233	233	
17	Weld Inspection	RT or Other	100 of 100%	100 of 100%	100 of 100%	
18	Weld Heat Treatment	s.rel., t.stab. or none	None	None	None	
19	Hydrostatic Test Pressure	psig	per API	per API	per API	
20						
21	Coil Arrangement:		Horizontal	Horizontal	Horizontal	
22	Coil Type	- - -	Helical	Serpentine	Serpentine	
23	Tube Material (pipe or tube spec)	ASTM	SA106GrB	SA106GrB	SA106GrB	
24	Supplementary Mfg Requirements	ASTM	None	None	None	
25	Tube Outside Diameter	in	4.500	4.500	4.500	
26	Tube Wall Thickness (aw / mw)	in	0.337 / 0.295	0.337 / 0.295	0.337 / 0.295	
27	Number of Cells (radiant or convection)	- - -	1	1	1	
28	Number of Flow Passes (total / cell)	- - -	1 / 1	1 / 1	1 / 1	
29	Number of Tubes per Row (total / cell)	- - -		4 / 4	4 / 4	
30	Overall Tube (1 turn in radiant) Length	ft	20.42	9.04	9.04	
31	Effective Tube Length / Helix Diameter	ft	20.42 / 6.50	7.46	7.46	
32	Number of Turns or Tubes (total / pass)		11.8 / 11.8	4.0 / 4.0	0.0 / 0.0	
33	Total Exposed Surface	ft2	283	35	0	
34	Number of Ext.Surf. Tubes (total / cell)	- - -	0 / 0.0	0 / 0.0	12 / 12.0	
35	Total Exposed Surface	ft2	0	0	1,309	
36	Tube Spacing (horiz. / tube centers)	in	- - - / 8.00	8.00 / 8.00	8.00 / 8.00	
37	Tube Spacing (horiz. to refractory)	in	6.00	4.00	4.00	
38						
39	Coil Fittings:		Regen Gas Heate	Regen Gas Heate	Regen Gas Heater	
40	Fitting Type	- - -	SR 90° Elbows	SR 180° U-Bends	SR 180° U-Bends	
41	Fitting Material	ASTM	SA234 WPB	SA234 WPB	SA234 WPB	
42	Supplementary Mfg Requirements	ASTM	None	None	None	
43	Fitting Outside Diameter	in	4.500	4.500	4.500	
44	Fitting Wall Thickness (aw / mw)	in	0.337 / 0.295	0.337 / 0.295	0.337 / 0.295	
45	Fitting Location	internal or external	Internal	External	External	
46	Tube Attachment	welded or rolled	Welded	Welded	Welded	
47						
48	Coil Terminals:		Outlet		Inlet	
49	Terminal Type	beveled or flanged	Flanged		Flanged	
50	Flange Material	ASTM	SA105		SA105	
51	Supplementary Mfg Requirements	ASTM	None		None	
52	Flange Size and Rating	NPS/ ASME	4" NPS / 900#		4" NPS / 900#	
53	Flange Type	RFWN or RTJ	RFWN		RFWN	
54	Location	- - -	Burner Endwall		Terminal End	
55						
56	Extended Surface:			CONVECTION	CONVECTION	
57	Service	- - -		Regen Gas Heate	Regen Gas Heater	
58	Fin or Stud Row Number	starting @ bottom		No.1 / No.2-3		
59	Ext. Surface Type	seg.fins, solid fins, studs		HF Seg. Fins		
60	Fin/Stud Material	- - -		C.S. / C.S.		
61	Fin/Stud Height	in		1.00 / 1.00		
62	Fin/Stud Thickness	in		0.06 / 0.06		
63	Fin/Stud Density	fin/ in		4.00 / 5.00		
64						

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PRESSURE PARTS DESIGN (continued)

		RADIANT	SHIELD	CONVECTION	
Crossovers:					
Type, location / connections	- - -	External	/ Flanged	None	
Tube / Fittings Material	ASTM	SA106GrB	/ SA234 WPB		
Tube & Fitting OD / Thickness (aw)	in	4.500	/ 0.337		
Inlet Manifold(s):	type			N/A	
Location	- - -				
Design Basis for Manifold Thickness	- - -				
Design Conditions (temp./press.)	°F/ psig				
Pipe Material	ASTM				
Fittings Material	ASTM				
Flange Material / Style	ASTM				
Outside Diameters, each Branch	in				
Wall Thickness(es); aw ~~or mw~~	in				
End Types (terminal/ dead)	beveled or flanged				
Manifold Terminal Type	NPS/ ASME				
Coil Connection Type	extrusion, olet, etc.				
Coil Terminal Type	NPS/ ASME				
Outlet Manifold(s):	type	N/A			
Location	- - -				
Design Basis for Manifold Thickness	- - -				
Design Conditions (temp./press.)	°F/ psig				
Pipe Material	ASTM				
Fittings Material	ASTM				
Flange Material / Style	ASTM				
Outside Diameters, each Branch	in				
Wall Thickness(es); aw ~~or mw~~	in				
End Types (terminal/ dead)	beveled or flanged				
Manifold Terminal Type	NPS/ ASME				
Coil Connection Type	extrusion, olet, etc.				
Coil Terminal Type	NPS/ ASME				

COIL & MANIFOLD SUPPORTS DESIGN

		RADIANT	SHIELD	CONVECTION	
Tube Supports:					
Service		Regen Gas Heate	Regen Gas Heate	Regen Gas Heater	
Location	Top, Bottom, Ends	Bottom	Ends	Ends	
Support Type	casting, tubesht, spring, etc.	SS Pipe Rail	Welded Tbsheets	Welded Tbsheets	
Support Thicknesses	in	SCH40	0.375	0.375	
Support Materials	ASTM	A240 T304	A36 CS	A36 CS	
Support Temperatures (calc./ design)	°F / °F	1,130 / 1,310	612 / 770	612 / 770	
TbSht Ferrules Thickness/Materials	in/ ASTM	- - - / - - -	14 ga. / 304 SS	14 ga. / 304 SS	
Refractory & Anchor Materials & Types		none	per refrac. section	per refrac. section	
Intermediate Guides & Supports:		None	None	None	
Location	- - -				
Guide/ Support Type	casting, spring, etc.				
Material	ASTM				
Spacing, average	ft				
Tube Guides:	Top, Bottom, Ends	None	None	None	
Material	ASTM				
Manifold Supports:		Outlet Manifold		Intlet Manifold	
Material	ASTM	A36		N/A	
Materials Design & Supply	- - -	by THM			
Location	Top, Bottom, Ends				
Support Type	roller, shoe, spring, etc.	Simple Shelf			
Number of Supports	- - -	One (1)			

Owner Ref.: H-741 THM Ref.: MJ17-265

Line	Item	Units					Ftnt & Rev
1	CASING / REFRACTORY SYSTEMS DESIGN						
2							
3			BURNER		SHIELDED	ARCH	
4	Radiant Section Design:		ENDWALL		SIDEWALLS	ENDWALL	
5	Total Refractory Thickness	in	5.0		3.0	5.0	
6	Hot Face Temperature (design)	°F	2,000		2,000	2,000	
7	Hot Face Temperaure (calculated)	°F	1,649		1,130	1,649	
8	Hot Face Layer	in/ - - -	1/ 8# CF Blanket		1/ 8# CF Blanket	1/ 8# CF Blanket	
9	Back-Up Layer No.1	in/ - - -	1/ 8# CF Blanket		2/ 6# CF Blanket	1/ 8# CF Blanket	
10	Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 6# CF Blanket	
11	Foil Vapor Barrier	in/ - - -	None		None	None	
12	Castable Reinforcement (SS Needles)	wt%	None		None	None	
13	Anchors / Tie Backs:	- - -	Pins & Clips		Pins & Clips	Pins & Clips	
14	Material	- - -	310 S.S.		304 S.S.	310 S.S.	
15	Attachment	- - -	Welded		Welded	Welded	
16	Casing:						
17	Material	in/ ASTM	0.1875 / A36		0.1345 / A36	0.1875 / A36	
18	Internal Coating	- - -	None		None	None	
19	External Temperature, Typical	°F	180		180	180	
20	Comments / Clarifications	- - -	w/ cfb wraps		w/o cfb wraps	w/ cfb wraps	
21			SHOP Installed		SHOP Installed	SHOP Installed	
22							
23			SIDEWALLS		ENDWALLS		
24	Convection Section Design:		SHIELD	FINNED	TUBESHEETS	HEADER BOXES	
25	Total Refractory Thickness	in	3.0	3.0	3.0	2.0	
26	Hot Face Temperature (design)	°F	2,000	2,000	2,200	2,000	
27	Hot Face Temperaure (calculated)	°F	1,048	1,048	1,048	766	
28	Hot Face Layer	in/ - - -	1/ 8# CF Blanket	1/ 8# CF Blanket	3/ Sparlite HS	1/ 8# CF Blanket	
29	Back-Up Layer No.1	in/ - - -	2/ 6# CF Blanket	2/ 6# CF Blanket	None	1/ 8# CF Blanket	
30	Back-Up Layer No.2	in/ - - -	None	None	None	None	
31	Foil Vapor Barrier	in/ - - -	None	None	None	None	
32	Castable Reinforcement (SS Needles)	wt%	None	None	None	None	
33	Anchors / Tie Backs:	- - -	Pins & Clips	Pins & Clips	Bullhorns	Pins & Clips	
34	Material	- - -	310 S.S.	304 S.S.	304 S.S.	304 S.S.	
35	Attachment	- - -	Welded	Welded	Welded	Welded	
36	Casing:						
37	Material	in/ ASTM	0.1345 / A36	0.1345 / A36		0.1345 / A36	
38	Internal Coating	- - -	None	None	None	None	
39	External Temperature, Typical	°F	180	180		180	
40	Comments / Clarifications	- - -	Cleaning/Sootblowing lanes: none			Bolted Assembly	
41		- - -	SHOP Installed	SHOP Installed	SHOP Installed	SHOP Installed	
42							
43			FLUE GAS DUCTS				
44	Stack & Uptakes Design:			15° TRANSITION	DISCH. DUCT		
45	Quantity			One	One		
46	Type / Location	- - -		Full L / Conv	Self.Spt / Grade		
47	Length / Metal Outside Diameter (top)	ft/ ft		1.08 / n/ a	7 / 1.333		
48	Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 20		
49	Total Refractory Thickness	in		0.0	0.0		
50	Hot Face Temperature (design)	°F					
51	Hot Face Temperaure (calculated)	°F		447	447		
52	Hot Face Layer	in/ - - -		None	None		
53	Back-Up Layer No.1	in/ - - -					
54	Castable Reinforcement (SS Needles)						
55	Anchors / Tie Backs:	- - -					
56	Material	- - -					
57	Attachment	- - -					
58	Casing:						
59	Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36		
60	Corrosion Allowance	in		None	None		
61	Internal Coating	- - -		None	None		
62	External Temperature, Typical	°F		447	447		
63	Comments / Clarifications	- - -					
64							

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MECHANICAL / STRUCTURAL DESIGN BASIS

Refractory & Coatings Design:

Refractory Design	Per Std560: 180°F Avg. Casing Temperature @ Ambient Conditions of 0 MPH & 80°F
Refractory Dryout	SHOP dryout = None // FIELD dryout is NOT required with the use of TC's AHR additive to Castable.
Coating, Internal	None
Coating, External	Base Coat: 3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
	Int. Coat: None
	Top Coat: None

Applicable Standards:

API	~~Std 560 (ISO 13705); Fired Heaters for ...~~	AISC	Specification for Design, ... Steel for Buildings
API	Std 530 (ISO 13704); Calc. of Heater Tube ...	AWS	D 1.1; Structural Welding Code
ASME	B31.3, Chemical Plant and ... Piping	ASTM	tube/ smls pipe/ fitting spec's noted herein
ASME	Sections I, II, VIII, IX; ASME B&PV Code	ASTM	refractories per C27, C155, C401 & C612
ASME	Section V; Non Destructive Examination	NFPA	NFPA 70; National Electrical Code

Wind Design:		Seismic Design:	
Spec. or Standard	ASCE 7-10	Spec. or Standard	ASCE 7-10
Velocity/ Imp. Factor	120 mph / 1	Risck Cat./Imp. Factor	III / 1.25
Site Exposure	"C"		
Physical Design:		**Site Design Basis:**	
Plot Limitations	None	Site Elevation	750 ft AMSL
Tube Limitations	None	Stack Design Temp.	90 °F
Firebox Pressure	Positive; approximately +1.0 inH2O	FG Discharge Elev.	20 ft AG
Ambient Temp's	-20 °F Min/ 60 °F Dsn/ 110 °F Max	Area Classification	Unclassified

MAJOR SUBSYSTEMS & ACCESSORIES

Major Services & Subsystems		Major Accessories:		
Process Design	INCLUDED in base pricing	Casing/ Tube Seals	4	TubeSox; Radiant & Conv.
Mechanical Design	INCLUDED in base pricing	Observation Doors	2	4 in Dia. w/ H.T. glass
Structural Design	INCLUDED in base pricing	Observation Doors	1	4 in Dia. w/ HT glass on Arch
Radiant Section	INCLUDED in base pricing	Access Doors	1	Std 24" x 24"
Convection Section	INCLUDED in base pricing	Expansion Joints	None	
Combustion Mgmt	INCLUDED in base pricing	Ladders & Platforms	Not Included	
Burner Piping	INCLUDED in base pricing	L&P Coating	N/A	
Forced Draft System	INCLUDED in base pricing			

Casing Penetrations			Pressure Part Penetrations		
Fbox Purge/ Snuff	None		Coil TSTC's, Radiant	None	
CA Temp/Pres	None		Coil TSTC's, Convection	None	
FG Temperature	2	1.5"NPS 3000# Coupling	Process TI conn's	3	1.5" NPS 900# RFWN
FG Pressure	2	1.5"NPS 3000# Coupling	Process PI conn's	1	1.5" NPS 900# RFWN
FG Comp. (Sample)	2	1.5"NPS 3000# Coupling	spare		
FG Sample	2	4"NPS 150# RFWN's	spare		
O2 Analyzer Port	None		spare		

Dampers

	FD Fan (blower) qty = 0	Uptake Ducts	Stack qty = 0
Function	Note:		Note:
Design	Fan inlet damper is inappropriate		Stack Damper (which provides draft
Materials	for forced draft SHO's where O2		control) is inappropriate for forced
Bearings	Control is provided by the CMS O2		draft SHO's where the combustion
Operator	Trim Module which controls the fan		conditions are controlled real-time
Positioner	(blower) motor's VFD/ VSD.		via the CMS.
Instruments			

Sootblowers:	Qty.	Type	Location	FG T	Material	Steam T & P	O.E.M. / Ref.
Lane 1:	None						
Lane 2 :	None						

Owner:	Unknown	Owner Ref.:	H-741	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	Rev
SHO Model:	SHO500	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for RADIANT COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Radiant Coil Design Basis:	units	**Variable Values**	**Comments**	
Design Pressure, P	psig	**1,095**	Design Pressure is per PO / Contract.	[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**763** / **-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract	[b]
Design Allowances, Corrosion/ Erosion	in	0.0625 / 0.000	Allowances (both CA & EA) are per PO / Contract	[c]
Design Stress @ Design Temp, S	psi	**12,413**	Design Stress @ T.Dmax	[d]
Pipe/Tube Outside Diameter	in	**4.500**		[e]
Pipe/Tube Material Standard	ASME	SA106GrB	Max. Allowable Nonconcentricity, per ASTM: 12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless		[g]
Butt Weld Inspection	RT or Other	100 of 100%		[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 80 / 0.337	Tube Inside Radius (R.i), New = 1.913	
Actual Minimum Thickness, t.new / t.EOL	in	0.295 / 0.232	t.EOL = End of Life Thickness = t.new - (CA + EA)	

UG-27 Calculations:				
Circumferential Stress Calculations	---	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.178	UG-27(c) (1)&(2) Thickness Check: 0.18 = OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.054	UG-27(c) (1) Pressure Limit Check: 4,779 = OK!!	[c]
UG-27(c) (1) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]
Longitudinal Stress Calculations	---	0.85	Per UW-12, Circumferential JE of butt-welds is 85%	[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.097	UG-27(c) (2) Pressure Limit Check: 13,189 = OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.135		[g]
UG-27(c) (2) Acceptability	---	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[h]

Appendix 1, Para.1-1 Calculations:				[i]
Circumferential Stress Calculations	---		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	---		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Work this data sheet with Heater Datasheets and General Arrangement Drawings (latest versions).
i) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

CONFIDENTIAL PROPERTY of ...
TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-265-COIL.VIIIds-Rev. 1 **Pg 1 of 2**

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-741	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	Rev
SHO Model:	SHO500	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for CONVECTION COIL

Formulas:

t.s =

UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Convection Coil Design Basis:	units	**Variable Values**		**Comments**			[i]
Design Pressure, P	psig	**1,095**		Design Pressure is per PO / Contract.			[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**650** /	**-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract			[b]
Design Allowances, Corrosion/ Erosion	in	0.0625 /	0.000	Allowances (both CA & EA) are per PO / Contract.			[c]
Design Stress @ Design Temp, S	psi	**17,100**		Design Stress @ T.Dmax			[d]
Pipe/Tube Outside Diameter	in	**4.500**					[e]
Pipe/Tube Material Standard	ASME	SA106GrB		Max. Allowable Nonconcentricity, per ASTM:	12.50%		[f]
Pipe/Tube Type	welded or seamless	Seamless					[g]
Butt Weld Inspection	RT or Other	100 of 100%					[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 80 /	0.337	Tube Inside Radius (R.i), New =	1.913		
Actual Minimum Thickness, t.new / t.EOL	in	0.295 /	0.232	t.EOL = End of Life Thickness = t.new - (CA + EA)			

UG-27 Calculations:						[i]
Circumferential Stress Calculations	- - -	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%			[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.127	UG-27(c) (1)&(2) Thickness Check:	0.18	= OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.105	UG-27(c) (1) Pressure Limit Check:	6,584	= OK!!	[c]
UG-27(c) (1) Acceptability	- - -	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[d]
Longitudinal Stress Calculations	- - -	0.85	Per UW-12, Circumferential JE of butt-welds is 85%			[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.071	UG-27(c) (2) Pressure Limit Check:	18,169	= OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.161				[g]
UG-27(c) (2) Acceptability	- - -	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)			[h]

Appendix 1, Para.1-1 Calculations:				[g]
Circumferential Stress Calculations:	- - -		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	- - -		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
i) These calculations are for the Convection Coil and for the Crossovers (between radaint and convection modules).
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
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TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-265-COIL.VIIIds-Rev. 1

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-741	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	Rev
Burner OEM:	**Callidus Technologies, LLC**	OEM Ref.:	9020143	
SHO Model:	SHO500	Service:	Regen Gas Heater	
CMS Model:	CMS1500	Location:	Unknown @ 750 ft elevation	

GENERAL DESIGN CONDITIONS

General Application:

Service	- - -	Regen Gas Heater	Regen Gas Heater
Operating Case	- - -	**Over-Design Case**	**Design Case**
Burner Type		Enhanced IFGR	Enhanced IFGR
Burner Quantity	- - -	1	1
Model & Size:	- - -	CUBL-3W	CUBL-3W
Flame Shape	cylindrical or flat	Cylindrical	Cylindrical
Applicable Fuel(s)	- - -	Fuel Gases pg. 2	Fuel Gases pg. 2
Location(s) / Firing Direction		Endwall Center	Endwall Center
Firing Orientation		Horizontal	Horizontal
BridgeWall Temperature, calc.	°F	1,649	1,526

Heat Release Performance:

		MMBTU/hr	MMBTU/hr
Operating Case	- - -	Over-Design Case	Design Case
Max. Heat Release, per Burner	LHV Basis	9.20	6.93
Design Heat Release, per Burner	LHV Basis	8.37	6.30
Min. Heat Release, per Burner	LHV Basis	1.84	1.84
Turndown, minimum/ actual	max / min	5.00 / 5.00	5.00 / 5.00

Radiant Dimensions:

	comments	ft / (in)
Casing Width / Height, Casing	face - face	8.00 / (96)
Casing Length, Casing to Casing	face - face	10.00 / (120)
Helical Coil CenterLine Diameter	CL - CL	6.50 / (78)
Helical Coil Inside Diameter	face - face	6.13 / (74)
Serpentine Coil CtrLine Dimensions	W / H	
Serpentine Coil Inside Dimensions	face - face	
Firebox Length, Refractory Faces	face - face	9.17 / (110)

Flame Dimensions:

		ft / (in)
Burner CL elev., approx.	AG	4.50 / (54)
Flame Length, calc.	@ design HR	10.9 / (131)
Flame Dia., calc.	@ design HR	2.50 / (30)

Actual Clearances

		ft / (in)
Burner - tube (tangential)	CL / Net	3.25 / (39)

Combustion Air (CA) Basis - All Fuel(s):

CA Temperature, min.	-20	°F
CA Temperature, design	60	°F
CA Temperature, max.	110	°F
CA Pressure, Ambient	14.30	psia
CA Humidity, Design	50%	%RH

FG Draft, at Bridgewall	0.50	inH2O	(positive)
CA Pressure, at Burner	7.64	inH2O	(positive)
CA Pressure Drop, Design	7.10	inH2O	
CA Pressure Drop, Actual	t.b.q.	inH2O	

Emissions -	- - -	**Gaseous Fuel(s):**		**Liquid Fuel(s):** **no**
Design/ Guaranteed Emissions:	basis	3.0% O2, dry (LHV)		
NOx Emissions	LHV Basis	0.053	Lb/MMBTU	
SOx Emissions	LHV Basis	no quote	Lb/MMBTU	
CO Emissions	LHV Basis	0.041	Lb/MMBTU	
VOC Emissions	LHV Basis	0.019	Lb/MMBTU	
UHC Emissions	LHV Basis	0.007	Lb/MMBTU	
SPM10 Emissions	LHV Basis	0.014	Lb/MMBTU	
Noise Emissions	- - -	85	dBA @	

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

SHO = Superior Quality, Flexibility, Dependability & Modularity

BURNER DATA SHEET

AES SYSTEMS of UNITS

MJ17-265-BRNRds-Rev. 1

Owner Ref.: **H-741** THM Ref.: **MJ17-265**

Ftnt & Rev

GASEOUS FUEL(S) & PRODUCTS OF COMBUSTION

Fuel Gas Basis:	- - -	**Gas 1**	**Mol.Wt.**
Operating Mode	- - -	Over-Design Case	
Temperature, at Burner	°F	100	
Pressure, at Burner (available)	psig	75	
LHV (net HV), mass basis	AES units	20,426	BTU/ Lbm
LHV (net HV), volume basis	AES units	976	BTU/ scf
HHV (gross HV), mass basis	AES units	22,613	BTU/ Lbr
HHV (gross HV), volume basis	AES units	1,080	BTU/ scf
Molecular Weight (mass)	all units	18.13	x/ xmole

Fuel Gas Composition(s): symbol	MW	**Gas 1**	**Mol.Wt.**
H_2	2.02	0.00%	mole %
O_2	32.00	0.00%	mole %
N_2 + Ar	28.15	1.00%	mole %
CO	28.01	0.00%	mole %
CO_2	44.01	1.00%	mole %
CH_4	16.04	88.00%	mole %
C_2H_6	30.07	8.00%	mole %
C_2H_4	28.05	0.00%	mole %
C_3H_8	44.10	2.00%	mole %
C_3H_6	42.08	0.00%	mole %
C_4H_{10}	58.12	0.00%	mole %
C_4H_8	56.11	0.00%	mole %
C_5H_{12}	72.15	0.00%	mole %
C_5H_{10}	70.13	0.00%	mole %
C6+	86.18	0.00%	mole %
H_2S	34.08	0.00%	mole %
SO_2	64.06	0.00%	mole %
NH_3	17.09	0.00%	mole %
H_2O	18.02	0.00%	mole %
spare		0.00%	mole %

Products of Combustion @ Design:		**Gas 1**	**Mol.Wt.**
Excess Air Concentration	mole%	**15%**	mole%
Temperature, PoC at Bridgewall	°F	1,649	
Temperature, PoC at Burner	°F	1,450	
Temperature, PoC Acid Dew Point	°F	151	

<< ------- mass balance by TULSA HEATERS MIDSTREAM LLC ------- >>

Combustion Mass Balances:		MW	Lbm/ hr	
Fuel Flow Rates	mass in		410	
Comb. Air Flow Rates	mass in	28.96	7,736	
POC Mass Flow Rates (wet)	mass out	27.89	8,145	
POC Mass Flow Rates (dry)	mass out	29.91	7,251	
POC Component Flow Rates ...	O_2	32.00	233	
	N_2 + Ar	28.15	5,915	
	CO_2	44.01	1,102	
	H_2O	18.02	894	
	<< ------- vapor / solid concentrations are in ppmvd / ppmd, resp. ------- >>			
	NOx	46.01	0.45	40 ppm
	SOx	64.06	0.00	0 ppm
	CO	28.01	0.34	50 ppm
	VOC	44.10	0.16	15 ppm
	UHC	16.04	0.06	15 ppm
	SPM		0.12	16 ppm

Owner Ref.: **H-741** THM Ref.: **MJ17-265**

Ftnt & Rev

ADDITIONAL REQUIREMENTS

QA Requirements:			**Connections:**		
Performance Test @ shop	- - -	Not Required	Primary Fuel Gas	sz & spec	by OEM & 150# A105 RF
CFD Model of Firebox	- - -	None	Secondary Fuel Gas	sz & spec	None
CFM of CA Ducting	- - -	None	Fuel Oil	sz & spec	None
Mill Certs, fuel wetted parts	- - -	Not Required	Atomizing Media	sz & spec	None
PMI, fuel wetted parts	- - -	Not Required	Pilot Gas	sz & spec	by OEM & 150# A105 RF
			Detector, Main Flame	sz & spec	None
Fuel Wetted Components:			Detector, Pilot Flame	sz & spec	by OEM - UV Scanner Mount
Oil Gun Model	- - -	None	Sight Ports	sz & spec	None
Gun Tip / Atomizer Mat'ls	ASTM	None / None			
Gas Risers Material	ASTM	t.b.d.	**Windbox or Plenum:**		
Gas Manifolds Mat'l	ASTM	Carbon Steel	Individual windbox	yes or no	yes
			Material Description	th x ASTM	12 ga. x A36
Burner Pilot:	model	by O.E.M.	Common Plenum Depth	ft.	none
Type	- - -	Self-Inspirating	Refractory Description	th x type	1.00 in x Min.Wool
Heat Release	BTU/ hr	> 90,000	Refractory Anchors	ASTM	C.S. Expanded Metal
Ignition Method	man.or elec.	Electric	Register Type		none
Pilot Fuel Gas	- - -	Gas 1 Mol.Wt.	Register Material	ASTM	C.S.
Pilot Detection	type or none	None	Leakage, guaranteed	wt%	< 5.0 % of Max HR Flow
Fuel P, avail. @ pilot	psig	10 (5 -15 is OK)	Actuation	man., pneu.or elec.	manual

APPLICABLE SPECIFICATIONS & STANDARDS

TULSA HEATERS MIDSTREAM LLC Specifications:

a) Burner scope …

1) Pilot w/ Electric Ignition - Ignition Transformer is by others (CMS Supplier)

2) UV Scanner is by others. Swivel scanner mount (by burner supplier) aimed at pilot and main flame when pilot off.

3) Sight port(s) for viewing pilot and main flames.

b) Burner shall have 5:1 turndown; this capability shall NOT compromise flame size or performance.

c) External Coatings shall be as follows:

Prime:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
Intermediate:	None
Finish:	None

d) Burner is mounted and fired horizontally. Tile to be shop mounted in 304 SS case.

e) Even though job location/elevation is different, burner to be sized to range from sea level to 3500 ft and worst case air delta P reported.

Owner:	Unknown	Owner Ref.:	H-741	Ftnt & Rev
Purchaser:	UOPR	Purch. Ref.:	J463	
Heater OEM:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	
CMS OEM:	**International Custom Controls**	CMS Model:	CMS1500	

System Overview:

Design Philosophy	Meet or Exceed NFPA 85 with packaged Combustion Management System
Heater DHR	Heater Design Heat Release = 9 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
CMS DHR	CMS Design Heat Release = 15 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
No. of Burners	One Callidus CUBL-3W Burner per heater

THM Specs	Provided datasheets	Ambient P, Design	750 ft AMSL = 14.30 psia
THM P&ID	CMS1500 P&ID	Ambient T Range	-20 °F Minimum to 110 °F Maximum
Area Classification	Unclassified	Noise Limit	85 dBA @ 3 ft
Supply Power	**120V** / **1 ph** / **60 Hz**	Ind. Standard(s)	B31.3, NFPA 70 (NEC), **NFPA 85**
Supply Air	**80** psig	Customer Specs	**None**

Subsystem Design:		Dsn P	Dsn T	NPS	Dsn V	End Con.[4]
Main Gas Train[3]	Double Block & Bleed SDVs with **ZSC's**	150 psig	150°F	1-1/2"	67	150# RF
Pilot Gas Train	Double Block & Bleed SDVs	150 psig	150°F	1/2"	11	150# RF
Instrument Air Hdr		125 psig	150°F	1"	- - -	150# RF
Main Oil Train	None					
Atom. Media Train	None					
Local Panel (LCP)	**NEMA 4** Enclosure for Controls, HMI, Pushbuttons & Lights				**Z-Purge:**	**No**
Other Panel(s)	**NEMA 7** Enclosure with 6kV Ignition Transformer & 7mm HiV IGN Cable					
Other Panel(s)	**None**					
Forced Draft Sys.	One FD Fan[1]; a) unlined ducting, b) CA controlled by **Damper**					

Minimum Pre-Purge Interlocks:

- ✓ Manual ESD Switch (pushbutton)
- ✓ SDVs FailSafe Positions
- ✓ Stack High Temperature
- ✓ Process High Temperature
- ✓ Gas Supply Low Pressure
- ✓ Gas to Burner High Pressure
- – Firebox High Pressure
- – Oil Supply Low Pressure
- – Atom.Media Low Pressure

Minimum Purge Interlocks:

- ✓ Minimum CA Flow

Gas / Oil Trains Overview:

- ✓ Pilot Double Block & Bleed SDVs
- ✓ Gas Train Dbl Block & Bleed SDVs
- ✓ Inlet Header Isolation Valve
- ✓ Inlet Header Sediment Trap w/ Cap
- ✓ Inlet Header Gas Strainer
- ✓ Inlet Header Pressure Regulator
- – Inlet Header Relief Valve
- – Oil Train Dbl Block & Bleed SDVs
- – Atom.Media dP Controls
- – Gas/ Oil Flow Element
- – Comb. Air Flow Element
- – Min. Fire PCV in Parallel w/ TCV

Local Panel Components Overview:

- ✓ **Slate Control Package**
- ✓ Touchscreen HMI
- – Remote Control Panel
- – Field Wiring schematic to connect LCP to J/B
- – LCP Weather/Sun Shield

Supporting Components:

- ✓ **Pilot Flame UV Detector**
- – **Main Flame UV Detector**
- ✓ CA Ducting to Burner(s)
- ✓ Flex Hoses at Brnr Terminals
- – Individual Burner SDVs
- ✓ **Fuel Train Only (no skid)**
- – O2 Analyzer
- ✓ Process TC (control loop)
- ✓ Process TC (shutdown)
- ✓ Process Pressure Gauge[2]
- ✓ Stack TC
- – Process Coil Relief

NOTES:

1. Forced draft fan supplied by THM
2. Process Pressure Gauge to be designed for 0-1095 psig
3. ZSC's only on block valves, not bleed.
4. Piping 2" and below to use threaded fittings, except end connections.
5. FAT required

rev.	date	description	by	appv'd
1	13-Nov-17	Rev'd Purch. Ref. No.	JDC	JF
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THM TULSA HEATERS MIDSTREAM

COMBUSTION MANAGEMENT SYSTEM

15 MMBTU/hr RATED HEAT RELEASE

CMS1500 DATA SHEET

MJ17-265-CMS1500ds- Rev. 1

Purch. Ref.: **H-741** THM Ref.: **MJ17-265**

	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Process Interlocks:								
Process Flow	MLb/hr	FALL-300	7.6	None	20.8	116.2	- - -	
		Action:	S/D @ minimum flow to avoid "short circuiting" one or more coil passes					
Process Temperature	°F	TSHH-202	None	600	- - -	550	600	
		Action:	S/D @ maximum fluid temperature to avoid "overheating" the coil					
Heater Interlocks:								
Stack Temperature	°F	TSHH-201	None	700	377	483	- - -	
		Action:	S/D @ 700 F, which is indicative of an "out-of-control" fire in the heater					
CMS Interlocks:								
FG Train Pressure	psig	PSLL-101	10	None	- - -	- - -	150	
		Action:	S/D @ 10 psig, which is indicative of "inadequate" fuel gas supply					
FG Train Pressure	psig	PSHH-103	None	35	- - -	- - -	150	
		Action:	S/D @ 35 psig, which is indicative of a "failure" of PCV-100 &/or FG supply					
FD Fan Interlocks:								
FD Fan (blower) SP	inH2O	PSLL-107	0.20	None	0.46	7.6	11.4	
FDF turndown:	5.0	Action:	S/D @ 0.2 inH2O, which is indicative of a FD Fan (blower) "failure".					

Other permissives/interlocks in BMS Operations Manual (block valves, FCV, and flame signal).

CMS CONTROL COMPONENTS

	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Process Control:								
Remote T Setpoint	°F	TY-700	0	999	- - -	550	600	4 -20 mA INPUT
		Action:	4 -20 mA input corresponds to a temperature setpoint range of 0 -999 °F					
Process Temperature	°F	TT-203	0	999	- - -	550	600	4 -20 mA OUTPUT
		Action:	4 -20 mA output corresponds to a process temperature range of 0 -999 °F					
Main Gas Regulator	psig	PCV-100	- - -	- - -	- - -	35	150	Factory Set @ 35 psig
Pilot Gas Regulator	psig	PCV-105	- - -	- - -	- - -	10	150	Factory Set @ 10 psig
Inst. Air Regulator	psig	PCV-107	- - -	- - -	- - -	80	150	Factory Set @ 80 psig

CUSTOMER CONNECTIONS (TO DCS)

The following signals are sent to the customer's DCS from the control panel:

- Remote ESD
- Heater Run
- Low Process Flow
- High Stack Temperature
- High Process Temperature
- Burner Status

Owner:	Unknown	Heater Ref.:	H-741	
Purchaser:	UOPR	Purch. Ref.:	J463	Ftnt
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	&
Location:	Unknown	FDF OEM Ref.:	340802	Rev
FD Fan OEM:	**Chicago Blower**	FDF Item No.:	BL-741	

General Application:

FD Fan(s) Design Basis	mass.flow.%	115% of Design MASS Flows per API Standard 560	
Location(s)	- - -	@ Grade, adjacent to Burner Endwall (incorporated into Combustion Skid)	
Area Classification	NEC	Unclassified	

		AES Units				
Process Design Conditions:		**Heater Design**	**FDF Test Block**			
Mass Flow Rate/ % Htr Design	Lb/hr / kg/ hr	7,736 / 100%	8,900 / 115%			
Volumetric Flow/ % Htr Design	acfm / am3/ hr	1,800 / 100%	2,200 / 122%			
Density, @ Suction	as noted	0.074 Lb/ ft3	0.068 Lb/ ft3			
Design Allowances, Temp./ SP	°F / °C	- - - / - - -	130 °F / 149%			
Temperature @ Min / Suction / Design	°F / °C	-20 / 60 / 110				
Static Pressure @ Suction	as ntoed	-0.2 inH2O	-0.2 inH2O			
Site Elevation/ Atm. P	as ntoed	750 ftAMSL	14.30 psia			
Static Pressure Rise (min./ guar.)	inH2O	7.6 / **7.6**	11.4 / **11.4**			
Fan Speed (allowable/ actual)	RPM	3,600 / 3,525	3,600 / 3,525			
Sound Pressure (allowable/ guar.)	dBA	< 85 / < 85	< 85 / < 85			
Relative Humidity	%	50%				

Fan Mechanical Design:	tag // OEM	**BL-741 // CHICAGO BLOWER Corp.**	
OEM Reference	CMS // FD Fan	International Custom Controls // 340802	1
OEM Model &/or Type-Size	per OEM	D/36A (SQAD)	
Arrangement	- - -	Arrangement 4 (direct drive)	
Brake Power, Design/ Test Block (calc.)	HP	10.0 / 10.0	
Temperature, Mechanical Design	°F	135 °F Mechanical Design	
Casing Description / Materials	- - -	"Square" pattern / CS	
Rotor Description / Materials	- - -	Airfoil Blades / CS	
Shaft Description / Materials	- - -	None - Arrangement 4	
Bearings Description / Materials	- - -	None - Arrangement 4	
Noise Abatement Provisions / SPL	- - -	85 dBA	
External Coatings / Surface Prep.	- - -	OEM's Std Multiple Coat System	
Purchase Specifications	- - -	OEM's Std Industrial Quality Design	

Fan Control Design:	tag // OEM	**VSD-741 / by OTHERS**	
VFD Description	- - -	by Others / Owner	
VFD Rating	- - -	- - -	
Damper Actuator Description	- - -	- - -	
Damper Actuator Operation	- - -	- - -	

Fan Motor Design:	tag // OEM	**BM-741 / TECO-WESTINGHOUSE**	
OEM Model &/or Type-Size	- - -	Catalog EP0102 / AEHH8N	1
VFD Service / speed range	- - -	YES / 3 - 60 Hz or 180 - 3,600 rpm	
Motor Type / Frame Size	- - -	NEMA TEFC / 215T	
Rated Power w/ SF @ Speed	NEMA	10 HP w/ 1.15 SF @ 40°C	
Nameplate Input Power	V/ Hz/ ph	**460V / 60 Hz / 3 ph**	
Typical Performance	- - -	89.5- 91.0 % FL Eff'y @ 89.5 % FL PF	
Insulation Description	- - -	Class F / B Rise	
External Coatings & Surface Prep.	- - -	OEM's Std Multiple Coat System	
Purchase Specifications	- - -	None	

Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	
revision	date	description	by	chk'd	appv'd

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FD FAN DATA SHEET

AES & cgs or SI SYSTEMS of UNITS

MJ17-265-FDFANds-Rev. 1

Owner:	Unknown	Owner Ref.:	H-781	Ftnt & Rev
Purchaser:	UOPR	Purchaser Ref.:	J463	
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	
Service:	Heat Medium Heater	Project:	200 MMscfd Cryo Plant	
Quantity:	1	Location:	Unknown	
SHO Duty:	17.55 MMBTU/ hr	SHO Model:	SHO1750	
CMS Release:	22.30 MMBTU/ hr	CMS Model:	CMS2500	
SHOS Flow:	650 USgpm @ 137 ft TDH	SHOS.Model:	SHOS660	

PROCESS DESIGN CONDITIONS

Heater Section	- - -	Radiant / Convection	Radiant / Convection
Operating Case	- - -	Over-Design Case	Design Case
Service	- - -	Heat Medium Hea	Heat Medium Hea
Heat Absorption (R/C)	MMBTU/ hr	11.82 / 5.72	10.88 / 5.07
Process Fluid	- - -	Therminol 55	Therminol 55
Process Mass Flow Rate, Total	Lb/ hr	267,775	267,775
Process Bulk Velocity (calc. R/C)	ft/ s	9 / 8	9 / 8
Process Mass Velocity (calc. R/C)	Lb/ s ft2	421 / 421	421 / 421
Coking Allowance (dP calcs)	in		
Pressure Drop, Clean (allow. / calc.)	psi	20 / 21	20 / 21
Pressure Drop, Fouled (allow. / calc.)	psi		
Average Heat Flux (allowable)	BTU/ hr ft2	13,000	13,000
Average Heat Flux (calculated)	BTU/ hr ft2	11,560	10,640
Maximum Heat Flux (allowable)	BTU/ hr ft2		
Maximum Heat Flux (calc. R/C)	BTU/ hr ft2	20,600 / 32,070	18,900 / 29,070
Fouling Factor, Internal	hr ft2 °F/ BTU	0.002	0.002
Corrosion or Erosion Characteristics	- - -		
Max. Film Temperature (allow. / calc.)	°F	650 / 423	650 / 413
Inlet Conditions:			
Temperature	°F	195	195
Pressure	psig	60	60
Mass Flow Rate, Liquid	Lb/ hr	267,775	267,775
Mass Flow Rate, Vapor	Lb/ hr	0	0
Weight Percent, Liquid / Vapor	wt%	100% / 0%	100% / 0%
Density, Liquid / Vapor	Lb/ ft3	51.30 / 0.00	51.30 / 0.00
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	- - - / 0.0	- - - / 0.0
Viscosity, Liquid / Vapor	cp	3.3101 / 0.000	3.310 / 0.000
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.518 / 0.000	0.518 / 0.000
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.0693 / 0.000	0.069 / 0.000
Outlet Conditions:			
Temperature	°F	305	305
Pressure	psig	41	41
Mass Flow Rate, Liquid	Lb/ hr	267,775	267,775
Mass Flow Rate, Vapor	Lb/ hr	0	0
Weight Percent, Liquid / Vapor	wt%	100% / 0%	100% / 0%
Density, Liquid / Vapor	Lb/ ft3	49.00 / 0.00	49.00 / 0.00
Molecular Weight, Liquid / Vapor	Lb/ Lbmole	- - - / 0.0	- - - / 0.0
Viscosity, Liquid / Vapor	cp	1.311 / 0.000	1.311 / 0.000
Specific Heat, Liquid / Vapor	BTU/ Lb °F	0.565 / 0.000	0.565 / 0.000
Thermal Conductivity, Liq./Vap.	BTU/hr ft °F	0.066 / 0.000	0.0656 / 0.000

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FIRED HEATER DATA SHEET

AMERICAN ENGINEERING SYSTEM of UNITS

MJ17-266-HTRds- Rev. 1

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COMBUSTION DESIGN CONDITIONS

Overall Performance:

Operating Case	- - -	Over-Design Case	Design Case		
Service	- - -	Heat Medium Heat	Heat Medium Heat		
Excess Air	mol%	15.0%	15.0%		
Calculated Heat Release (LHV)	MMBTU/ hr	20.28	18.22		
Guaranteed Efficiency	HR%	84.5%	85.6%		
Calculated Efficiency	HR%	86.5%	87.6%		
Radiation Loss	HR%	3.00%	3.00%		
Flow Rate, Combustion Gen./ Imp.	Lb/ hr	19,739	17,736		
Flue Gas Temp. Leaving (R/C)	°F	1,452 / 468	1,402 / 429		
Flue Gas Mass Velocity	Lb/ sec ft2	0.472	0.424		

Fuel(s) Data:

		Gas 1 Mol.Wt.			
LHV	BTU/ scf	976			
LHV	BTU/ Lb	20,426			
P @ Burner	psig	75			
T @ Burner	°F	100			
MW	Lb/ Lbmole	18.13			
m @ ??? °F	cp	- - -			
m @ ??? °F	cp	- - -			
Atomizing Media		- - -			
Atom. Media P & T		- - -			

Components:

N	wt%	- - -			
S	wt%	- - -			
Ash	wt%	- - -			
Ni	ppm	- - -			
Va	ppm	- - -			
Na	ppm	- - -			
Fe	ppm	- - -			
H2	mol%	0.0%			
O2	mol%	0.0%			
N2 + Ar	mol%	1.0%			
CO	mol%	0.0%			
CO2	mol%	1.0%			
CH4	mol%	88.0%			
C2H6	mol%	8.0%			
C2H4	mol%	0.0%			
C3H8	mol%	2.0%			
C3H6	mol%	0.0%			
C4H10	mol%	0.0%			
C4H8	mol%	0.0%			
C5H12	mol%	0.0%			
C5H10	mol%	0.0%			
C6+	mol%	0.0%			
H2S	ppmv	0.0%			
SO2	mol%	0.0%			
NH3	mol%	0.0%			
H2O	mol%	0.0%			
spare	mol%	0.0%			

Blower/Fan Peformance:

Volumetric Flow	acfm	4,300
Rated Power	HP	15
Fan Speed	RPM	3,600
Sound Pressure	dBA	< 85
Area Classification	NEC	Unclassified

Burner Design:

OEM	- - -	Callidus Technologies, LLC	
Type	- - -	Enhanced IFGR	ULTRA Low NOx
Quantities	- - -	1	Burner
Model No.	- - -	CUBL-5W	Cylindrical
Windbox	- - -	yes ...	
Location	- - -	EndWall Center ...	Horizontally Fired

Pilot Design:

Type / Model		Self-Inspirating	/	by O.E.M.
Ignition	- - -	Electric		requires elec.ign.system
Heat Release	- - -	> 90000	BTU/ hr on ...	Gas 1

Burner Performance:

Minimum Heat Release	MMBTU/ hr	4.46
Design Heat Release	MMBTU/ hr	20.28
Maximum Heat Release	MMBTU/ hr	22.30
Burner Turndown	Max:Min	5.00
Volumetric Ht. Release	BTU/ hr ft3	10,034
Pressure @ Arch	inH2O	0.60
Pressure @ Burner	inH2O	7.75
Combustion Air T @ Burner	°F	60
Flue Gas T @ Burner	°F	1,260

Guaranteed Emissions:

Basis of Guarantee	- - -	3.0% O2,	dry (LHV)
NOx Emissions	Lb/MMBTU	0.053	40 ppm
SOx Emissions	Lb/MMBTU	no quote	
CO Emissions	Lb/MMBTU	0.041	50 ppm
VOC Emissions	Lb/MMBTU	0.019	15 ppm
UHC Emissions	Lb/MMBTU	0.007	15 ppm
SPM10 Emissions	Lb/MMBTU	0.014	16 ppm
Noise Emissions	dBA @ 3ft	85	

Net Flame Clearances:

Est. Flame Size	approx. 19.7 ft L x 3.5 ft Diameter
Hor Clearance	1 ft NET Tube Clearance
Vert. Clearance	1 ft NET Tube Clearance
Axial Clearance	1.45 ft NET Refractory Clearance (to Arch hot face)

Nominal Flame Clearances:

from burner CL ...		Vertical	Horizontal
to Tube CL, API	ft	10.61	7.08
to Tube CL, calc.	ft	4.50	4.50
to Refrac., calc.	ft	n / a	21.17

Owner Ref.: H-781 THM Ref.: MJ17-266

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No.	Item	Units			
1	PRESSURE PARTS DESIGN				
2					
3	Coil Design:		RADIANT	SHIELD	CONVECTION
4	Service		Heat Medium Heat	Heat Medium Heat	Heat Medium Heater
5	Design Basis for Tube Temperature		API 530	API 530	API 530
6	Design Basis for Tube Wall Thickness		ASME Sec. VIII-1	ASME Sec. VIII-1	ASME Sec. VIII-1
7	Design Life	hr	100,000	100,000	100,000
8	Design Pressure (elastic / rupture)	psig	150 /	150 /	150 /
9	Design Fluid Temperature	°F	305	305	305
10	Design Temperature Allowance	°F	29	29	29
11	Design Corrosion Allowance (tubes/fittings)	in	0.063 / 0.063	0.063 / 0.063	0.063 / 0.063
12					
13	Maximum Tube Temperature (clean)	°F	440		
14	Maximum Tube Temperature (fouled)	°F	486	389	582
15	Design Tube Temperature	°F	515	611	611
16	Inside Film Coefficient	BTU/ hr ft2 °F	195	141	141
17	Weld Inspection	RT or Other	100 of 100%	100 of 100%	100 of 100%
18	Weld Heat Treatment	s.rel., t.stab. or none	None	None	None
19	Hydrostatic Test Pressure	psig	per API	per API	per API
20					
21	Coil Arrangement:		Horizontal	Horizontal	Horizontal
22	Coil Type	- - -	Helical	Serpentine	Serpentine
23	Tube Material (pipe or tube spec)	ASTM	SA106GrB	SA106GrB	SA106GrB
24	Supplementary Mfg Requirements	ASTM	None	None	None
25	Tube Outside Diameter	in	4.500	4.500	4.500
26	Tube Wall Thickness (aw / mw)	in	0.237 / 0.207	0.237 / 0.207	0.237 / 0.207
27	Number of Cells (radiant or convection)	- - -	1	1	1
28	Number of Flow Passes (total / cell)	- - -	2 / 2	2 / 2	2 / 2
29	Number of Tubes per Row (total / cell)	- - -		4 / 4	4 / 4
30	Overall Tube (1 turn in radiant) Length	ft	28.27	11.54	11.54
31	Effective Tube Length / Helix Diameter	ft	28.27 / 9.00	9.96	9.96
32	Number of Turns or Tubes (total / pass)		30.7 / 15.3	4.0 / 4.0	0.0 / 0.0
33	Total Exposed Surface	ft2	1,023	47	0
34	Number of Ext.Surf. Tubes (total / cell)	- - -	0 / 0.0	0 / 0.0	20 / 20.0
35	Total Exposed Surface	ft2	0	0	2,940
36	Tube Spacing (horiz. / tube centers)	in	- - - / 8.00	8.00 / 8.00	8.00 / 8.00
37	Tube Spacing (horiz. to refractory)	in	6.00	4.00	4.00
38					
39	Coil Fittings:		Heat Medium Heat	Heat Medium Heat	Heat Medium Heater
40	Fitting Type	- - -	SR 90° Elbows	SR 180° U-Bends	SR 180° U-Bends
41	Fitting Material	ASTM	SA234 WPB	SA234 WPB	SA234 WPB
42	Supplementary Mfg Requirements	ASTM	None	None	None
43	Fitting Outside Diameter	in	4.500	4.500	4.500
44	Fitting Wall Thickness (aw / mw)	in	0.237 / 0.207	0.237 / 0.207	0.237 / 0.207
45	Fitting Location	internal or external	Internal	External	External
46	Tube Attachment	welded or rolled	Welded	Welded	Welded
47					
48	Coil Terminals:		Outlet		Inlet
49	Terminal Type	beveled or flanged	Flanged		Flanged
50	Flange Material	ASTM	SA105		SA105
51	Supplementary Mfg Requirements	ASTM	None		None
52	Flange Size and Rating	NPS/ ASME	4" NPS / 300#		4" NPS / 300#
53	Flange Type	RFWN or RTJ	RFWN		RFWN
54	Location	- - -	Burner Endwall		Terminal End
55					
56	Extended Surface:			CONVECTION	CONVECTION
57	Service	- - -		Heat Medium Heat	Heat Medium Heater
58	Fin or Stud Row Number	starting @ bottom		No.1 / No.2-3	No.4-5 /
59	Ext. Surface Type	seg.fins, solid fins, studs		HF Seg. Fins	HF Seg. Fins
60	Fin/Stud Material	- - -		C.S. / C.S.	C.S. /
61	Fin/Stud Height	in		0.75 / 1.00	1.00 /
62	Fin/Stud Thickness	in		0.06 / 0.06	0.06 /
63	Fin/Stud Density	fin/ in		5.00 / 5.00	5.00 /
64					

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PRESSURE PARTS DESIGN (continued)

		RADIANT	SHIELD	CONVECTION	
Crossovers:		RADIANT	SHIELD	CONVECTION	
Type, location / connections	- - -	External	/ Flanged	None	
Tube / Fittings Material	ASTM	SA106GrB	/ SA234 WPB		
Tube & Fitting OD / Thickness (aw)	in	4.500	/ 0.237		
Inlet Manifold(s):	type			Simple LOG	
Location	- - -			Top - Term. End	
Design Basis for Manifold Thickness	- - -			ASME B31.3	
Design Conditions (temp./press.)	°F/ psig			611 / 150	
Pipe Material	ASTM			SA106GrB	
Fittings Material	ASTM			SA234 WPB	
Flange Material / Style	ASTM			SA105 / RFWN	
Outside Diameters, each Branch	in			8" NPS	
Wall Thickness(es); aw ~~or mw~~	in			SCH40 (0.322)	
End Types (terminal/ dead)	beveled or flanged			Flanged / W.Cap	
Manifold Terminal Type	NPS/ ASME			8" NPS / 300# Flg	
Coil Connection Type	extrusion, olet, etc.			Weld-O-Let	
Coil Terminal Type	NPS/ ASME			4" NPS / 300# Flg	
Outlet Manifold(s):	type	Simple LOG			
Location	- - -	Burner Endwall			
Design Basis for Manifold Thickness	- - -	ASME B31.3			
Design Conditions (temp./press.)	°F/ psig	515 / 150			
Pipe Material	ASTM	SA106GrB			
Fittings Material	ASTM	SA234 WPB			
Flange Material / Style	ASTM	SA105 / RFWN			
Outside Diameters, each Branch	in	8" NPS			
Wall Thickness(es); aw ~~or mw~~	in	SCH40 (0.322)			
End Types (terminal/ dead)	beveled or flanged	Flanged / W.Cap			
Manifold Terminal Type	NPS/ ASME	8" NPS / 300# Flg			
Coil Connection Type	extrusion, olet, etc.	Weld-O-Let			
Coil Terminal Type	NPS/ ASME	4" NPS / 300# Flg			

COIL & MANIFOLD SUPPORTS DESIGN

		RADIANT	SHIELD	CONVECTION	
Tube Supports:		RADIANT	SHIELD	CONVECTION	
Service		Heat Medium Heat	Heat Medium Heat	Heat Medium Heater	
Location	Top, Bottom, Ends	Bottom	Ends	Ends	
Support Type	casting, tubesht, spring, etc.	SS Pipe Rail	Welded Tbsheets	Welded Tbsheets	
Support Thicknesses	in	SCH40	0.375	0.375	
Support Materials	ASTM	A240 T304	A36 CS	A36 CS	
Support Temperatures (calc./ design)	°F / °F	840 / 1,030	536 / 690	536 / 690	
TbSht Ferrules Thickness/Materials	in/ ASTM	- - - / - - -	14 ga. / 304 SS	14 ga. / 304 SS	
Refractory & Anchor Materials & Types		none	per refrac. section	per refrac. section	
Intermediate Guides & Supports:		None	None	None	
Location	- - -				
Guide/ Support Type	casting, spring, etc.				
Material	ASTM				
Spacing, average	ft				
Tube Guides:	Top, Bottom, Ends	None	None	None	
Material	ASTM				
Manifold Supports:		Outlet Manifold		Intlet Manifold	
Material	ASTM	A36		N/A	
Materials Design & Supply	- - -	by THM			
Location	Top, Bottom, Ends	Burner Endwall			
Support Type	roller, shoe, spring, etc.	Simple Shelf			
Number of Supports	- - -	One (1)			

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No.	Item	Units				
1	CASING / REFRACTORY SYSTEMS DESIGN					
2						
3			BURNER		SHIELDED	ARCH
4	Radiant Section Design:		ENDWALL		SIDEWALLS	ENDWALL
5	Total Refractory Thickness	in	5.0		3.0	5.0
6	Hot Face Temperature (design)	°F	2,000		2,000	2,000
7	Hot Face Temperaure (calculated)	°F	1,452		840	1,452
8	Hot Face Layer	in/ - - -	1/ 8# CF Blanket		1/ 8# CF Blanket	1/ 8# CF Blanket
9	Back-Up Layer No.1	in/ - - -	1/ 8# CF Blanket		2/ 6# CF Blanket	1/ 8# CF Blanket
10	Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 6# CF Blanket
11	Foil Vapor Barrier	in/ - - -	None		None	None
12	Castable Reinforcement (SS Needles)	wt%	None		None	None
13	Anchors / Tie Backs:	- - -	Pins & Clips		Pins & Clips	Pins & Clips
14	Material	- - -	310 S.S.		304 S.S.	310 S.S.
15	Attachment	- - -	Welded		Welded	Welded
16	Casing:					
17	Material	in/ ASTM	0.1875 / A36		0.1345 / A36	0.1875 / A36
18	Internal Coating	- - -	None		None	None
19	External Temperature, Typical	°F	180		180	180
20	Comments / Clarifications	- - -	w/ cfb wraps		w/o cfb wraps	w/ cfb wraps
21			SHOP Installed		SHOP Installed	SHOP Installed
22						
23			SIDEWALLS		ENDWALLS	
24	Convection Section Design:		SHIELD	FINNED	TUBESHEETS	HEADER BOXES
25	Total Refractory Thickness	in	3.0	3.0	3.0	2.0
26	Hot Face Temperature (design)	°F	2,000	2,000	2,200	2,000
27	Hot Face Temperaure (calculated)	°F	960	960	960	650
28	Hot Face Layer	in/ - - -	1/ 8# CF Blanket	1/ 8# CF Blanket	3/ Sparlite HS	1/ 8# CF Blanket
29	Back-Up Layer No.1	in/ - - -	2/ 6# CF Blanket	2/ 6# CF Blanket	None	1/ 8# CF Blanket
30	Back-Up Layer No.2	in/ - - -	None	None	None	None
31	Foil Vapor Barrier	in/ - - -	None	None	None	None
32	Castable Reinforcement (SS Needles)	wt%	None	None	None	None
33	Anchors / Tie Backs:	- - -	Pins & Clips	Pins & Clips	Bullhorns	Pins & Clips
34	Material	- - -	310 S.S.	304 S.S.	304 S.S.	304 S.S.
35	Attachment	- - -	Welded	Welded	Welded	Welded
36	Casing:					
37	Material	in/ ASTM	0.1345 / A36	0.1345 / A36		0.1345 / A36
38	Internal Coating	- - -	None	None	None	None
39	External Temperature, Typical	°F	180	180		180
40	Comments / Clarifications	- - -	Cleaning/Sootblowing lanes: none			Bolted Assembly
41		- - -	SHOP Installed	SHOP Installed	SHOP Installed	SHOP Installed
42						
43				FLUE GAS DUCTS		
44	Stack & Uptakes Design:			15° TRANSITION	DISCH. DUCT	
45	Quantity			One	One	
46	Type / Location	- - -		Full L / Conv	Self.Spt / Grade	
47	Length / Metal Outside Diameter (top)	ft/ ft		1.41 / n/ a	7 / 2.333	
48	Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 24	
49	Total Refractory Thickness	in		0.0	0.0	
50	Hot Face Temperature (design)	°F				
51	Hot Face Temperaure (calculated)	°F		468	468	
52	Hot Face Layer	in/ - - -		None	None	
53	Back-Up Layer No.1	in/ - - -				
54	Castable Reinforcement (SS Needles)					
55	Anchors / Tie Backs:	- - -				
56	Material	- - -				
57	Attachment	- - -				
58	Casing:					
59	Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36	
60	Corrosion Allowance	in		None	None	
61	Internal Coating	- - -		None	None	
62	External Temperature, Typical	°F		468	468	
63	Comments / Clarifications	- - -				
64						

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MECHANICAL / STRUCTURAL DESIGN BASIS

Refractory & Coatings Design:

Refractory Design	Per Std560: 180°F Avg. Casing Temperature @ Ambient Conditions of 0 MPH & 80°F	
Refractory Dryout	SHOP dryout = None // FIELD dryout is NOT required with the use of TC's AHR additive to Castable.	
Coating, Internal	None	
Coating, External	Base Coat:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
	Int. Coat:	None
	Top Coat:	None

Applicable Standards:

API	~~Std 560 (ISO 13705); Fired Heaters for ...~~	AISC	Specification for Design, ... Steel for Buildings
API	Std 530 (ISO 13704); Calc. of Heater Tube ...	AWS	D 1.1; Structural Welding Code
ASME	B31.3, Chemical Plant and ... Piping	ASTM	tube/ smls pipe/ fitting spec's noted herein
ASME	Sections I, II, VIII, IX; ASME B&PV Code	ASTM	refractories per C27, C155, C401 & C612
ASME	Section V; Non Destructive Examination	NFPA	NFPA 70; National Electrical Code

Wind Design:		Seismic Design:	
Spec. or Standard	ASCE 7-10	Spec. or Standard	ASCE 7-10
Velocity/ Imp. Factor	120 mph / 1	Risck Cat./Imp. Factor	III / 1.25
Site Exposure	"C"		
Physical Design:		**Site Design Basis:**	
Plot Limitations	None	Site Elevation	750 ft AMSL
Tube Limitations	None	Stack Design Temp.	90 °F
Firebox Pressure	Positive; approximately +1.0 inH2O	FG Discharge Elev.	24 ft AG
Ambient Temp's	-20 °F Min/ 60 °F Dsn/ 110 °F Max	Area Classification	Unclassified

MAJOR SUBSYSTEMS & ACCESSORIES

Major Services & Subsystems		Major Accessories:		
Process Design	INCLUDED in base pricing	Casing/ Tube Seals	8	TubeSox; Radiant & Conv.
Mechanical Design	INCLUDED in base pricing	Observation Doors	2	4 in Dia. w/ H.T. glass
Structural Design	INCLUDED in base pricing	Observation Doors	1	4 in Dia. w/ HT glass on Arch
Radiant Section	INCLUDED in base pricing	Access Doors	1	Std 24" x 24"
Convection Section	INCLUDED in base pricing	Expansion Joints	None	
Combustion Mgmt	INCLUDED in base pricing	Ladders & Platforms	Not Included	
Burner Piping	INCLUDED in base pricing	L&P Coating	N/A	
Forced Draft System	INCLUDED in base pricing			

Casing Penetrations			Pressure Part Penetrations		
Fbox Purge/ Snuff	None		Coil TSTC's, Radiant	None	
CA Temp/Pres	None		Coil TSTC's, Convection	None	
FG Temperature	2	1.5"NPS 3000# Coupling	Process TI conn's	3	1.5" NPS 300# RFWN
FG Pressure	2	1.5"NPS 3000# Coupling	Process PI conn's	1	1.5" NPS 300# RFWN
FG Comp. (Sample)	2	1.5"NPS 3000# Coupling	spare		
FG Sample	2	4"NPS 150# RFWN's	spare		
O2 Analyzer Port	None		spare		

Dampers

	FD Fan (blower) qty = 0	Uptake Ducts	Stack qty = 0
Function	Note:		Note:
Design	Fan inlet damper is inappropriate		Stack Damper (which provides draft
Materials	for forced draft SHO's where O2		control) is inappropriate for forced
Bearings	Control is provided by the CMS O2		draft SHO's where the combustion
Operator	Trim Module which controls the fan		conditions are controlled real-time
Positioner	(blower) motor's VFD/ VSD.		via the CMS.
Instruments			

Sootblowers:	Qty.	Type	Location	FG T	Material	Steam T & P	O.E.M. / Ref.
Lane 1:	None						
Lane 2 :	None						

Owner:	Unknown	Owner Ref.:	H-781	Ftnt & Rev
Purchaser:	UOPR	Purch. Ref.:	J463	
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	
SHO Model:	SHO1750	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for RADIANT COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Radiant Coil Design Basis:	units	**Variable Values**	**Comments**	
Design Pressure, P	psig	**150**	Design Pressure is per PO / Contract.	[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**515** / **-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract	[b]
Design Allowances, Corrosion/ Erosion	in	0.063 / 0.000	Allowances (both CA & EA) are per PO / Contract	[c]
Design Stress @ Design Temp, S	psi	**17,100**	Design Stress @ T.Dmax	[d]
Pipe/Tube Outside Diameter	in	**4.500**		[e]
Pipe/Tube Material Standard	ASME	SA106GrB	Max. Allowable Nonconcentricity, per ASTM: 12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless		[g]
Butt Weld Inspection	RT or Other	100 of 100%		[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 40 / 0.237	Tube Inside Radius (R.i), New = 2.013	
Actual Minimum Thickness, t.new / t.EOL	in	0.207 / 0.145	t.EOL = End of Life Thickness = t.new - (CA + EA)	

UG-27 Calculations:				
Circumferential Stress Calculations	- - -	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.018	UG-27(c) (1)&(2) Thickness Check: 0.12 = OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.127	UG-27(c) (1) Pressure Limit Check: 6,584 = OK!!	[c]
UG-27(c) (1) Acceptability	- - -	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]
Longitudinal Stress Calculations	- - -	0.85	Per UW-12, Circumferential JE of butt-welds is 85%	[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.010	UG-27(c) (2) Pressure Limit Check: 18,169 = OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.135		[g]
UG-27(c) (2) Acceptability	- - -	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[h]

Appendix 1, Para.1-1 Calculations:				[i]
Circumferential Stress Calculations	- - -		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	- - -		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Work this data sheet with Heater Datasheets and General Arrangement Drawings (latest versions).
i) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

CONFIDENTIAL PROPERTY of ...
TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-266-COIL.VIIIds-Rev. 1

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-781	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	Rev
SHO Model:	SHO1750	Location:	Unknown	

ASME SECTION VIII - DIVISION 1 CALCULATIONS for CONVECTION COIL

Formulas:

	UG-27(c) (1)		UG-27(c) (2)		Appendix 1, 1-1(1)
t.s =	$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$	or	$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$	or	$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
	Circumferential Stress		Longitudinal Stress		Circumferential Stress

where:		units	comments:
t.s	Required / Minimum Stress Thickness	in	Excludes corrosion and/or erosion allowances
P	Design Pressure, per PO / Contract	psig	Per PO / Contract
Ro / Ri	Outside / Inside Radius of Tube	in	Calculated values for New Condition
S	Design (Max. Allowable) Stress @ T	psi	Per UG-23 / ASME Section II, Part D, Subpart 1
JE	Joint Efficiency, per UW-12	%	TABLE UW-12; 100% seamless pipe/tube = 1.00

Convection Coil Design Basis:	units	**Variable Values**	**Comments**	[i]
Design Pressure, P	psig	**150**	Design Pressure is per PO / Contract.	[a]
Design Temperatures, T.Dmax./ T.Dmin.	°F	**611** / **-20**	T.Dmax per THM calcs / T.Dmin per PO / Contract	[b]
Design Allowances, Corrosion/ Erosion	in	0.063 / 0.000	Allowances (both CA & EA) are per PO / Contract.	[c]
Design Stress @ Design Temp, S	psi	**17,100**	Design Stress @ T.Dmax	[d]
Pipe/Tube Outside Diameter	in	**4.500**		[e]
Pipe/Tube Material Standard	ASME	SA106GrB	Max. Allowable Nonconcentricity, per ASTM: 12.50%	[f]
Pipe/Tube Type	welded or seamless	Seamless		[g]
Butt Weld Inspection	RT or Other	100 of 100%		[h]
Tube Schedule / New Avg.Wall	ASTM	SCH 40 / 0.237	Tube Inside Radius (R.i), New = 2.013	
Actual Minimum Thickness, t.new / t.EOL	in	0.207 / 0.145	t.EOL = End of Life Thickness = t.new - (CA + EA)	

UG-27 Calculations:				[i]
Circumferential Stress Calculations	- - -	1.00	Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
UG-27(c) (1) Minimum Thickness, t.s	in	0.018	UG-27(c) (1)&(2) Thickness Check: 0.12 = OK!!	[b]
UG-27(c) (1) Surplus Wall Thickness	in	0.127	UG-27(c) (1) Pressure Limit Check: 6,584 = OK!!	[c]
UG-27(c) (1) Acceptability	- - -	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]
Longitudinal Stress Calculations	- - -	0.85	Per UW-12, Circumferential JE of butt-welds is 85%	[e]
UG-27(c) (2) Minimum Thickness, t.s	in	0.010	UG-27(c) (2) Pressure Limit Check: 18,169 = OK!!	[f]
UG-27(c) (2) Surplus Wall Thickness	in	0.135		[g]
UG-27(c) (2) Acceptability	- - -	**Acceptable!**	Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[h]

Appendix 1, Para.1-1 Calculations:				[g]
Circumferential Stress Calculations:	- - -		Per UW-12, Longitudinal JE of seamless pipe is 100%	[a]
Appendix 1 (1-1) (1) Min. Thickness, t.s	in			[b]
Appendix 1 (1-1) (1) Surplus Thickness	in			[c]
Appendix 1 (1-1) (1) Acceptability	- - -		Acceptable if t.EOL > t.s (ie, Surplus Thickness > 0.000)	[d]

Footnotes / Clarifications:

a) Fluxed coil (inside casing) & XOvers are per ASME Section VIII -Div.1; unfluxed manifolds are per ASME B31.3.
b) This design is per the 2015 Edition of Section VIII - Division 1 (UG-27 basis; not Appendix 1).
c) These calculations are "preliminary" until accepted by the Coil Manufacturer; whom provides the code stamp on the coil.
d) The different Design Temp's of Radiant and Convection coils reflect the heater's large process temp rise.
e) Per UG-11 & UG-44, the Pressure-Temperature ratings of standard components shall be per noted ASME/ANSI Stds.
f) Per UG-44, fittings per B16.9 & B16.11 shall be calculated as for straight seamless pipe per Section VIII - Divivision 1.
g) Per UCS-66, charpy impact testing for this coil is not mandatory (ref. FIG UCS-66, Curve B).
h) Mandatory Appendix 1 provides supplemental design formulas that MAY be substituted for UG-27(c) formulas.
i) These calculations are for the Convection Coil and for the Crossovers (between radaint and convection modules).
j) spare

rev.	date	description	by	appv'd
1	13-Nov-17	Revised Purch. Ref. No. per Customer	JDC	JDF
0	19-Aug-17	Issued for Approval	JF	JDC

CONFIDENTIAL PROPERTY of ...
TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE
ASME SECTION VIII - DIVISION 1 CALCS

FLUXED HEATER COIL
MJ17-266-COIL.VIIIds-Rev. 1

info@tulsaheatersmidstream.com u (918) 392 -8000(vce) u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com

Owner:	Unknown	Owner Ref.:	H-781	Ftnt
Purchaser:	UOPR	Purch. Ref.:	J463	&
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	Rev
Burner OEM:	**Callidus Technologies, LLC**	OEM Ref.:	9020130	
SHO Model:	SHO1750	Service:	Heat Medium Heater	
CMS Model:	CMS2500	Location:	Unknown @ 750 ft elevation	

GENERAL DESIGN CONDITIONS

General Application:

Service	- - -	Heat Medium Heater	Heat Medium Heater
Operating Case	- - -	**Over-Design Case**	**Design Case**
Burner Type		Enhanced IFGR	Enhanced IFGR
Burner Quantity	- - -	1	1
Model & Size:	- - -	CUBL-5W	CUBL-5W
Flame Shape	cylindrical or flat	Cylindrical	Cylindrical
Applicable Fuel(s)	- - -	Fuel Gases pg. 2	Fuel Gases pg. 2
Location(s) / Firing Direction		Endwall Center	Endwall Center
Firing Orientation		Horizontal	Horizontal
BridgeWall Temperature, calc.	°F	1,452	1,402

Heat Release Performance:

		MMBTU/hr	MMBTU/hr
Operating Case	- - -	Over-Design Case	Design Case
Max. Heat Release, per Burner	LHV Basis	22.30	20.04
Design Heat Release, per Burner	LHV Basis	20.28	18.22
Min. Heat Release, per Burner	LHV Basis	4.46	4.46
Turndown, minimum/ actual	max / min	5.00 / 5.00	5.00 / 5.00

Radiant Dimensions:

	comments	ft / (in)
Casing Width / Height, Casing	face - face	10.50 / (126)
Casing Length, Casing to Casing	face - face	22.00 / (264)
Helical Coil CenterLine Diameter	CL - CL	9.00 / (108)
Helical Coil Inside Diameter	face - face	8.63 / (104)
Serpentine Coil CtrLine Dimensions	W / H	
Serpentine Coil Inside Dimensions	face - face	
Firebox Length, Refractory Faces	face - face	21.17 / (254)

Flame Dimensions:

		ft / (in)
Burner CL elev., approx.	AG	5.75 / (69)
Flame Length, calc.	@ design HR	19.7 / (237)
Flame Dia., calc.	@ design HR	3.50 / (42)

Actual Clearances

		ft / (in)
Burner - tube (tangential)	CL / Net	4.50 / (54)

Combustion Air (CA) Basis - All Fuel(s):

CA Temperature, min.	-20	°F
CA Temperature, design	60	°F
CA Temperature, max.	110	°F
CA Pressure, Ambient	14.30	psia
CA Humidity, Design	50%	%RH

FG Draft, at Bridgewall	0.60	inH2O	(positive)
CA Pressure, at Burner	7.75	inH2O	(positive)
CA Pressure Drop, Design	7.10	inH2O	
CA Pressure Drop, Actual	t.b.q.	inH2O	

Emissions -	- - -	**Gaseous Fuel(s):**		**Liquid Fuel(s):** **no**
Design/ Guaranteed Emissions:	basis		3.0% O2, dry (LHV)	
NOx Emissions	LHV Basis	0.053	Lb/MMBTU	
SOx Emissions	LHV Basis	no quote	Lb/MMBTU	
CO Emissions	LHV Basis	0.041	Lb/MMBTU	
VOC Emissions	LHV Basis	0.019	Lb/MMBTU	
UHC Emissions	LHV Basis	0.007	Lb/MMBTU	
SPM10 Emissions	LHV Basis	0.014	Lb/MMBTU	
Noise Emissions	- - -	85	dBA @	

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

BURNER DATA SHEET

AES SYSTEMS of UNITS

MJ17-266-BRNRds-Rev. 1

SHO = Superior Quality, Flexibility, Dependability & Modularity

Owner Ref.: **H-781** THM Ref.: **MJ17-266**

Ftnt & Rev

GASEOUS FUEL(S) & PRODUCTS OF COMBUSTION

Fuel Gas Basis:	---	**Gas 1**	**Mol.Wt.**
Operating Mode	---	Over-Design Case	
Temperature, at Burner	°F	100	
Pressure, at Burner (available)	psig	75	
LHV (net HV), mass basis	AES units	20,426	BTU/ Lbm
LHV (net HV), volume basis	AES units	976	BTU/ scf
HHV (gross HV), mass basis	AES units	22,613	BTU/ Lbr
HHV (gross HV), volume basis	AES units	1,080	BTU/ scf
Molecular Weight (mass)	all units	18.13	x/ xmole

Fuel Gas Composition(s): symbol	MW	**Gas 1**	**Mol.Wt.**
H2	2.02	0.00%	mole %
O2	32.00	0.00%	mole %
N2 + Ar	28.15	1.00%	mole %
CO	28.01	0.00%	mole %
CO2	44.01	1.00%	mole %
CH4	16.04	88.00%	mole %
C2H6	30.07	8.00%	mole %
C2H4	28.05	0.00%	mole %
C3H8	44.10	2.00%	mole %
C3H6	42.08	0.00%	mole %
C4H10	58.12	0.00%	mole %
C4H8	56.11	0.00%	mole %
C5H12	72.15	0.00%	mole %
C5H10	70.13	0.00%	mole %
C6+	86.18	0.00%	mole %
H2S	34.08	0.00%	mole %
SO2	64.06	0.00%	mole %
NH3	17.09	0.00%	mole %
H2O	18.02	0.00%	mole %
spare		0.00%	mole %

Products of Combustion @ Design:		**Gas 1**	**Mol.Wt.**
Excess Air Concentration	mole%	**15%**	mole%
Temperature, PoC at Bridgewall	°F	1,452	
Temperature, PoC at Burner	°F	1,260	
Temperature, PoC Acid Dew Point	°F	151	

<< ------- mass balance by TULSA HEATERS MIDSTREAM LLC ------- >>

Combustion Mass Balances:		MW	Lbm/ hr	
Fuel Flow Rates	mass in		993	
Comb. Air Flow Rates	mass in	28.96	18,747	
POC Mass Flow Rates (wet)	mass out	27.89	19,739	
POC Mass Flow Rates (dry)	mass out	29.91	17,573	
POC Component Flow Rates ...	O2	32.00	564	
	N2 + Ar	28.15	14,335	
	CO2	44.01	2,671	
	H2O	18.02	2,166	
	<< ------- vapor / solid concentrations are in ppmvd / ppmd, resp. ------- >>			
	NOx	46.01	1.08	40 ppm
	SOx	64.06	0.00	0 ppm
	CO	28.01	0.82	50 ppm
	VOC	44.10	0.39	15 ppm
	UHC	16.04	0.14	15 ppm
	SPM		0.28	16 ppm

Owner Ref.: **H-781** THM Ref.: **MJ17-266**

Ftnt & Rev

ADDITIONAL REQUIREMENTS

QA Requirements:

Performance Test @ shop	- - -	Not Required
CFD Model of Firebox	- - -	None
CFM of CA Ducting	- - -	None
Mill Certs, fuel wetted parts	- - -	Not Required
PMI, fuel wetted parts	- - -	Not Required

Fuel Wetted Components:

Oil Gun Model	- - -	None
Gun Tip / Atomizer Mat'ls	ASTM	None / None
Gas Risers Material	ASTM	t.b.d.
Gas Manifolds Mat'l	ASTM	Carbon Steel

Burner Pilot:

Burner Pilot	model	by O.E.M.
Type	- - -	Self-Inspirating
Heat Release	BTU/ hr	> 90,000
Ignition Method	man.or elec.	Electric
Pilot Fuel Gas	- - -	Gas 1 Mol.Wt.
Pilot Detection	type or none	None
Fuel P, avail. @ pilot	psig	10 (5 -15 is OK)

Connections:

Primary Fuel Gas	sz & spec	by OEM & 150# A105 RF
Secondary Fuel Gas	sz & spec	None
Fuel Oil	sz & spec	None
Atomizing Media	sz & spec	None
Pilot Gas	sz & spec	by OEM & 150# A105 RF
Detector, Main Flame	sz & spec	None
Detector, Pilot Flame	sz & spec	by OEM - UV Scanner Mount
Sight Ports	sz & spec	None

Windbox or Plenum:

Individual windbox	yes or no	yes
Material Description	th x ASTM	12 ga. x A36
Common Plenum Depth	ft.	none
Refractory Description	th x type	1.00 in x Min.Wool
Refractory Anchors	ASTM	C.S. Expanded Metal
Register Type		none
Register Material	ASTM	C.S.
Leakage, guaranteed	wt%	< 5.0 % of Max HR Flow
Actuation	man., pneu.or elec.	manual

APPLICABLE SPECIFICATIONS & STANDARDS

TULSA HEATERS MIDSTREAM LLC Specifications:

a) Burner scope …

1) Pilot w/ Electric Ignition - Ignition Transformer is by others (CMS Supplier)
2) UV Scanner is by others. Swivel scanner mount (by burner supplier) aimed at pilot and main flame when pilot off.
3) Sight port(s) for viewing pilot and main flames.

b) Burner shall have 5:1 turndown; this capability shall NOT compromise flame size or performance.

c) External Coatings shall be as follows:

Prime:	3 mils dft IOZ (InOrganic Zinc) on SP-6 Surface
Intermediate:	None
Finish:	None

d) Burner is mounted and fired horizontally. Tile to be shop mounted in 304 SS case.

e) Even though job location/elevation is different, burner to be sized to range from sea level to 3500 ft and worst case air delta P reported.

Owner:	Unknown	Owner Ref.:	H-781	Ftnt & Rev
Purchaser:	UOPR	Purch. Ref.:	J463	
Heater OEM:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	
CMS OEM:	**International Custom Controls**	CMS Model:	CMS2500	

System Overview:

Design Philosophy	Meet or Exceed NFPA 85 with packaged Combustion Management System
Heater DHR	Heater Design Heat Release = 22 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
CMS DHR	CMS Design Heat Release = 25 MMBTU/hr (LHV); ref. Burner Data Sheets for fuel composition
No. of Burners	One Callidus CUBL-5W Burner per heater

THM Specs	Provided datasheets	Ambient P, Design	750 ft AMSL = 14.30 psia
THM P&ID	CMS2500 P&ID	Ambient T Range	-20 °F Minimum to 110 °F Maximum
Area Classification	Unclassified	Noise Limit	85 dBA @ 3 ft
Supply Power	**120V** / **1 ph** / **60 Hz**	Ind. Standard(s)	B31.3, NFPA 70 (NEC), **NFPA 85**
Supply Air	**80** psig	Customer Specs	**None**

Subsystem Design:

		Dsn P	Dsn T	NPS	Dsn V	End Con.[4]
Main Gas Train[3]	Double Block & Bleed SDVs with **ZSC's**	150 psig	150°F	2"	67	150# RF
Pilot Gas Train	Double Block & Bleed SDVs	150 psig	150°F	1/2"	11	150# RF
Instrument Air Hdr		125 psig	150°F	1"	- - -	150# RF
Main Oil Train	None					
Atom. Media Train	None					
Local Panel (LCP)	**NEMA 4** Enclosure for Controls, HMI, Pushbuttons & Lights				**Z-Purge:**	**No**
Other Panel(s)	**NEMA 7** Enclosure with 6kV Ignition Transformer & 7mm HiV IGN Cable					
Other Panel(s)	**None**					
Forced Draft Sys.	One FD Fan[1]; a) unlined ducting, b) CA controlled by **Damper**					

Minimum Pre-Purge Interlocks:

- ✔ Manual ESD Switch (pushbutton)
- ✔ SDVs FailSafe Positions
- ✔ Stack High Temperature
- ✔ Process High Temperature
- ✔ Gas Supply Low Pressure
- ✔ Gas to Burner High Pressure
- – Firebox High Pressure
- – Oil Supply Low Pressure
- – Atom.Media Low Pressure

Minimum Purge Interlocks:

- ✔ Minimum CA Flow

Gas / Oil Trains Overview:

- ✔ Pilot Double Block & Bleed SDVs
- ✔ Gas Train Dbl Block & Bleed SDVs
- ✔ Inlet Header Isolation Valve
- ✔ Inlet Header Sediment Trap w/ Cap
- ✔ Inlet Header Gas Strainer
- ✔ Inlet Header Pressure Regulator
- – Inlet Header Relief Valve
- – Oil Train Dbl Block & Bleed SDVs
- – Atom.Media dP Controls
- – Gas/ Oil Flow Element
- – Comb. Air Flow Element
- – Min. Fire PCV in Parallel w/ TCV

Local Panel Components Overview:

- ✔ **Slate Control Package**
- ✔ Touchscreen HMI
- – Remote Control Panel
- – Field Wiring schematic to connect LCP to J/B
- – LCP Weather/Sun Shield

Supporting Components:

- ✔ **Pilot Flame UV Detector**
- – **Main Flame UV Detector**
- ✔ CA Ducting to Burner(s)
- ✔ Flex Hoses at Brnr Terminals
- – Individual Burner SDVs
- ✔ **Fuel Train Only (no skid)**
- – O2 Analyzer
- ✔ Process TC (control loop)
- ✔ Process TC (shutdown)
- ✔ Process Pressure Gauge[2]
- ✔ Stack TC
- – Process Coil Relief

NOTES:
1. Forced draft fan supplied by THM
2. Process Pressure Gauge to be designed for 0-150 psig
3. ZSC's only on block valves, not bleed.
4. Piping 2" and below to use threaded fittings, except end connections.
5. FAT required

rev.	date	description	by	appv'd
1	13-Nov-17	Rev'd Purch. Ref. No.	JDC	JF
0	19-Aug-17	Issued for Approval	JF	JDC

THM TULSA HEATERS MIDSTREAM

COMBUSTION MANAGEMENT SYSTEM

25 MMBTU/hr RATED HEAT RELEASE

CMS2500 DATA SHEET

MJ17-266-CMS2500ds- Rev. 1

Purch. Ref.: **H-781** THM Ref.: **MJ17-266**

Process Interlocks:

	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Process Flow	MLb/hr	FALL-300	105.1	None	116.2	267.8	- - -	
		Action:	S/D @ minimum flow to avoid "short circuiting" one or more coil passes					
Process Temperature	°F	TSHH-202	None	355	- - -	305	355	
		Action:	S/D @ maximum fluid temperature to avoid "overheating" the coil					

Heater Interlocks:

	units	Tag No.	Low	/ High	Min.	Design	Max.	Comments
Stack Temperature	°F	TSHH-201	None	700	429	483	- - -	
		Action:	S/D @ 700 F, which is indicative of an "out-of-control" fire in the heater					

CMS Interlocks:

	units	Tag No.	Low	/ High	Min.	Design	Max.	Comments
FG Train Pressure	psig	PSLL-101	10	None	- - -	- - -	150	
		Action:	S/D @ 10 psig, which is indicative of "inadequate" fuel gas supply					
FG Train Pressure	psig	PSHH-103	None	35	- - -	- - -	150	
		Action:	S/D @ 35 psig, which is indicative of a "failure" of PCV-100 &/or FG supply					

FD Fan Interlocks:

	units	Tag No.	Low	/ High	Min.	Design	Max.	Comments
FD Fan (blower) SP	inH2O	PSLL-107	0.20	None	0.47	7.8	11.8	
FDF turndown:	5.0	Action:	S/D @ 0.2 inH2O, which is indicative of a FD Fan (blower) "failure".					

Other permissives/interlocks in BMS Operations Manual (block valves, FCV, and flame signal).

CMS CONTROL COMPONENTS

Process Control:	units	Tag No.	Factory Settings Low	/ High	Design Conditions Min.	Design	Max.	Comments
Remote T Setpoint	°F	TY-700	0	999	- - -	305	355	4 -20 mA INPUT
		Action:	4 -20 mA input corresponds to a temperature setpoint range of 0 -999 °F					
Process Temperature	°F	TT-203	0	999	- - -	305	355	4 -20 mA OUTPUT
		Action:	4 -20 mA output corresponds to a process temperature range of 0 -999 °F					
Main Gas Regulator	psig	PCV-100	- - -	- - -	- - -	35	150	Factory Set @ 35 psig
Pilot Gas Regulator	psig	PCV-105	- - -	- - -	- - -	10	150	Factory Set @ 10 psig
Inst. Air Regulator	psig	PCV-107	- - -	- - -	- - -	80	150	Factory Set @ 80 psig

CUSTOMER CONNECTIONS (TO DCS)

The following signals are sent to the customer's DCS from the control panel:

- Remote ESD
- Heater Run
- Low Process Flow
- High Stack Temperature
- High Process Temperature
- Burner Status

Owner:	Unknown	Heater Ref.:	H-781	
Purchaser:	UOPR	Purch. Ref.:	J463	Ftnt
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	&
Location:	Unknown	FDF OEM Ref.:	340829	Rev
FD Fan OEM:	**Chicago Blower**	FDF Item No.:	BL-781	

General Application:

FD Fan(s) Design Basis	mass.flow.%	115% of Design MASS Flows per API Standard 560	
Location(s)	- - -	@ Grade, adjacent to Burner Endwall (incorporated into Combustion Skid)	
Area Classification	NEC	Unclassified	

		AES Units				
Process Design Conditions:		**Heater Design**	**FDF Test Block**			
Mass Flow Rate/ % Htr Design	Lb/hr / kg/ hr	18,747 / 100%	21,560 / 115%			
Volumetric Flow/ % Htr Design	acfm / am3/ hr	4,300 / 100%	5,300 / 123%			
Density, @ Suction	as noted	0.074 Lb/ ft3	0.068 Lb/ ft3			
Design Allowances, Temp./ SP	°F / °C	- - - / - - -	130 °F / 152%			
Temperature @ Min / Suction / Design	°F / °C	-20 / 60 / 110				
Static Pressure @ Suction	as ntoed	-0.2 inH2O	-0.2 inH2O			
Site Elevation/ Atm. P	as ntoed	750 ftAMSL	14.30 psia			
Static Pressure Rise (min./ guar.)	inH2O	7.8 / **7.8**	11.8 / **11.8**			
Fan Speed (allowable/ actual)	RPM	3,600 / 3,525	3,600 / 3,525			
Sound Pressure (allowable/ guar.)	dBA	< 85 / < 85	< 85 / < 85			
Relative Humidity	%	50%				

Fan Mechanical Design:	tag // OEM	**BL-781 // CHICAGO BLOWER Corp.**	
OEM Reference	CMS // FD Fan	International Custom Controls // 340829	1
OEM Model &/or Type-Size	per OEM	D/36A (SQAD)	
Arrangement	- - -	Arrangement 4 (direct drive)	
Brake Power, Design/ Test Block (calc.)	HP	15.0 / 20.0	
Temperature, Mechanical Design	°F	135 °F Mechanical Design	
Casing Description / Materials	- - -	"Square" pattern / CS	
Rotor Description / Materials	- - -	Airfoil Blades / CS	
Shaft Description / Materials	- - -	None - Arrangement 4	
Bearings Description / Materials	- - -	None - Arrangement 4	
Noise Abatement Provisions / SPL	- - -	85 dBA	
External Coatings / Surface Prep.	- - -	OEM's Std Multiple Coat System	
Purchase Specifications	- - -	OEM's Std Industrial Quality Design	
Fan Control Design:	tag // OEM	**VSD-781 / by OTHERS**	
VFD Description	- - -	by Others / Owner	
VFD Rating	- - -	- - -	
Damper Actuator Description	- - -	- - -	
Damper Actuator Operation	- - -	- - -	
Fan Motor Design:	tag // OEM	**BM-781 / TECO-WESTINGHOUSE**	
OEM Model &/or Type-Size	- - -	Catalog EP0202 / AEHH8N	1
VFD Service / speed range	- - -	YES / 3 - 60 Hz or 180 - 3,600 rpm	
Motor Type / Frame Size	- - -	NEMA TEFC / 256T	
Rated Power w/ SF @ Speed	NEMA	20 HP w/ 1.15 SF @ 40°C	
Nameplate Input Power	V/ Hz/ ph	**460V / 60 Hz / 3 ph**	
Typical Performance	- - -	91.0- 92.4 % FL Eff'y @ 92.5 % FL PF	1
Insulation Description	- - -	Class F / B Rise	
External Coatings & Surface Prep.	- - -	OEM's Std Multiple Coat System	
Purchase Specifications	- - -	None	

revision	date	description	by	chk'd	appv'd
Rev. 1	13-Nov-17	Revised Purchaser Ref. No. per Customer Comments	JDC	JF	
Rev. 0	19-Aug-17	Issued for Approval	JF	JDC	

THM TULSA HEATERS MIDSTREAM

USA Applications
SHO = Superior Quality, Flexibility, Dependability & Modularity

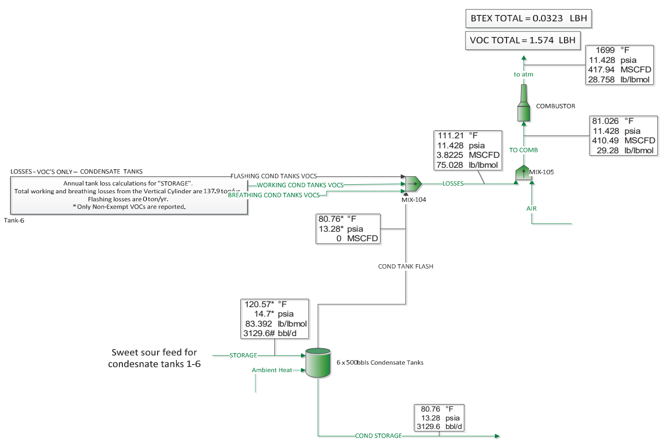
FD FAN DATA SHEET
AES & cgs or SI SYSTEMS of UNITS

MJ17-266-FDFANds-Rev. 1

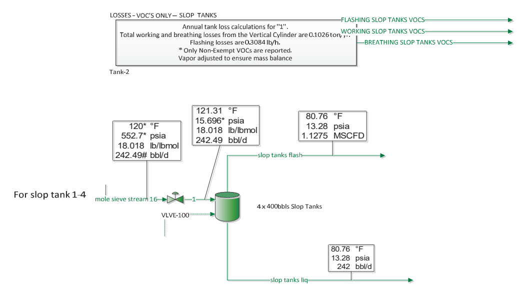
LUCID GAS PLANT – TANKS LOSSES

- FEED TO SLOP TANKS COMPOSITION taken from Excel file "Lucid RH 5 Mol Sieve 245MM (04.24.19)" Stream 16, provided by client.
- FEED TO CONDENSATE TANKS COMPOSITION taken from Excel file "Lucid Expansion 10K – Stabilizer Sweet-Sour Feed (05.3.19)", stream "Storage" provided by client.
- FEED TO SOUR WATER TANKS COMPOSITION taken from Excel file "Lucid AGI- Sour Water (05.3.19)", stream "Sour Water " provided by client.
- SOURCES: e-mail by Chris Kassen <CKassen@lucid-energy.com> on Friday, May 3, 2019 12:49 PM

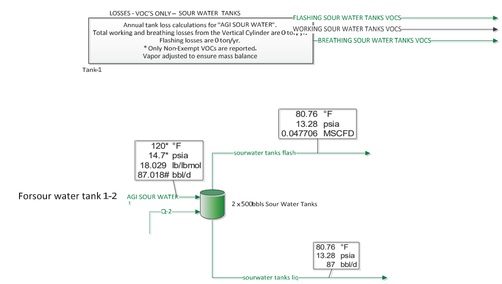
CONDENSATE TANKS



SLOP TANKS



SOUR WATER TANKS



Project information	
File Name	LUCID
Company	
City	
State	
Equation of State	Peng-Robinson
Description	

Separator Information	
Separator Name	2 x 500bbls Sour Water Tanks
Separator Inlet Stream	AGI SOUR WATER
Separator Inlet Pressure [psia]	14.70
Separator Inlet Temperature [°F]	120.00
Separator Outlet Pressure [psia]	13.28
Separator Outlet Temperature [°F]	80.76

Tank Specifications	
Tank Losses Stencil Name	Tank-1
Tank Losses Stencil Reference Stream	AGI SOUR WATER
Number of Tanks	2
Shell Height [ft]	16
Diameter [ft]	15.5
Maximum Fill Percent [%]	100
Average Fill Percent [%]	50
Total Tank Volume [bbl]	537.7
Is Tank Heated?	
Paint Characteristics	
Shell Color	Tan
Shell Paint Condition	Good
Roof Color	Tan
Roof Condition	Good
Roof Characteristics	
Type	Cone
Diameter [ft]	18
Slope [ft/ft]	0.0625
Breather Vent Settings	
Vacuum Settings [psig]	-0.030
Pressure Settings [psig]	0.030

Meteorological Data	
Location	Midland-Odessa, Texas
Atmospheric Pressure [psia]	13.28
Min Ambient Temperature [°F]	49.33
Max Ambient Temperature [°F]	77.23
Solar Insolation [BTU/ft2*day]	1689.49
Wind Speed [mph]	11.12

Tank Conditions		
Atmospheric Pressure [psia]	13.28	
Flashing Temperature [°F]	110.89	
Max Liquid Surface Temperature [°F]	110.89	
Avg. Liquid Surface Temperature [°F]	100.78	
Avg. Throughput [bbl/d] [bbl/yr]	88	31951
Avg. Throughput Per Tank [bbl/d] [bbl/yr]	44	15975
Turnovers Per Tank (per year)	30	
Throughput [bbl/d] [bbl/yr]		
Throughput Per Tank [bbl/d] [bbl/yr]	0	0
True Vapor Pressure [psia]	11.90	

Emission Summary [Total]

Item	Flashing Losses		Working Losses		Breathing Losses		Loading Losses		Total Losses	
	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
VOCs [C3+]	0.000	0.000	0.000	0.000	0.000	0.000			0.000	0.000
HAPs	0.080	0.349	0.000	0.000	0.328	1.437			0.408	1.787
BTEX	0.000	0.000	0.000	0.000	0.000	0.000			0.000	0.000
H2S	0.080	0.349	0.000	0.000	0.328	1.437			0.408	1.787

Emission Summary [Per Tank]

Item	Flashing Losses		Working Losses		Breathing Losses		Loading Losses		Total Losses	
	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
VOCs [C3+]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HAPs	0.040	0.175	0.000	0.000	0.164	0.719	0.000	0.000	0.204	0.893
BTEX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2S	0.040	0.175	0.000	0.000	0.164	0.719	0.000	0.000	0.204	0.893

Stream Compostion

No.	Component	Pressurized Inlet [Mol%]	Flashing Losses [Mol%]	Working Losses [Mol%]	Breathing Losses [Mol%]	Loading Losses [Mol%]	Residual [Mol%]
1	Nitrogen	0.000	0.000	0.000	0.000		
2	Methane	0.000	0.000	0.000	0.000		
3	Carbon Dioxide	0.041	75.687	45.448	45.448		
4	Ethane	0.000	0.000	0.000	0.000		
5	Propane	0.000	0.000	0.000	0.000		
6	Isobutane	0.000	0.000	0.000	0.000		
7	n-Butane	0.000	0.000	0.000	0.000		
8	Isopentane	0.000	0.000	0.000	0.000		
9	n-Pentane	0.000	0.000	0.000	0.000		
10	Cyclopentane	0.000	0.000	0.000	0.000		
11	2-Methylpentane	0.000	0.000	0.000	0.000		
12	3-Methylpentane	0.000	0.000	0.000	0.000		
13	n-Hexane	0.000	0.000	0.000	0.000		
14	Methylcyclopentane	0.000	0.000	0.000	0.000		
15	Benzene	0.000	0.000	0.000	0.000		
16	Cyclohexane	0.000	0.000	0.000	0.000		
17	2-Methylhexane	0.000	0.000	0.000	0.000		
18	3-Methylhexane	0.000	0.000	0.000	0.000		
19	n-Heptane	0.000	0.000	0.000	0.000		
20	Methylcyclohexane	0.000	0.000	0.000	0.000		
21	Toluene	0.000	0.000	0.000	0.000		
22	n-Octane	0.000	0.000	0.000	0.000		
23	Ethylbenzene	0.000	0.000	0.000	0.000		
24	n-Nonane	0.000	0.000	0.000	0.000		
25	n-Decane	0.000	0.000	0.000	0.000		
26	Undecane	0.000	0.000	0.000	0.000		
27	Dodecane	0.000	0.000	0.000	0.000		
28	Water	99.942	9.930	28.108	28.108		
29	Hydrogen Sulfide	0.017	14.383	26.444	26.444		
30	2,2-Dimethylpropane	0.000	0.000	0.000	0.000		
31	2,2-Dimethylbutane	0.000	0.000	0.000	0.000		
32	2,3-Dimethylbutane	0.000	0.000	0.000	0.000		
33	2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000		
34	Tridecane	0.000	0.000	0.000	0.000		
35	Tetradecane	0.000	0.000	0.000	0.000		
36	Pentadecane	0.000	0.000	0.000	0.000		
37	Hexadecane	0.000	0.000	0.000	0.000		
38	Heptadecane	0.000	0.000	0.000	0.000		
39	Octadecane	0.000	0.000	0.000	0.000		
40	Nonadecane	0.000	0.000	0.000	0.000		
41	Eicosane	0.000	0.000	0.000	0.000		
42	Heneicosane	0.000	0.000	0.000	0.000		
43	Docosane	0.000	0.000	0.000	0.000		
44	Tricosane	0.000	0.000	0.000	0.000		
45	Tetracosane	0.000	0.000	0.000	0.000		
46	Pentacosane	0.000	0.000	0.000	0.000		
47	Hexacosane	0.000	0.000	0.000	0.000		
48	Heptacosane	0.000	0.000	0.000	0.000		
49	Octacosane	0.000	0.000	0.000	0.000		
50	Nonacosane	0.000	0.000	0.000	0.000		
51	Triacontane	0.000	0.000	0.000	0.000		
52	2,2,4-Trimethyl-4-Pentene	0.000	0.000	0.000	0.000		
53	m-Xylene	0.000	0.000	0.000	0.000		
54	o-Xylene	0.000	0.000	0.000	0.000		
55	1,t-2-Dimethylcyclopentane	0.000	0.000	0.000	0.000		
56	4,4-Dimethyl-c-pentene-2	0.000	0.000	0.000	0.000		
57	p-Xylene	0.000	0.000	0.000	0.000		
58	TEG	0.000	0.000	0.000	0.000		
59	Piperazine	0.000	0.000	0.000	0.000		
60	MDEA	0.000	0.000	0.000	0.000		
61	O2	0.000	0.000	0.000	0.000		

Stream Mass Flow [Total]										
No.	Component	MW [lb/lbmol]	Pressurized Inlet [lb/hr]	Flashing Losses [lb/hr]	Working Losses [lb/hr]	Breathing Losses [lb/hr]	Loading Losses [lb/hr]	Residual [lb/hr]	Total Emissions [lb/hr]	
1	Nitrogen	28.013	0.000	0.000	0.000	0.000			0.000	
2	Methane	16.042	0.000	0.000	0.000	0.000			0.000	
3	Carbon Dioxide	44.010	1.270	0.542	0.000	0.728			1.270	
4	Ethane	30.069	0.000	0.000	0.000	0.000			0.000	
5	Propane	44.096	0.000	0.000	0.000	0.000			0.000	
6	Isobutane	58.122	0.000	0.000	0.000	0.000			0.000	
7	n-Butane	58.122	0.000	0.000	0.000	0.000			0.000	
8	Isopentane	72.149	0.000	0.000	0.000	0.000			0.000	
9	n-Pentane	72.149	0.000	0.000	0.000	0.000			0.000	
10	Cyclopentane	70.133	0.000	0.000	0.000	0.000			0.000	
11	2-Methylpentane	86.175	0.000	0.000	0.000	0.000			0.000	
12	3-Methylpentane	86.175	0.000	0.000	0.000	0.000			0.000	
13	n-Hexane	86.175	0.000	0.000	0.000	0.000			0.000	
14	Methylcyclopentane	84.159	0.000	0.000	0.000	0.000			0.000	
15	Benzene	78.112	0.000	0.000	0.000	0.000			0.000	
16	Cyclohexane	84.159	0.000	0.000	0.000	0.000			0.000	
17	2-Methylhexane	100.202	0.000	0.000	0.000	0.000			0.000	
18	3-Methylhexane	100.202	0.000	0.000	0.000	0.000			0.000	
19	n-Heptane	100.202	0.000	0.000	0.000	0.000			0.000	
20	Methylcyclohexane	98.186	0.000	0.000	0.000	0.000			0.000	
21	Toluene	92.138	0.000	0.000	0.000	0.000			0.000	
22	n-Octane	114.229	0.000	0.000	0.000	0.000			0.000	
23	Ethylbenzene	106.165	0.000	0.000	0.000	0.000			0.000	
24	n-Nonane	128.255	0.000	0.000	0.000	0.000			0.000	
25	n-Decane	142.282	0.000	0.000	0.000	0.000			0.000	
26	Undecane	156.308	0.000	0.000	0.000	0.000			0.000	
27	Dodecane	170.335	0.000	0.000	0.000	0.000			0.000	
28	Water	18.015	1267.541	0.029	0.000	0.184			0.213	
29	Hydrogen Sulfide	34.081	0.408	0.080	0.000	0.328			0.408	
30	2,2-Dimethylpropane	72.149	0.000	0.000	0.000	0.000			0.000	
31	2,2-Dimethylbutane	86.175	0.000	0.000	0.000	0.000			0.000	
32	2,3-Dimethylbutane	86.175	0.000	0.000	0.000	0.000			0.000	
33	2,2,4-Trimethylpentane	114.229	0.000	0.000	0.000	0.000			0.000	
34	Tridecane	184.361	0.000	0.000	0.000	0.000			0.000	
35	Tetradecane	198.388	0.000	0.000	0.000	0.000			0.000	
36	Pentadecane	212.415	0.000	0.000	0.000	0.000			0.000	
37	Hexadecane	226.441	0.000	0.000	0.000	0.000			0.000	
38	Heptadecane	240.468	0.000	0.000	0.000	0.000			0.000	
39	Octadecane	254.494	0.000	0.000	0.000	0.000			0.000	
40	Nonadecane	268.521	0.000	0.000	0.000	0.000			0.000	
41	Eicosane	282.547	0.000	0.000	0.000	0.000			0.000	
42	Heneicosane	296.574	0.000	0.000	0.000	0.000			0.000	
43	Docosane	310.601	0.000	0.000	0.000	0.000			0.000	
44	Tricosane	324.627	0.000	0.000	0.000	0.000			0.000	
45	Tetracosane	338.654	0.000	0.000	0.000	0.000			0.000	
46	Pentacosane	352.680	0.000	0.000	0.000	0.000			0.000	
47	Hexacosane	366.707	0.000	0.000	0.000	0.000			0.000	
48	Heptacosane	380.734	0.000	0.000	0.000	0.000			0.000	
49	Octacosane	394.760	0.000	0.000	0.000	0.000			0.000	
50	Nonacosane	408.787	0.000	0.000	0.000	0.000			0.000	
51	Triacontane	422.813	0.000	0.000	0.000	0.000			0.000	
52	2,2,4-Trimethyl-4-Pentene	112.213	0.000	0.000	0.000	0.000			0.000	
53	m-Xylene	106.165	0.000	0.000	0.000	0.000			0.000	
54	o-Xylene	106.165	0.000	0.000	0.000	0.000			0.000	
55	1,t-2-Dimethylcyclopentane	98.186	0.000	0.000	0.000	0.000			0.000	
56	4,4-Dimethyl-c-pentene-2	98.186	0.000	0.000	0.000	0.000			0.000	
57	p-Xylene	106.165	0.000	0.000	0.000	0.000			0.000	
58	TEG	150.173	0.000	0.000	0.000	0.000			0.000	
59	Piperazine	86.136	0.000	0.000	0.000	0.000			0.000	
60	MDEA	119.162	0.000	0.000	0.000	0.000			0.000	
61	O2	31.999	0.000	0.000	0.000	0.000			0.000	

Stream Properties										
			Pressurized Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual		
MW [lb/lbmol]			18.03	40.00	34.08	34.08				
Heating Value [BTU/scf]			-	96.6	182.6	182.6		-		
Specific Gravity				-	-	-	-			
Reid Vapor Pressure [psi]			2.48	-	-	-	-			
Gas Volumetric Flow [scf/hr]			-	6.18	0.00	13.82		-		

Project information	
File Name	LUCID
Company	
City	
State	
Equation of State	Peng-Robinson
Description	

Separator Information	
Separator Name	4 x 400bbls Slop Tanks
Separator Inlet Stream	1
Separator Inlet Pressure [psia]	15.70
Separator Inlet Temperature [°F]	121.31
Separator Outlet Pressure [psia]	13.28
Separator Outlet Temperature [°F]	80.76

Tank Specifications	
Tank Losses Stencil Name	Tank-2
Tank Losses Stencil Reference Stream	1
Number of Tanks	4
Shell Height [ft]	20
Diameter [ft]	12
Maximum Fill Percent [%]	100
Average Fill Percent [%]	50
Total Tank Volume [bbl]	402.9
Is Tank Heated?	
Paint Characteristics	
Shell Color	Tan
Shell Paint Condition	Good
Roof Color	Tan
Roof Condition	Good
Roof Characteristics	
Type	Cone
Diameter [ft]	14
Slope [ft/ft]	0.0625
Breather Vent Settings	
Vacuum Settings [psig]	-0.030
Pressure Settings [psig]	0.030

Meteorological Data	
Location	Midland-Odessa, Texas
Atmospheric Pressure [psia]	13.28
Min Ambient Temperature [°F]	49.33
Max Ambient Temperature [°F]	77.23
Solar Insolation [BTU/ft2*day]	1689.49
Wind Speed [mph]	11.12

Tank Conditions		
Atmospheric Pressure [psia]	13.28	
Flashing Temperature [°F]	111.62	
Max Liquid Surface Temperature [°F]	111.62	
Avg. Liquid Surface Temperature [°F]	101.51	
Avg. Throughput [bbl/d] [bbl/yr]	244	88944
Avg. Throughput Per Tank [bbl/d] [bbl/yr]	61	22236
Turnovers Per Tank (per year)	55	
Throughput [bbl/d] [bbl/yr]		
Throughput Per Tank [bbl/d] [bbl/yr]	0	0
True Vapor Pressure [psia]	12.31	

Emission Summary [Total]

Item	Flashing Losses		Working Losses		Breathing Losses		Loading Losses		Total Losses	
	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
VOCs [C3+]	0.308	1.351	0.001	0.003	0.023	0.099			0.332	1.453
HAPs	0.016	0.069	0.001	0.002	0.016	0.072			0.033	0.143
BTEX	0.013	0.057	0.001	0.002	0.016	0.072			0.030	0.131
H2S	0.000	0.000	0.000	0.000	0.000	0.000			0.000	0.000

Emission Summary [Per Tank]

Item	Flashing Losses		Working Losses		Breathing Losses		Loading Losses		Total Losses	
	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
VOCs [C3+]	0.077	0.338	0.000	0.001	0.006	0.025	0.000	0.000	0.083	0.363
HAPs	0.004	0.017	0.000	0.001	0.004	0.018	0.000	0.000	0.008	0.036
BTEX	0.003	0.014	0.000	0.001	0.004	0.018	0.000	0.000	0.007	0.033
H2S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Stream Compostion

No.	Component	Pressurized Inlet [Mol%]	Flashing Losses [Mol%]	Working Losses [Mol%]	Breathing Losses [Mol%]	Loading Losses [Mol%]	Residual [Mol%]
1	Nitrogen	0.001	1.194	0.109	0.109		
2	Methane	0.051	72.626	13.540	13.540		
3	Carbon Dioxide	0.000	0.197	0.629	0.629		
4	Ethane	0.008	11.166	2.686	2.686		
5	Propane	0.002	3.452	0.576	0.576		
6	Isobutane	0.000	0.205	0.020	0.020		
7	n-Butane	0.001	0.771	0.119	0.119		
8	Isopentane	0.000	0.083	0.008	0.008		
9	n-Pentane	0.000	0.047	0.002	0.002		
10	Cyclopentane	0.000	0.000	0.000	0.000		
11	2-Methylpentane	0.000	0.000	0.000	0.000		
12	3-Methylpentane	0.000	0.000	0.000	0.000		
13	n-Hexane	0.000	0.023	0.001	0.001		
14	Methylcyclopentane	0.000	0.000	0.000	0.000		
15	Benzene	0.000	0.105	0.954	0.954		
16	Cyclohexane	0.000	0.010	0.005	0.005		
17	2-Methylhexane	0.000	0.000	0.000	0.000		
18	3-Methylhexane	0.000	0.000	0.000	0.000		
19	n-Heptane	0.000	0.000	0.000	0.000		
20	Methylcyclohexane	0.000	0.001	0.000	0.000		
21	Toluene	0.000	0.018	0.160	0.160		
22	n-Octane	0.000	0.000	0.000	0.000		
23	Ethylbenzene	0.000	0.000	0.000	0.000		
24	n-Nonane	0.000	0.000	0.000	0.000		
25	n-Decane	0.000	0.000	0.000	0.000		
26	Undecane	0.000	0.000	0.000	0.000		
27	Dodecane	0.000	0.000	0.000	0.000		
28	Water	99.936	10.102	81.191	81.191		
29	Hydrogen Sulfide	0.000	0.000	0.000	0.000		
30	2,2-Dimethylpropane	0.000	0.000	0.000	0.000		
31	2,2-Dimethylbutane	0.000	0.000	0.000	0.000		
32	2,3-Dimethylbutane	0.000	0.000	0.000	0.000		
33	2,2,4-Trimethylpentane	0.000	0.000	0.000	0.000		
34	Tridecane	0.000	0.000	0.000	0.000		
35	Tetradecane	0.000	0.000	0.000	0.000		
36	Pentadecane	0.000	0.000	0.000	0.000		
37	Hexadecane	0.000	0.000	0.000	0.000		
38	Heptadecane	0.000	0.000	0.000	0.000		
39	Octadecane	0.000	0.000	0.000	0.000		
40	Nonadecane	0.000	0.000	0.000	0.000		
41	Eicosane	0.000	0.000	0.000	0.000		
42	Heneicosane	0.000	0.000	0.000	0.000		
43	Docosane	0.000	0.000	0.000	0.000		
44	Tricosane	0.000	0.000	0.000	0.000		
45	Tetracosane	0.000	0.000	0.000	0.000		
46	Pentacosane	0.000	0.000	0.000	0.000		
47	Hexacosane	0.000	0.000	0.000	0.000		
48	Heptacosane	0.000	0.000	0.000	0.000		
49	Octacosane	0.000	0.000	0.000	0.000		
50	Nonacosane	0.000	0.000	0.000	0.000		
51	Triacontane	0.000	0.000	0.000	0.000		
52	2,2,4-Trimethyl-4-Pentene	0.000	0.000	0.000	0.000		
53	m-Xylene	0.000	0.000	0.000	0.000		
54	o-Xylene	0.000	0.000	0.000	0.000		
55	1,t-2-Dimethylcyclopentane	0.000	0.000	0.000	0.000		
56	4,4-Dimethyl-c-pentene-2	0.000	0.000	0.000	0.000		
57	p-Xylene	0.000	0.000	0.000	0.000		
58	TEG	0.001	0.000	0.000	0.000		
59	Piperazine	0.000	0.000	0.000	0.000		
60	MDEA	0.000	0.000	0.000	0.000		
61	O2	0.000	0.000	0.000	0.000		

Stream Mass Flow [Total]										
No.	Component	MW [lb/lbmol]	Pressurized Inlet [lb/hr]	Flashing Losses [lb/hr]	Working Losses [lb/hr]	Breathing Losses [lb/hr]	Loading Losses [lb/hr]	Residual [lb/hr]	Total Emissions [lb/hr]	
1	Nitrogen	28.013	0.045	0.045	0.000	0.001			0.045	
2	Methane	16.042	1.596	1.555	0.001	0.040			1.596	
3	Carbon Dioxide	44.010	0.017	0.012	0.000	0.005			0.017	
4	Ethane	30.069	0.463	0.448	0.000	0.015			0.463	
5	Propane	44.096	0.208	0.203	0.000	0.005			0.208	
6	Isobutane	58.122	0.016	0.016	0.000	0.000			0.016	
7	n-Butane	58.122	0.061	0.060	0.000	0.001			0.061	
8	Isopentane	72.149	0.008	0.008	0.000	0.000			0.008	
9	n-Pentane	72.149	0.005	0.004	0.000	0.000			0.005	
10	Cyclopentane	70.133	0.000	0.000	0.000	0.000			0.000	
11	2-Methylpentane	86.175	0.000	0.000	0.000	0.000			0.000	
12	3-Methylpentane	86.175	0.000	0.000	0.000	0.000			0.000	
13	n-Hexane	86.175	0.003	0.003	0.000	0.000			0.003	
14	Methylcyclopentane	84.159	0.000	0.000	0.000	0.000			0.000	
15	Benzene	78.112	0.035	0.011	0.000	0.014			0.025	
16	Cyclohexane	84.159	0.001	0.001	0.000	0.000			0.001	
17	2-Methylhexane	100.202	0.000	0.000	0.000	0.000			0.000	
18	3-Methylhexane	100.202	0.000	0.000	0.000	0.000			0.000	
19	n-Heptane	100.202	0.000	0.000	0.000	0.000			0.000	
20	Methylcyclohexane	98.186	0.000	0.000	0.000	0.000			0.000	
21	Toluene	92.138	0.006	0.002	0.000	0.003			0.005	
22	n-Octane	114.229	0.000	0.000	0.000	0.000			0.000	
23	Ethylbenzene	106.165	0.000	0.000	0.000	0.000			0.000	
24	n-Nonane	128.255	0.000	0.000	0.000	0.000			0.000	
25	n-Decane	142.282	0.000	0.000	0.000	0.000			0.000	
26	Undecane	156.308	0.000	0.000	0.000	0.000			0.000	
27	Dodecane	170.335	0.000	0.000	0.000	0.000			0.000	
28	Water	18.015	3530.245	0.243	0.008	0.268			0.519	
29	Hydrogen Sulfide	34.081	0.000	0.000	0.000	0.000			0.000	
30	2,2-Dimethylpropane	72.149	0.000	0.000	0.000	0.000			0.000	
31	2,2-Dimethylbutane	86.175	0.000	0.000	0.000	0.000			0.000	
32	2,3-Dimethylbutane	86.175	0.000	0.000	0.000	0.000			0.000	
33	2,2,4-Trimethylpentane	114.229	0.000	0.000	0.000	0.000			0.0000000	
34	Tridecane	184.361	0.000	0.000	0.000	0.000			0.000	
35	Tetradecane	198.388	0.000	0.000	0.000	0.000			0.000	
36	Pentadecane	212.415	0.000	0.000	0.000	0.000			0.000	
37	Hexadecane	226.441	0.000	0.000	0.000	0.000			0.000	
38	Heptadecane	240.468	0.000	0.000	0.000	0.000			0.000	
39	Octadecane	254.494	0.000	0.000	0.000	0.000			0.000	
40	Nonadecane	268.521	0.000	0.000	0.000	0.000			0.000	
41	Eicosane	282.547	0.000	0.000	0.000	0.000			0.000	
42	Heneicosane	296.574	0.000	0.000	0.000	0.000			0.000	
43	Docosane	310.601	0.000	0.000	0.000	0.000			0.000	
44	Tricosane	324.627	0.000	0.000	0.000	0.000			0.000	
45	Tetracosane	338.654	0.000	0.000	0.000	0.000			0.000	
46	Pentacosane	352.680	0.000	0.000	0.000	0.000			0.000	
47	Hexacosane	366.707	0.000	0.000	0.000	0.000			0.000	
48	Heptacosane	380.734	0.000	0.000	0.000	0.000			0.000	
49	Octacosane	394.760	0.000	0.000	0.000	0.000			0.000	
50	Nonacosane	408.787	0.000	0.000	0.000	0.000			0.000	
51	Triacontane	422.813	0.000	0.000	0.000	0.000			0.000	
52	2,2,4-Trimethyl-4-Pentene	112.213	0.000	0.000	0.000	0.000			0.000	
53	m-Xylene	106.165	0.000	0.000	0.000	0.000			0.000	
54	o-Xylene	106.165	0.000	0.000	0.000	0.000			0.000	
55	1,t-2-Dimethylcyclopentane	98.186	0.000	0.000	0.000	0.000			0.000	
56	4,4-Dimethyl-c-pentene-2	98.186	0.000	0.000	0.000	0.000			0.000	
57	p-Xylene	106.165	0.000	0.000	0.000	0.000			0.000000	
58	TEG	150.173	0.395	0.000	0.000	0.000			0.000	
59	Piperazine	86.136	0.000	0.000	0.000	0.000			0.000	
60	MDEA	119.162	0.000	0.000	0.000	0.000			0.000	
61	O2	31.999	0.000	0.000	0.000	0.000			0.000	

Stream Properties										
			Pressurized Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual		
MW [lb/lbmol]			18.02	19.56	19.15	19.15				
Heating Value [BTU/scf]			-	1066.4	287.7	287.7		-		
Specific Gravity				-	-	-	-			
Reid Vapor Pressure [psi]			1.05	-	-	-	-			
Gas Volumetric Flow [scf/hr]			-	50.64	0.22	6.95		-		

Project information

File Name	LUCID
Company	
City	
State	
Equation of State	Peng-Robinson
Description	

Separator Information

Separator Name	6 x 500bbls Condensate Tanks
Separator Inlet Stream	STORAGE
Separator Inlet Pressure [psia]	14.70
Separator Inlet Temperature [°F]	120.57
Separator Outlet Pressure [psia]	13.28
Separator Outlet Temperature [°F]	80.76

Tank Specifications

Tank Losses Stencil Name	Tank-6
Tank Losses Stencil Reference Stream	STORAGE
Number of Tanks	6
Shell Height [ft]	16
Diameter [ft]	15.5
Maximum Fill Percent [%]	100
Average Fill Percent [%]	50
Total Tank Volume [bbl]	537.7
Is Tank Heated?	
Paint Characteristics	
Shell Color	Tan
Shell Paint Condition	Good
Roof Color	Tan
Roof Condition	Good
Roof Characteristics	
Type	Cone
Diameter [ft]	18
Slope [ft/ft]	0.0625
Breather Vent Settings	
Vacuum Settings [psig]	-0.030
Pressure Settings [psig]	0.030

Meteorological Data

Location	Midland-Odessa, Texas
Atmospheric Pressure [psia]	13.28
Min Ambient Temperature [°F]	49.33
Max Ambient Temperature [°F]	77.23
Solar Insolation [BTU/ft2*day]	1689.49
Wind Speed [mph]	11.12

Tank Conditions

Atmospheric Pressure [psia]	13.28	
Flashing Temperature [°F]	111.21	
Max Liquid Surface Temperature [°F]	111.21	
Avg. Liquid Surface Temperature [°F]	101.10	
Avg. Throughput [bbl/d] [bbl/yr]	3216	1173898
Avg. Throughput Per Tank [bbl/d] [bbl/yr]	536	195650
Turnovers Per Tank (per year)	364	
Throughput [bbl/d] [bbl/yr]		
Throughput Per Tank [bbl/d] [bbl/yr]	0	0
True Vapor Pressure [psia]	9.24	

Emission Summary [Total]

Item	Flashing Losses		Working Losses		Breathing Losses		Loading Losses		Total Losses	
	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
VOCs [C3+]			23.155	101.419	8.334	36.502			31.489	137.921
HAPs			8.519	37.315	3.066	13.430			11.586	50.745
BTEX			0.475	2.081	0.171	0.749			0.646	2.829
H2S			0.000	0.000	0.000	0.000			0.000	0.000

Emission Summary [Per Tank]

Item	Flashing Losses		Working Losses		Breathing Losses		Loading Losses		Total Losses	
	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]	[lb/hr]	[ton/yr]
VOCs [C3+]	0.000	0.000	3.859	16.903	1.389	6.084	0.000	0.000	5.248	22.987
HAPs	0.000	0.000	1.420	6.219	0.511	2.238	0.000	0.000	1.931	8.457
BTEX	0.000	0.000	0.079	0.347	0.028	0.125	0.000	0.000	0.108	0.472
H2S	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Stream Compostion

No.	Component	Pressurized Inlet [Mol%]	Flashing Losses [Mol%]	Working Losses [Mol%]	Breathing Losses [Mol%]	Loading Losses [Mol%]	Residual [Mol%]
1	Nitrogen	0.000		0.000	0.000		
2	Methane	0.000		0.000	0.000		
3	Carbon Dioxide	0.000		0.000	0.000		
4	Ethane	0.000		0.003	0.003		
5	Propane	0.021		0.376	0.376		
6	Isobutane	0.198		1.486	1.486		
7	n-Butane	2.406		12.065	12.065		
8	Isopentane	9.363		22.190	22.190		
9	n-Pentane	14.945		27.190	27.190		
10	Cyclopentane	1.754		2.184	2.184		
11	2-Methylpentane	0.000		0.000	0.000		
12	3-Methylpentane	0.000		0.000	0.000		
13	n-Hexane	53.994		29.982	29.982		
14	Methylcyclopentane	0.000		0.000	0.000		
15	Benzene	2.561		1.435	1.435		
16	Cyclohexane	3.443		1.452	1.452		
17	2-Methylhexane	0.000		0.000	0.000		
18	3-Methylhexane	0.000		0.000	0.000		
19	n-Heptane	2.184		0.401	0.401		
20	Methylcyclohexane	3.029		0.523	0.523		
21	Toluene	1.980		0.360	0.360		
22	n-Octane	0.988		0.059	0.059		
23	Ethylbenzene	0.239		0.014	0.014		
24	n-Nonane	0.659		0.013	0.013		
25	n-Decane	0.000		0.000	0.000		
26	Undecane	0.000		0.000	0.000		
27	Dodecane	0.000		0.000	0.000		
28	Water	0.000		0.000	0.000		
29	Hydrogen Sulfide	0.000		0.000	0.000		
30	2,2-Dimethylpropane	0.000		0.000	0.000		
31	2,2-Dimethylbutane	0.000		0.000	0.000		
32	2,3-Dimethylbutane	0.000		0.000	0.000		
33	2,2,4-Trimethylpentane	1.053		0.200	0.200		
34	Tridecane	0.000		0.000	0.000		
35	Tetradecane	0.000		0.000	0.000		
36	Pentadecane	0.000		0.000	0.000		
37	Hexadecane	0.000		0.000	0.000		
38	Heptadecane	0.000		0.000	0.000		
39	Octadecane	0.000		0.000	0.000		
40	Nonadecane	0.000		0.000	0.000		
41	Eicosane	0.000		0.000	0.000		
42	Heneicosane	0.000		0.000	0.000		
43	Docosane	0.000		0.000	0.000		
44	Tricosane	0.000		0.000	0.000		
45	Tetracosane	0.000		0.000	0.000		
46	Pentacosane	0.000		0.000	0.000		
47	Hexacosane	0.000		0.000	0.000		
48	Heptacosane	0.000		0.000	0.000		
49	Octacosane	0.000		0.000	0.000		
50	Nonacosane	0.000		0.000	0.000		
51	Triacontane	0.000		0.000	0.000		
52	2,2,4-Trimethyl-4-Pentene	0.000		0.000	0.000		
53	m-Xylene	0.000		0.000	0.000		
54	o-Xylene	0.000		0.000	0.000		
55	1,t-2-Dimethylcyclopentane	0.000		0.000	0.000		
56	4,4-Dimethyl-c-pentene-2	0.000		0.000	0.000		
57	p-Xylene	1.184		0.068	0.068		
58	TEG	0.000		0.000	0.000		
59	Piperazine	0.000		0.000	0.000		
60	MDEA	0.000		0.000	0.000		
61	O2	0.000		0.000	0.000		

Stream Mass Flow [Total]										
No.	Component	MW [lb/lbmol]	Pressurized Inlet [lb/hr]	Flashing Losses [lb/hr]	Working Losses [lb/hr]	Breathing Losses [lb/hr]	Loading Losses [lb/hr]	Residual [lb/hr]	Total Emissions [lb/hr]	
1	Nitrogen	28.013	0.000		0.000	0.000			0.000	
2	Methane	16.042	0.000		0.000	0.000			0.000	
3	Carbon Dioxide	44.010	0.000		0.000	0.000			0.000	
4	Ethane	30.069	0.006		0.000	0.000			0.000	
5	Propane	44.096	3.376		0.051	0.018			0.070	
6	Isobutane	58.122	42.535		0.267	0.096			0.362	
7	n-Butane	58.122	516.905		2.164	0.779			2.943	
8	Isopentane	72.149	2496.777		4.941	1.778			6.719	
9	n-Pentane	72.149	3985.468		6.054	2.179			8.233	
10	Cyclopentane	70.133	454.625		0.473	0.170			0.643	
11	2-Methylpentane	86.175	0.000		0.000	0.000			0.000	
12	3-Methylpentane	86.175	0.000		0.000	0.000			0.000	
13	n-Hexane	86.175	17198.087		7.974	2.870			10.844	
14	Methylcyclopentane	84.159	0.000		0.000	0.000			0.000	
15	Benzene	78.112	739.320		0.346	0.125			0.470	
16	Cyclohexane	84.159	1071.015		0.377	0.136			0.513	
17	2-Methylhexane	100.202	0.000		0.000	0.000			0.000	
18	3-Methylhexane	100.202	0.000		0.000	0.000			0.000	
19	n-Heptane	100.202	808.984		0.124	0.045			0.169	
20	Methylcyclohexane	98.186	1099.279		0.158	0.057			0.215	
21	Toluene	92.138	674.191		0.102	0.037			0.139	
22	n-Octane	114.229	417.071		0.021	0.008			0.028	
23	Ethylbenzene	106.165	93.861		0.005	0.002			0.006	
24	n-Nonane	128.255	312.555		0.005	0.002			0.007	
25	n-Decane	142.282	0.000		0.000	0.000			0.000	
26	Undecane	156.308	0.000		0.000	0.000			0.000	
27	Dodecane	170.335	0.000		0.000	0.000			0.000	
28	Water	18.015	0.000		0.000	0.000			0.000	
29	Hydrogen Sulfide	34.081	0.000		0.000	0.000			0.000	
30	2,2-Dimethylpropane	72.149	0.000		0.000	0.000			0.000	
31	2,2-Dimethylbutane	86.175	0.000		0.000	0.000			0.000	
32	2,3-Dimethylbutane	86.175	0.000		0.000	0.000			0.000	
33	2,2,4-Trimethylpentane	114.229	444.492		0.070	0.025			0.096	
34	Tridecane	184.361	0.000		0.000	0.000			0.000	
35	Tetradecane	198.388	0.000		0.000	0.000			0.000	
36	Pentadecane	212.415	0.000		0.000	0.000			0.000	
37	Hexadecane	226.441	0.000		0.000	0.000			0.000	
38	Heptadecane	240.468	0.000		0.000	0.000			0.000	
39	Octadecane	254.494	0.000		0.000	0.000			0.000	
40	Nonadecane	268.521	0.000		0.000	0.000			0.000	
41	Eicosane	282.547	0.000		0.000	0.000			0.000	
42	Heneicosane	296.574	0.000		0.000	0.000			0.000	
43	Docosane	310.601	0.000		0.000	0.000			0.000	
44	Tricosane	324.627	0.000		0.000	0.000			0.000	
45	Tetracosane	338.654	0.000		0.000	0.000			0.000	
46	Pentacosane	352.680	0.000		0.000	0.000			0.000	
47	Hexacosane	366.707	0.000		0.000	0.000			0.000	
48	Heptacosane	380.734	0.000		0.000	0.000			0.000	
49	Octacosane	394.760	0.000		0.000	0.000			0.000	
50	Nonacosane	408.787	0.000		0.000	0.000			0.000	
51	Triacontane	422.813	0.000		0.000	0.000			0.000	
52	2,2,4-Trimethyl-4-Pentene	112.213	0.000		0.000	0.000			0.000	
53	m-Xylene	106.165	0.000		0.000	0.000			0.000	
54	o-Xylene	106.165	0.000		0.000	0.000			0.000	
55	1,t-2-Dimethylcyclopentane	98.186	0.000		0.000	0.000			0.000	
56	4,4-Dimethyl-c-pentene-2	98.186	0.000		0.000	0.000			0.000	
57	p-Xylene	106.165	464.437		0.022	0.008			0.030	
58	TEG	150.173	0.000		0.000	0.000			0.000	
59	Piperazine	86.136	0.000		0.000	0.000			0.000	
60	MDEA	119.162	0.000		0.000	0.000			0.000	
61	O2	31.999	0.000		0.000	0.000			0.000	

Stream Properties										
			Pressurized Inlet	Flashing Losses	Working Losses	Breathing Losses	Loading Losses	Residual		
MW [lb/lbmol]			83.39		75.03	75.03				
Heating Value [BTU/scf]			-		4142.7	4142.7		-		
Specific Gravity			0.646	-	-	-	-			
Reid Vapor Pressure [psi]			8.91	-	-	-	-			
Gas Volumetric Flow [scf/hr]			-	0.00	117.12	42.15		-		

	UOM	Gas	2 x 500bbls Sour Water Tanks	4 x 400bbls Slop Tanks	6 x 500bbls Condensate Tanks	
Daily Rate	MMSCFD					
Daily Throughput	bbl/d		87	242	3130	
Annual Throughput	gal/yr		1333710	3709860	47976768	
Per Tank Throughput	gal/yr		666855	927465	7996128	
# of Tanks			2	4	6	
Turnover Per Tank	per year		30	55	364	
Total Flow	lb/hr		1.89	2.97	31.49	
VOC [C3+] total	lb/hr		0.00	0.33	31.49	
VOC [C3+] per tank	lb/hr		0.00	0.082955	5.25	
Bz total	lb/hr		0.00	0.025054	0.47	
Bz per tank	lb/hr		0.00	0.006264	0.08	
H2S total	lb/hr		0.41	0.000000	0.00	
H2S per tank	lb/hr		0.20	0.000000	0.00	
Temperature	°F		110.89	111.62	111.21	
VOC [C3+] wt %	%		0.00	11.16	100.00	
Bz wt %	%		0.00	0.84	1.49	
H2S wt %	%		21.56	0.00	0.00	
MW Vapors	lb/lbmol		40.00	19.56	75.03	
SCF/hr	SCF/hr		19.99	57.81	159.27	
HV	btu/ft^3		96.63	1066.42	4142.72	
C3 % (mass)	%		0.00	7.00	0.22	
			sourwater tanks liq	slop tanks liq	COND STORAGE	
RVP	psi		2.33	1.04	8.91	
Vapor Pressure @ 100 °F	psia		16.4870	15.3910	9.06029	
Vapor Pressure @ 65 °F	psia					

*Results for vapor streams are for flashing, working ,and breathing combined unless otherwise noted in cell comments

Stream Vapor Pressures

Stream	**VP @ 100 °F [psia]**	**VP at 65 °F [psia]**	VP @ 62.4
1	495.843	383.586	
AGI SOUR WATER	19.0200	12.6503	12.17715574
AIR			
BREATHING COND TANKS	18.3345	9.57073	
BREATHING SLOP TANKS VOCS			
BREATHING SOUR WATER	992.902	663.519	
COND STORAGE	9.06029	4.42361	4.079166381
COND TANK FLASH		13.28	
FLASHING COND TANKS VOCS			
FLASHING SLOP TANKS VC	2343.36		
FLASHING SOUR WATER T	1028.03	689.383	
LOSSES	18.3345	9.57073	
mole sieve stream 16	495.843	383.586	
slop tanks flash		2020.04	
slop tanks liq	15.3910	11.6343	11.35522193
sourwater tanks flash	1086.13	757.299	
sourwater tanks liq	16.4870	10.9207	
STORAGE	9.06029	4.42361	
to atm			
TO COMB			
WORKING COND TANKS V	18.3345	9.57073	
WORKING SLOP TANKS VOCS			
WORKING SOUR WATER T	992.902	663.519	

4.0 DESIGN BASIS

4.1 Site Conditions

Elevation, ft	3612
Seismic Zone	Zone 0, ASCE 7-10
Design Wind Velocity	100 MPH, ASCE 7-10
Barometric Pressure, psia	13.0 (assumed)
Temperature, °F (Min/Max)	0 / 105
Design Relative Humidity	90% (assumed)

4.2 Waste Stream Summary

	Amine Acid Gas	**TEG Overhead**
COMPONENT:	Mol%	Mol%
N2	0.000476436	0.023533817
C1	0.160343489	10.52602613
CO2	92.80947832	0.139200764
C2	0.043605007	13.12750526
H2S	0.006564341	0
C3	0.013389894	17.86443624
iC4	0.00094232	2.552395332
nC4	0.003913018	10.55245659
iC5	0.000141998	4.19340138
nC5	0.000248341	5.266306596
C6	0.000126353	8.807176215
C7	2.72456E-07	0.15051084
C8	1.06148E-07	0.059643694
C9	2.60623E-09	0.044655609
Cyclopentane	0.00016068	2.031482149
Benzene	0.012892923	7.777448444
Cyclohexane	0.000139167	1.150332198
Methylcyclohexane	9.42409E-06	0.457895628
2,2,4-Trimethylpentane	2.13572E-07	0.073574104
Toluene	0.002402702	2.682916488
Ethylbenzene	5.08093E-05	0.110829457
p-Xylene	0.000330822	0.500214123
H2O	6.944783312	11.90746968
MDEA	2.22147E-08	0.000589214
Piperazine	2.96789E-08	7.98446E-12
TEG	0	4.50342E-08

Total Flowrate for Base Case, lbmol/hr	**1622.5**	**3.5**
Total Flowrate for 2x Base Case, lbmol/hr	**3245.0**	**7.0**
Mol. Wt.	42.2	50.2
Pressure, psig	11.8	1.3
Temperature, °F	120	120

All waste streams are assumed to be in vapor state, no liquids have been considered in the design of the thermal oxidizer. If liquids are present, a knock out drum needs to be installed upstream of the thermal oxidizer as well as heat tracing and insulating the waste lines to avoid condensation. This additional scope is currently not included in Zeeco's scope.
It is assumed that the Acid Gas, Amine and TEG Flash Gases and TEG Overhead streams will be entering in two separate connections, inert streams such as Acid Gas in one connection and rich gases, such as the Amine and TEG Flash Gases and TEG Overhead streams in the other. It is assumed both inert and rich gas streams and will be running continuously and simultaneously. The Acid Gas stream will never be without TEG/ Amine Flash streams and vice versa.

4.3 Utilities

Electrical Power	460V / 3 Phase / 60 Hz
Instrument Air, SCFH	2000 to 4000
Fuel Gas Required for Base Case- all waste coming to TO simultaneously (Fuel Gas assumed as Methane)	58 MMBtu/hr
Fuel Gas Required for 2x Base Case - all waste coming to TO simultaneously (Fuel Gas assumed as Methane)	112 MMBtu/hr

4.4 Flue Gas at 1600°F

	Base Case (all waste streams with 0% margin included)	**2X Base Case (all waste streams with 0% margin included)**
COMPONENT:	**Mol%**	**Mol%**
CO_2	38.51	39.04
H_2O	15.69	15.60
N_2	42.74	42.32
SO_2	0.00	0.00
O_2	3.06	3.03
TOTAL, lbmol/hr	**4390.11**	**8637.01**

4.5 System Performance for the Base Case and 2x Waste Flow Case

Stack Emission	Expected Performance
Destruction Efficiency	> 99.9% of VOCs
NOx, ppm_{vd} @ 3% O2	50
CO, ppm_{vd} @ 3% O2	50

These values are understood to apply only when the system is operated in accordance with the operating conditions stipulated in the design summary and for the waste stipulated in the design basis sections of this proposal. VOC is defined as non-methane and non-ethane hydrocarbons.

5.0 EQUIPMENT DESCRIPTION- BASE CASE

5.1 Thermal Oxidizer

One (1) vertical thermal oxidizer with integral stack is offered. It is designed to operate at 1600°F with excess air to ensure complete combustion of the waste gas combustible components. The thermal oxidizer has the following features:

- Nominal 10'-0" OD to 75'- 0" elevation
- Shell Material: SA-36
- All Carbon Steel External Surfaces Sandblasted to SSPC-SP6
- Painted per Zeeco Standard

5.2 Burner

One (1) Forced Draft Zeeco GB Burner is offered with the following features:

- 60 MMBtu/hr maximum fuel gas release rating
- AR/GS Pilot for intermittent use
- A-36 Carbon Steel Construction
- 60% Al_2O_3 Burner Tile Construction
- 10:1 Fuel Gas Turndown
- All Carbon Steel External Surfaces Sandblasted to SSPC-SP6
- Painted per Zeeco Standard

5.3 Combustion Air Fan

One (1) Combustion Air Fan is offered and has the following features:

- Design Rate: 79672 lb/hr
- Discharge Pressure: 6 in W.C
- Motor HP: ≤30
- Manufacturer's standard design
- Painted as per Manufacturer's Standard

5.4 Refractory

The bottom of the thermal oxidizer, near the burner, is dual lined with 4" of 3000 °F castable, backed with 2" of lightweight insulating castable. The stack of the thermal oxidizer is lined with a single layer of 4", 2300°F lightweight insulating castable. Refractory will be supplied, shop installed and partially dried out in the shop by Zeeco.

5.5 Instrumentation & Controls

Zeeco Instrumentation and Controls scope includes basic burner management functions within a local control panel to comply with **NFPA 86**. A fuel rack is included in the base scope for pilot and main burner fuel supply and control/shutdown. All instruments included are sourced from Zeeco standard suppliers. See attached P&IDs. Line sizes will be adjusted as necessary.

Zeeco has not offered the waste gas piping or isolation valve/ controls. These items can be offered as an optional price.

6.0 EQUIPMENT DESCRIPTION- 2x BASE CASE

6.1 Thermal Oxidizer

One (1) vertical thermal oxidizer with integral stack is offered. It is designed to operate at 1600°F with excess air to ensure complete combustion of the waste gas combustible components. The thermal oxidizer has the following features:

- Nominal 12’-9” OD to 70’- 0” elevation
- Shell Material: SA-36
- All Carbon Steel External Surfaces Sandblasted to SSPC-SP6
- Painted per Zeeco Standard

6.2 Burner

One (1) Forced Draft Zeeco GB Burner is offered with the following features:

- 118.0 MMBtu/hr maximum fuel gas release rating
- AR/GS Pilot for intermittent use
- A-36 Carbon Steel Construction
- 60% Al_2O_3 Burner Tile Construction
- 10:1 Fuel Gas Turndown
- All Carbon Steel External Surfaces Sandblasted to SSPC-SP6
- Painted per Zeeco Standard

6.3 Combustion Air Fan

One (1) Combustion Air Fan is offered and has the following features:

- Design Rate: 155233 lb/hr
- Discharge Pressure: 7 in W.C
- Motor HP: ≤75
- Manufacturer’s standard design and construction
- Painted as per Manufacturer’s Standard

6.4 Refractory

The bottom of the thermal oxidizer, near the burner, is dual lined with 4” of 3000 °F castable, backed with 2” of lightweight insulating castable. The stack of the thermal oxidizer is lined with a single layer of 4”, 2300°F lightweight insulating castable. Refractory will be supplied, shop installed and partially dried out in the shop by Zeeco.

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Zeeco has not offered the waste gas piping or isolation valve/ controls. These items can be offered as an optional price.

Process Conditions -- English Units

Client: Lucid Midstream	Zeeco Ref.: 2019-03373FL-01	Date: 21-May-19
Location: Jal, NM	Client Ref.: "Red Hills V"	Rev. 0

	Mol %					
	Cold Case 1	Cold Case 2	Warm Case 1	Warm Case 2	Case E	Case F
METHANE	75.95	1.22		69.81		
ETHANE	11.67	60.16	0.25	10.97		
PROPANE	5.82	26.07	99.00	5.78		
BUTANE	2.16	9.31	0.75	2.49		
PENTANE	0.55	2.56		0.87		
HEXANE	0.09	0.48		0.26		
HEPTANE	0.02	0.14		0.12		
OCTANE		0.02		0.03		
NONANE						
DECANE						
DODECANE						
TRIDECANE						
CYCLOPENTANE						
ETHYLENE						
PROPYLENE						
BUTYLENE						
ACETYLENE						
BENZENE						
TOLUENE						
XYLENE						
CARBON MONOXIDE						
CARBON DIOXIDE	1.01	0.03		7.00		
HYDROGEN SULFIDE				0.20		
SULFUR DIOXIDE						
AMMONIA						
AIR						
HYDROGEN						
OXYGEN						
NITROGEN	2.70			2.48		
WATER						
BUTADIENE						
METHANOL						
Total	**100**	**100**	**100**	**100**		
Mol. Wt.	21.21	37.63	44.17	23.34		
L. H. V. (BTU/SCF):	1,104	1,992	2,319	1,073		
Temperature (Deg. F):	9.0	170.0	190.0	65.0		
Avail. Static Pressure (psig):	40.00	20.00	10.00	20.00		
Flow Rate (lbs/hr):	1,052,040	535,560	221,526	352,687		
Smokeless Rate (lbs/hr):	210,408	107,112	44,305	70,537		

Attachment D

Specification Sheets:

- Flare Tip Specification Sheet
- Flare Pilot Specification Sheet
- Flare Stack Structure Specification Sheet
- High Energy Spark Ignition (HEI) Specification Sheet
- Utility Piping Scope of Supply Specification Sheet
- Typical High-Temp Ignition Wiring Spec Sheet

Air Assisted Flare Tip Specification Sheet

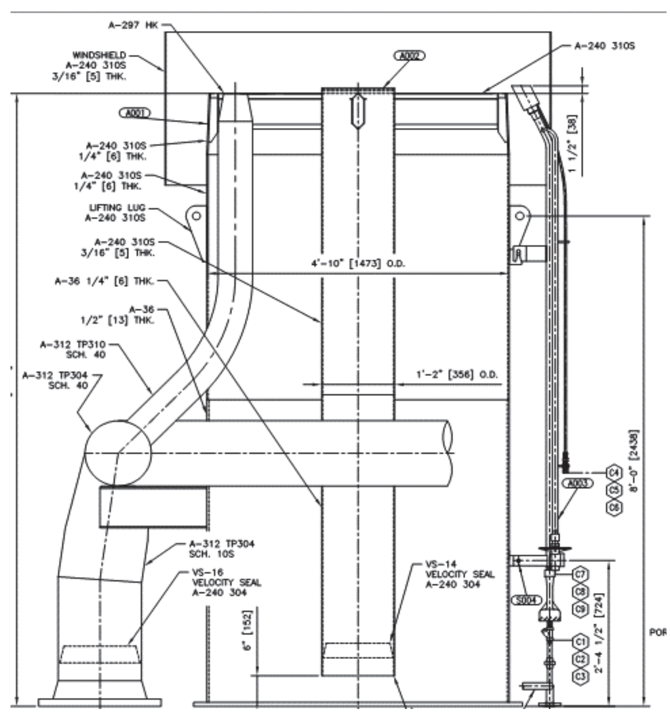
Client:	Lucid Midstream	Zeeco Ref.:	2019-03373FL-01	Date:	21-May-19
Location:	Jal, NM	Client Ref.:	"Red Hills V"	Rev.	0

General Information:

Tag No.:	FL-5100		
Model:	AFDSMJW-20/80 - 26	Type:	Air-Assisted
Length:	10'- 0 "		
Weight:	6000 lbs		
No. of Pilots	3		

Design Case:

Governing Case:	Cold Case 1	
Molecular weight:	21.2	
L. H. V. :	1,104	BTU/SCF
Temperature:	9	Deg. F
Available Static Pressure:	40.0	psig
Design Flow Rate:	1,052,040	lbs/hr
Governing Smokeless Case:	Case A	
Design Smokeless Rate:	210,408	lbs/hr
Approximate Exit Velocity:	1194	ft/s
Mach No.:	1.00	
Approx. Tip Press. Drop:	14.54	psig



(Typical drawing only)

Construction:

Upper Section:	310 SS	Flame Retention Hub:	310 SS
Warm / Air Riser Lower Section:	Carbon Steel	Lifting Lugs:	YES - C.S. Type
Cold Riser Lower Section:	304 SS	Refractory:	None
Windshield:	YES	Refractory Thk:	N/A

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	SSPC-SP6	Primer:	Inorganic Zinc
Paint (c. s. surfaces):	High Heat Aluminum		

Connections:

	Qty.	Size	Type	Material
N1 - Warm Flare Gas Inlet:	1	20 "	Beveled ; Weld	Carbon Steel
N2 - Cold Flare Gas Inlet	1	26 "	150# RFWN	304 SS
N3 - Combustion Air Inlet:	1	80 "	Fab. Plate Flange	Carbon Steel
N4 - Pilot Gas Manifold:	1	1 "	150# RFSW	Carbon Steel

Miscellaneous Notes:

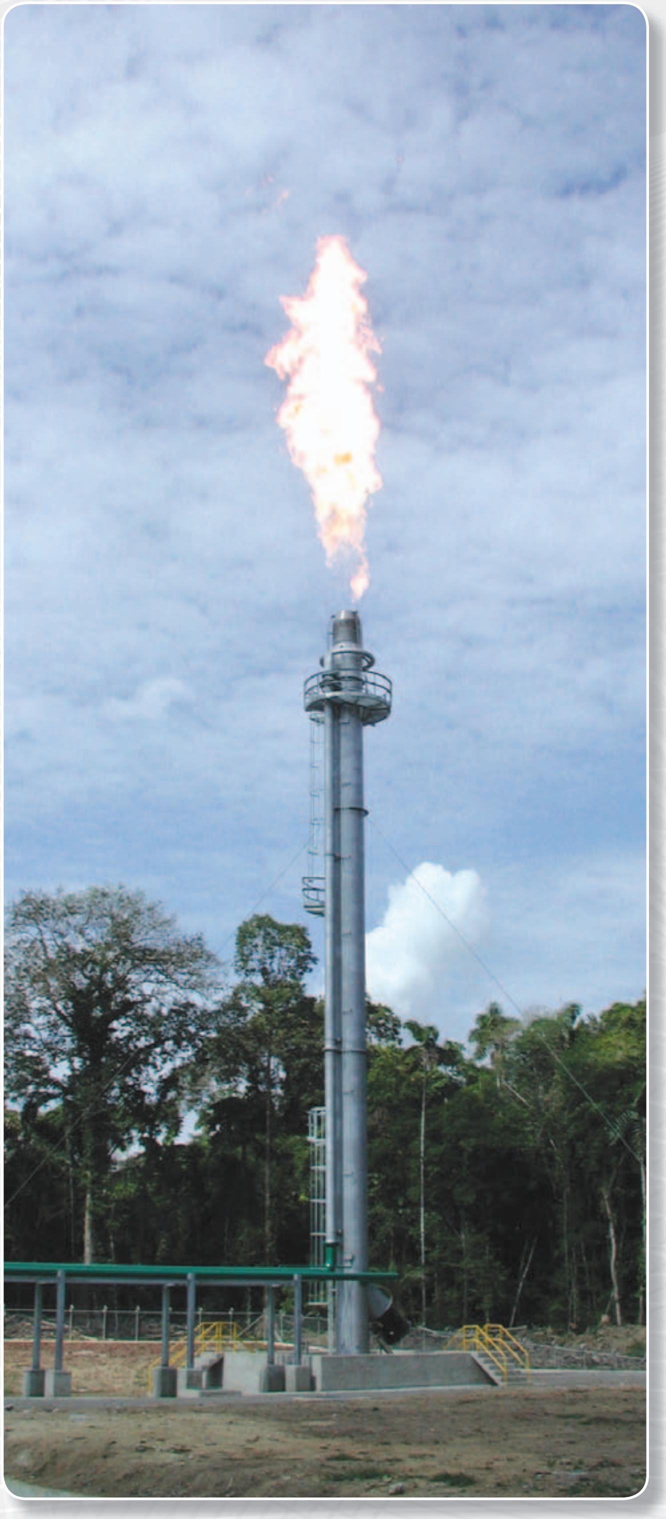
1. Includes Integral Purge Reducing Velocity Seals.
2. Warm Flare Required Fuel Gas Purge Rate = 1200 SCFH.
3. Cold Flare Required Fuel Gas Purge Rate = 1050 SCFH.

Note: Design case shown is for Cold flare only, please refer to process conditions for warm flare design conditions.

AIR ASSISTED FLARE

COMBUSTION AND ENVIRONMENTAL SOLUTIONS.
PURE AND SIMPLE.®

AF Series



AIR ASSISTED AF FLARE

AF SERIES DESCRIPTION

Zeeco's AF series flares use technology proven to achieve smokeless flaring when neither steam nor assist gas is available or economical.

Our AF series flares utilize a low-pressure blower to inject assist air via our proprietary design, which splits the waste gas stream into several smaller streams at the exit of the flare tip. This increases the contact surface area between the waste gas and the assist air, maximizing mixing and turbulence while minimizing the amount of blower horsepower required to achieve smokeless flaring.

BETTER DESIGN MEANS SAFER OPERATION

The waste gases from the flare header as well as the assist air from the blower are isolated from the base of the flare stack to the top of the flare tip. As a result, at no point do the two streams come in contact with each other prior to exiting the flare tip. This ensures the safe operation of your flare system. Zeeco's AF series flare systems can operate without the blower, providing safe disposal of the waste gas in the event of a power outage.

Our proprietary design and the blower's velocity virtually eliminate "flame lick" on the exterior of the flare tip and "burnback" inside the flare tip. The forced air from the blower also shortens the flame length and reduces the radiation at grade due to the highly aerated mixture of waste gases.

WHY CHOOSE ZEECO?

Zeeco is the leading designer of combustion equipment in the global market today in part because we have produced superior air assisted flare systems around the world for more than 30 years. Our philosophy of providing customers with superior quality, on-time shipments and competitive pricing is the cornerstone of our success. Let us put our experience to work for you. Call or email us today for more information on Zeeco's full line of flare products and replacement components for your new or existing flare system(s).

BURNERS

FLARES

INCINERATORS

PARTS & SERVICE

COMBUSTION AND ENVIRONMENTAL SOLUTIONS.
PURE AND SIMPLE.®

Air Assisted Flare

APPLICATIONS

- ZEECO® AF series flares are perfect for refining, LNG, production, steel industries, petrochemical, offshore platforms, pulp and paper plants, pharmaceuticals and food processing plants.
- Our AF series flares are the preferred choice for industries that require smokeless flaring when neither steam nor assist gas is desired, available or cost effective.
- AF series flares are the best option for harsh conditions such as arctic environments where steam could freeze or desert environments where water is scarce.
- ZEECO AF series flare tips make sense as a replacement for other manufacturers' flare tips.

FEATURES

- Sizes ranging from 2 inch (50 mm) to 120 inch (3050 mm)
- Longer flare tip life due to continual cooling by forced air flow
- Lower radiation level at grade due to a highly aerated flame
- Lower noise than similar size steam assisted flares
- High stability pilots (tested to 150 mph [241 Km/hr] wind speed)
- Critical parts supplied as investment castings
- 310 stainless steel in high heat areas

ADVANTAGES

- Very low operating cost for smokeless operation
- High stability, low fuel consumption pilots are standard with AF flare tips
- 98.5% or higher hydrocarbon destruction efficiency
- Superior materials and construction
- Lower blower horsepower requirements than competing designs

AIR ASSISTED AF FLARE BLOWERS

AIR ASSISTED AF FLARE

AIR ASSISTED AF FLARE

CERTIFICATIONS APPLY TO ZEECO HEADQUARTERS ONLY.

CERTIFIED NBBI | CERTIFIED ASME | CERTIFIED ASME | REGISTERED ISO 9001: 2008

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zeeco.com

Pre-Mix Flare Pilot Assembly Specification Sheet

Client:	Lucid Midstream	Zeeco Ref.:	2019-03373FL-01	Date:	21-May-19
Location:	Jal, NM	Client Ref.:	"Red Hills V"	Rev.	0

General Information:

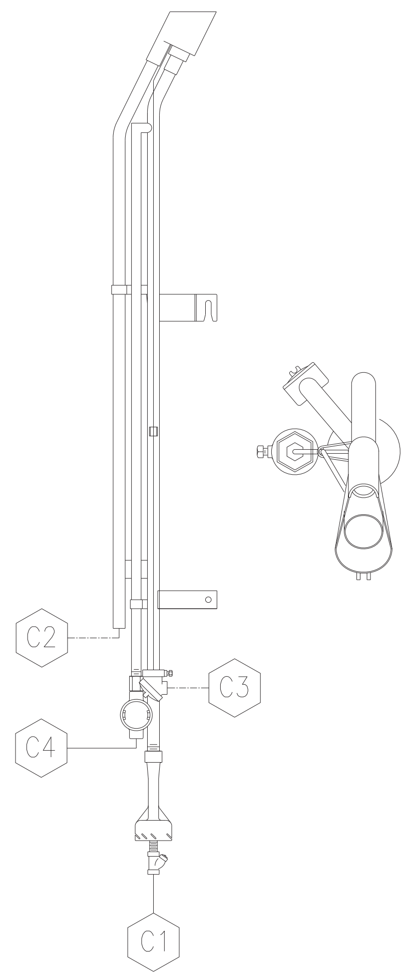
Tag No.:	FP-1	
Model:	HSLF	
Length:	9.135	feet
Weight:	68	lbs.
Pilot Type:	Pre-Mix	High Stability
Ignition Type:	High Energy Spark	

Process Design Data:

Design Heat Release:	65,000	BTU/hr
Fuel Gas MW:	18.00	
Fuel Gas LHV:	1,000	BTU/SCF
Fuel Gas Temperature:	100	Deg. F
Fuel Gas Inlet Pressure:	15.00	psig
Fuel Gas Flow rate:	65.0	SCFH
Design Wind Velocity:	150	mph
Design Rainfall:	50.00	inches/hr
Mounting Position:	Vertical	
Thermocouple Type:	K	Ungrounded

Construction:

Pilot Firing Tip:	HK
Windshield Assembly:	HK
Integral Thermowell:	HK
Mounting Brackets:	HK
Premix Fuel Line:	310 SS
Thermocouple Sheath:	310 SS
Thermocouple Head:	316 SS
Fuel Mixer / Spud Assembly:	CF-3M / 18-8
Fuel Strainer Assembly:	CF-8M
HEI Probe and Support:	310 SS
HEI Junction Head:	CF-3M



Connections:	Qty.	Size	Type	Material
C1 - Fuel Gas Inlet:	1	1/2"	FNPT	CF8M
C3 - Thermocouple:	1	1/2"	Tube	316 SS
C4 - HEI Ignition:	1	3/4"	FNPT	Cast Iron

Misc. Notes: (see ignition system datasheet for type applicable to this quote)

1. Upper mounting bracket is reinforced hook type for pilot removal from platform.
2. Pilot mounting brackets and thermocouple mounting brackets are investment cast assemblies.
3. Pilot mixer assembly is investment cast, high efficiency computer modeled venturi section.
4. Thermocouples are simplex, retractable type (replaceable from grade).

ZEECO

HSLF FLARE PILOT

HSLF Series

The only pilot to operate continuously in hurricane force winds.

Just ask our customers in the eye of the storm. They'll tell you the ZEECO® HSLF pilot was the only flare pilot to operate continuously when their facilities were directly hit by hurricanes Ike and Rita.

You can expect the same level of reliability – in some of the harshest weather conditions on the planet – when you install a ZEECO HSLF pilot. Proven to withstand hurricane-force winds of 170 mph (274 km/h) at Zeeco's Combustion Research and Test Facility, the HSLF flare pilot offers unparalleled performance.

To view the HSLF hurricane test video, visit www.zeeco.com/pilots

Engineering experience for extreme longevity.

Flare pilots are exposed to all kinds of extremes – temperature, inert flare purge, flame impingement, environmental conditions, weather events, and more. That's why Zeeco goes to extreme lengths to engineer and manufacture our HSLF pilots to withstand the challenges and outlast the rest.

The ZEECO HSLF flare pilot utilizes investment castings instead of welded seam fabrication to maximize the pilot's operating life. To guard the orifice and prevent weather from disrupting gas flow, we fortify our flare pilots with a unique investment cast pilot mixer assembly with an integrated weathershield. No other pilot has this feature. We can also retrofit the HSLF pilot to competitor flare systems.

The ZEECO HSLF pilot operates with a variety of hydrocarbon fuel gas compositions, including butane, ethylene, hydrogen and propane, low-BTU gases, or any combination of these fuels.

Why choose Zeeco?

Zeeco leads today's global market in the design of advanced combustion and environmental solutions. For nearly 40 years, ZEECO flare systems have played vital roles in industries around the world. Our mission to provide customers with superior quality, on-time shipments, and competitive pricing is the cornerstone of our success. Let Zeeco puts its experience to work for you. Call or email us today to learn more about the full line of ZEECO flare products and replacement components.


BURNERS


FLARES


INCINERATORS


PARTS & SERVICE

HSLF Flare Pilot

Standard Features

- Flame Front Generator (FFG) ignition
- Fixed, single element type K thermocouple with stainless steel thermocouple protection system (provides tertiary protection and ensures the thermocouple maintains the proper position in the thermo well)
- Cast heavy wall thermo wells included in pilot shields (maximizes thermal conductivity between flame and thermocouple)
- HSLF mixer is engineered to maximize the efficiency of inspiration and mixing
- Extensive utilization of stainless steel investment cast components
- All stainless steel construction, including a stainless steel strainer that prevents plugging of pilot mixer orifice
- Mixer is engineered to easily transfer and handle high utility piping loads
- Can operate using a wide variety of hydrocarbon fuel gas compositions
- Configurations available for all flare types


Standard HSLF Pilot

Options

- Stand-alone High Energy Ignition (HEI) with investment cast junction box and integral radiation shield (as an alternative to standard FFG ignition) or in combination with FFG ignition
- Dual High Energy Ignition (HEI) systems
- Flame proving using ionization rod
- Flame proving using optical monitoring from grade
- Dual element or multiple thermocouples
- Alternative metallurgies available, e.g. INCONEL® 625 or INCOLOY® 800H
- Retractable thermocouple systems
- Patented pusher/straightener installation machine

ZEECO® combustion solutions are designed and manufactured to comply with applicable local and international standards as defined by our customers.

REGISTERED
ISO 9001: 2008

CERTIFICATION APPLIES TO ZEECO HEADQUARTERS ONLY.

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Zeeco.com

Self-supported Flare Stack Specification Sheet

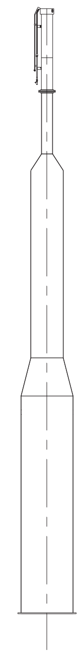
Client:	Lucid Midstream	Zeeco Ref.:	2019-03373FL-01	Date:	21-May-19
Location:	Jal, NM	Client Ref.:	"Red Hills V"	Rev.:	0

General Information:

Tag No.:	FL-5100
Overall Height:	199'- 0 "

Design Criteria:

Wind Design Code:	ASCE 7-05
Seismic Design Code:	UBC
Importance Factor:	1.00
Structural Design Code:	ASME STS-1 / AISC
Wind Speed (Structural):	120 mph
Seismic Zone:	1
Warm Min./Max. Design Temp.	-20 / 350 Deg. F
Cold Min./Max. Design Temp.:	-150 / 350 Deg. F
Air Riser Design Temp.:	Ambient
Warm / Cold Design Pressure:	50 psig
Air Riser Design Pressure:	Ambient
CS Riser Corrosion Allow.:	0.0625 in.



(Typical drawing only)

Construction:

Air Riser Diameter:	80"	Ladders & Step-offs:	None
Cold Riser Diameter:	26"	Platform at Tip:	None
Warm Riser Diameter:	20"	Additional Platforms:	None
Air / Warm Riser Material:	CS	ACWL:	None
Cold Riser Material:	304 SS		

Surface Finish (Carbon Steel Surfaces):

Surface Preparation:	SSPC-SP-6	Primer:	Inorganic Zinc
Int. Coat:	None	Finish Paint:	None

Utility Piping:

Per Attached Utility Piping Scope of Supply

Miscellaneous Notes:

1. Vane Axial blower mounted at base of stack.
2. Blower Power Available: 460 V, 3 Ph, 60 Hz
3. Elevation considered for blower sizing: 850 feet. Ambient temp considered: 20 / 100 F
4. See GA attached.

JOHN ZINK HAMWORTHY COMBUSTION
www.johnzinkhamworthy.com

OPD –F-1001- Lucid Energy PLA-30

DATA SHEET NO: 111272-A
May 16th, 2019

PROCESS DATA

GAS STREAM	*Amine Cont. LV / Stabilizer Surge*
FLOW MAXIMUM	*316,355 lb/hr / 9,917 lb/hr smokeless*
FLOW MINIMUM	*PURGE*
MOLECULAR WEIGHT	*25.5 / 46.4*
TEMPERATURE	*-26 / 142.5 °F*
INLET PRESSURE	*10 psig Max*

UTILITIES

PILOT FUEL GAS	*50 SCFH of N.G (per pilot)*
PURGE GAS	*139 SCFH*

PILOTS (RETRACTABLE)

QUANTITY	*Three (3)*	TYPE	*WindPROOF Zeus*
THERMOCOUPLES	*One / Pilot*		
TYPE	*Single Element Type K*		

DIMENSIONS (approx.)

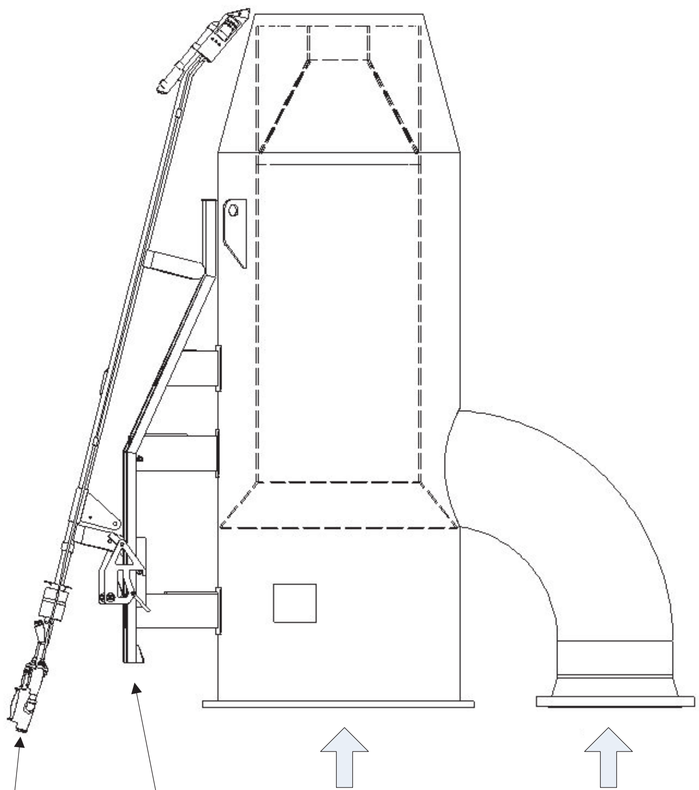
HEIGHT	*10' - 0"*
WEIGHT	*2,800 LBS*

MATERIALS

MAIN BODY	*316 SS Upper / 304 SS Lower*
MIXING HEAD	*316 SS*
PILOT	*310 SS*
PILOT NOZZLE	*Cast 310 SS*
LIFTING LUGS	*304 SS*

SURFACE FINISH / PAINT (stainless steel)

SANDBLAST	NONE
PRIMER	NONE
TOP COAT	NONE



This offer may not include all items show.

NDE

RADIOGRAPHY	*10% radiography butt weld*
OTHER NDE	*none*

TERMINAL POINTS

GAS INLET	*20"*	*Class 150 RF Carbon Steel*
AIR INLET	*30"*	*Plate Flange A36*
PILOT INLET	*¾"*	*Class 150 RF*

REMARKS

CARBON STEEL FLARE TIP INLET FLANGES SHALL BE COATED TO SSPC-SP6 SURFACE PREPARATION AND 2 COATS HIGH TEMP. ALUMINUM, 1-2 MILS DFT

Lucid Energy Delaware, LLC
3100 McKinnon Street, Suite 800
Dallas, TX 75201

PURCHASE ORDER

Vendor:	**Tulsa Combustion LLC**
Address:	2300 S. Adams Road
City, St., Zip:	Sand Springs, OK 74063
Phone:	918.215.1900
Fax:	918.215.1908
Email:	mittc@tulsacombustion.com
Attention:	Mitt Chinsethagid
Ship to:	Lucid Energy Delaware, LLC
Address:	**Red Hills Plant**
	1934 W. NM HWY 128
City, St., Zip:	**Jal, NM 88252**
Phone:	469.688.4130
Fax:	
Email:	
Attention:	Chris Middleton

Important Comments:
Attachment A: General Terms & Conditions
Please see attached quote received via email

Date:	10/11/2017
AFE#:	**PO-170084-07**
Project Name:	Red Hills AGI Well
Date Items Req'd:	**1/8/2018**
Invoice Date:	
Terms:	Net 30
Ship Via:	
FOB Point:	FOB Destination
Bill to:	**Lucid Energy Delaware, LLC**
Address:	3100 McKinnon Street, Suite 800
City, St., Zip:	Dallas, TX 75201
Phone:	214.420.4950
Fax:	
Invoices:	ap@lucid-energy.com
Email:	yrodriguez@lucid-energy.com
Attention:	Yelena Rodriguez

Note:
Send all documentation, U1A, drawings, MTR's, etc. to the address information listed above as the Bill To

ITEM NO:	DESCRIPTION	QTY	UNIT PRICE	EXT AMOUNT	ACCT CODE
1	85ft OAH Self-Supporting Flare with KO drum at base of flare	1	$ 99,156.00	$ 99,156.00	
2	20ft OAH Truck/Tank Flare	1	$ 9,632.00	$ 9,632.00	
	**Please direct any techical questions to Brad Campbell. (Mobile: 918.521.6571 Email: onstream_ops@yahoo.com) **				
			Subtotal:	$ 108,788.00	
			Estimated Sales Tax:	$ 6,799.25	
			Freight (est):	TBD	
			Purchase Order Total:	$ 115,587.25	

Ordered By:	Chris Middleton	Date:	10/11/2017		
Prepared By:	Sasha Vela	Date:	10/11/2017		
Authorized By:	**Lucid Energy Delaware, LLC**	Date:	10/11/17	Signature:	
Acknowledged By:		Date:		Signature:	

Tulsa Combustion

Office/Shop
2300 S. Adams Road
Sand Springs, OK 74063
U.S.A.

Contacts
Ph: 918-215-1900
Fax: 918-215-1908
E-mail: sales@tulsacombustion.com
Web site: www.tulsacombustion.com

October 10th, 2017

ONSTREAM OPERATIONS, LLC
2999 Ave T NE
Winter Haven, FL 33881

Attn: Brad Campbell

Ref: Lucid Sour Gas Flares
Tulsa Combustion TC-17-09-2126

Greetings:

Thank you for the opportunity to offer a proposal for the Sour Gas Flares mentioned above. The stated scope and technology requirements are a very good match for the expertise, experience and capabilities of Tulsa Combustion LLC. We understand well the physical and process implications and limitations of this application. In collaboration with Onstream, we will provide a system that is reliable and safe, with an optimal economic value over the long term.

The major design criterion was the ground level SO2 concentrations as required by the NAAQS for a 1-hour averaging time of 75 PPB SO2.

Following discussions with Onstream and RFS Consulting, the following approach was taken.

- Use of this flare will be limited to 500 Hours per year and based on this limitation the average SO2 molar emissions utilized was the design numbers presented times the ratio of 500/8760.
- We were advised by RFS Consulting that this approach has been accepted by the EPA for other applications and is a reasonable approach
- With these understandings, the height of the flare system is set by thermal radiation, not by ground level concentrations of SO2

Based on this, we are offering a self-supporting flare at 85ft OAH for the acid gas and inlet gas feed flare. An optional KO Drum at that base of the flare is also provided at an additional cost. A separate Tank and Truck loading self-supporting flare with a 20 ft overall height as the is also included in the proposal.

These are some features of our offer to which we invite your attention:

- We are comfortable in meeting the delivery requirements
- Tulsa Combustion will provide the engineering, design and fabrication for the scope of supply

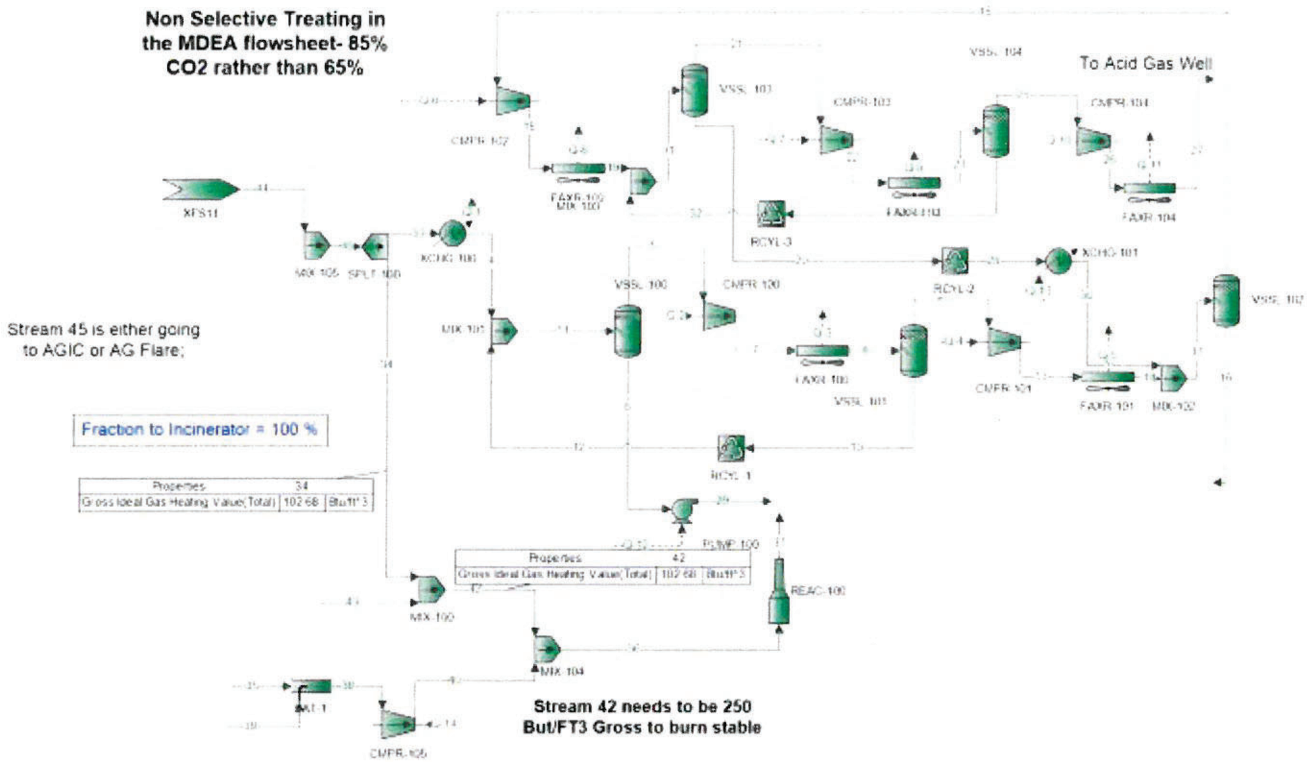
- Our senior staff individually have over 45 years of experience in flare design.

We look forward with enthusiasm to developing this project. Please let us know how we can assist you in moving to the next step.

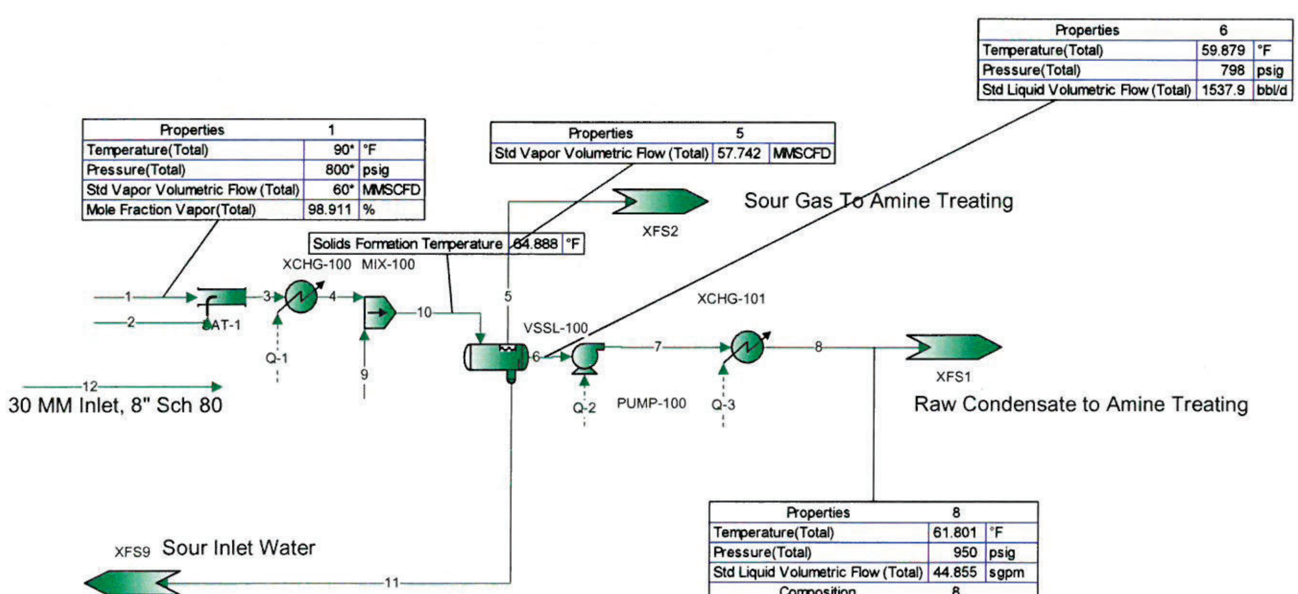
Best regards,

Mitt Chinsethagid
Tulsa Combustion LLC

Technical Specifications



Lucid Energy- 60 MMscfd, 800 psig, 0.55 mol% H2S, 3 mol% CO2, Winter



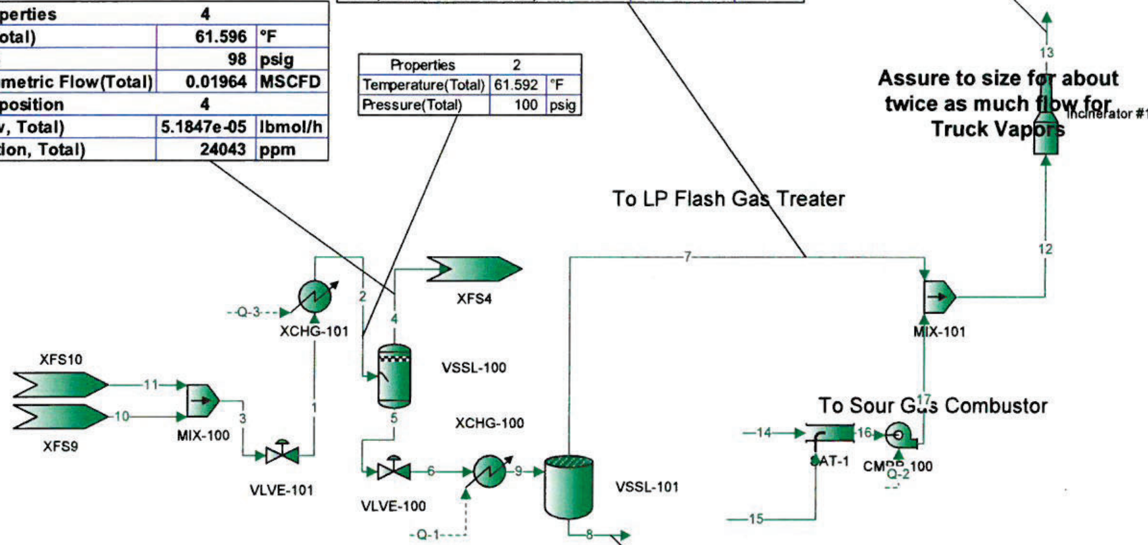
Need 99.9% DRE of the H2S Component at Minimum

Properties	7	
Std Vapor Volumetric Flow(Total)	0.010215	MSCFD
Gross Ideal Gas Heating Value(Total)	444.37	Btu/ft^3
Composition	7	
H2S(Molar Flow, Total)	0.00017746	lbmol/h
H2S(Mole Fraction, Total)	1.5822e+05	ppm
H2S(Mole Fraction, Total)	15.822	%

Composition	13	
SO2(Mass Flow, Total)	0.011369	lb/h
SO2(Mole Fraction, Total)	1.438	%
SO2(Mass Flow, Total)	0.049794	ton/yr

Properties	4	
Temperature(Total)	61.596	°F
Pressure(Total)	98	psig
Std Vapor Volumetric Flow(Total)	0.01964	MSCFD
Composition	4	
H2S(Molar Flow, Total)	5.1847e-05	lbmol/h
H2S(Mole Fraction, Total)	24043	ppm

Properties	2	
Temperature(Total)	61.592	°F
Pressure(Total)	100	psig



Properties	8	
Temperature(Total)	79.992	°F
Pressure(Total)	-0.69595	psig
Std Liquid Volumetric Flow (Total)	2.2272	bbl/d
Composition	8	
H2S(Mole Fraction, Total)	0.021435	%

Estimate 2- 210 bbl Atmospheric Tank with Cold Tar Epoxy Internal Coating for Sour Water, Estimate a simple Truck Loading Facility with Bulkhead and Vapor Return

There will be area H2S Monitors and Wind Socks in this Area, and a Panic ESD station to block it all in

Technical Discussion:

A review of the EPA Screen runs utilizing AERSCREEN showne below indicate 1-Hr concentrations of 17.70 ug/m3.

```
----------------------------------------------------------------------------
*****************************  FLARE PARAMETERS  ****************************
----------------------------------------------------------------------------

SOURCE EMISSION RATE:             3.3460 g/s                 26.556 lb/hr
FLARE HEIGHT:                     25.908 meters               85.00 feet
EFF RELEASE HEIGHT:               30.027 meters               98.51 feet
HEAT RELEASE RATE:            0.1527E+07 cal/sec
HEAT LOSS FRACTION:                0.120
EFF STACK DIAMETER:                1.145 meters               45.09 inches
EFF EXIT TEMPERATURE:             1273.0 K                   1831.7 Deg F
EFF EXIT VELOCITY:                20.000 m/s                  65.62 ft/s
RURAL OR URBAN:                    RURAL

INITIAL PROBE DISTANCE =           5000. meters              16404. feet
   **************************  PROBE ANALYSIS  **************************
                     25 meter receptor spacing: 1. meters - 5000. meters


        Zo       ROUGHNESS       1-HR CONC   DIST       TEMPORAL
        SECTOR    LENGTH          (ug/m3)     (m)         PERIOD
        --------------------------------------------------------------------
         1*       0.300           17.70      350.0       SPR
```

Main Gas and Acid Gas Flare Tips - Nominal 18" and 3" Size

- 10 feet overall length
- 316SS or higher grade shell upper 5 feet
- ASME Section IX welding with Fabrication in an ASME approved shop
- Mechanical details and Flanges per API standard 537
- Self-generating pilot proving system
- 3 Pilots per API Standard 537 - two per 18" and one per 3"

Purge Conservation Seal: Dry Type - Velocity Seal
Any flare stack is subject to the effects of wind, which will produce a high-pressure area on the side the wind strikes and a low-pressure area at the sides of the burner where the velocity is highest. This combination of high and low-pressure zones produces air flow into the stack. The velocity seal is a specially designed section that returns the air to the main flow where it is swept out of the stack. This purge conservation seal design greatly reduces the amount of purge gas required to keep the oxygen concentration at a safe level. In most flares, the design calls for 6% O_2 below the seal. This is a safe level for any gas that depends on oxygen for combustion.

TC HEI-800 Ignition system
Ignition Panel
Panel contains the BX igniters and temperature switches with logic that provides pilot monitoring and automatic ignition/relight. Form C contacts are provided for a common alarm. Panel IP 65 (NEMA 4X Stainless steel) with NFPA air purge for Div. 2 area.

Design
The TC-HEI-800 ignition modules were designed using the latest technology in high-performance solid state DC-to-DC converters and capacitive discharge modules for use with a state-of-the-art igniter which is currently used in aircraft turbines. The use of these high-performance units allows Tulsa Combustion to manufacture high quality and high output ignition modules while requiring a minimum input load. Many months of theoretical design and product research were expended in the development of the TC-HEI-800 ignition module which resulted in a very versatile, economical and powerful unit.

Application
The TC-HEI-800 ignition module is used exclusively with the TC-HEI-800 high performance igniter. This combination is used on flare and burner pilots alike.

Features
The TC-HEI-800 ignition module is manufactured with all solid state components to eliminate costly equipment failures. The TC-HEI-800 ignition module is encased in a high-performance epoxy to ensure long life and thermal stability of the solid state components. In the case of ignition modules supplied by our competitors, the user can only surmise that the igniter is

working by the ignition of the device on which it is installed. Because of this the TC-HEI-800 has a visual indicator that can be seen through a window mounted on the igniter module, one can be assured that the igniter is indeed working, thus eliminating the need to physically check the igniter when trouble-shooting pilot problems.

The TC-HEI-800 ignition module can be ordered in either a single-output or double-output application, and also for DIN rail mounting or panel mounting.

The TC-HEI-800 high-performance igniter is used in commercial aircraft turbines, which ensures reliability and long life as mandated by the FAA.

Specifications:

Input:	24 Vdc	
Output:	800 Vdc	
Power Usage:	< 10 watts	
Mounting:	DIN rail or Panel mount	
Environmental:	-47°C to 40°C	
	Humidity 85% non-condensing	
Weight:	Single output	468 gm (16.5 oz)
	Double output	510 gm (18.0 oz)
Dimensions:	150 mm x 70 mm x 76	

Flame Front Generator for manual back up of HEI-800 Automatic Ignition System
A manual Flame Front Generator system complete with pilot ignition lines is provided. The FFG will operate with fuel gas and has provisions for a back-up propane fuel supply. Propane bottles for the back-up FFG system are not in the Tulsa Combustion Scope of Supply, as these are site-dependent.

The manual FFG is optional with the application of the Tulsa Combustion HEI-800 pilot ignition system and can be eliminated if that is preferred.

Utilities

Service	Units	
Electricity	Volts/Ph/HZ	110/1/50
Fuel Gas Pilot	SCFH	100 SCFH per pilot
Purge Gas	SCFH	18" -233 SCFH / 3" – 10 SCFH

Self-Supported Flare

85ft Overall Height

- Flange per API Standard 537 for flare tip air attachment
- Base Ring for attachment to foundation
- Utility piping
- Material – A-53 b for 18" main gas and 3" acid gas
- Structural Design - Per ASCE 7 and AISC
- Paint System - SP-6 with one primer coat of inorganic zinc on external carbon steel surfaces and one finished coat of epoxy paint.
- Ignition system
- Two pilots
- Meets 40 CFR requirements
- Enrichment fuel for acid gas 1300 scfh to reach 200 Btu/SCF (40 CFR requirement)

Optional KO Drum-

The base of the self supporting stack can easily be designed as the main flare knock out drum by adding a bottom head and a few additional nozzles. This approach may make the self supporting stack more attractive economically as the cost of a separate KO drum is eliminated.

1. Drawings and Documents

The following customer deliverables are included in pricing:

	DRAWING/DATA	For Approval A	For Record B
1	Process Flow Diagram	A	B
2	Piping & Instrumentation Diagram	A	B
3	Engineering Drawings	A	B
4	System Plans & Elevations	A	B
5	Instrument List	A	B
6	General Assembly-Major Components	A	B
7	Foundation Plan & Anchor Bolt Layout	A	B
8	All Available Vendor Data		B
9	Specification Sheets	A	B

Pricing includes one submission, one review and return of documents incorporating all customer comments for submission A. Submission B will be for record only and not subject to review or modification within the original scope. Additional comments, format changes, additional documents are not included in the quoted price and will be supplied at the current professional rates and will be charged to the customer.

DEFINITIONS

1. Process Flow Diagram: A schematic representation of the process indicating state of the fluid at the input and output of each major component.
2. Piping and Instrumentation Diagram: A schematic representation of the process, based on the process flow diagram, indicating control, scope, functions, major interconnecting line sizes, and instrument locations (panel, field, etc.).
3. Engineering Drawings: Plan and Elevation with Member sizes and connection details
4. System Plans and Elevations: An orthographic depiction of the equipment indicating overall size of major components, plot area requirements, height and location of major components with respect to each other.
5. Instrument List: A list indicating type of instrument, tag number, location, and vendor.
6. General Assembly of Major Components: An orthographic depiction of each major component. This drawing will indicate overall dimensions, weight, connection locations, Nozzle legends, materials of construction and equipment features.
7. Foundation Plan and Anchor Bolt Layout: Orthographic depiction of foundation requirements including anchor bolt location and loading.
8. All Available Vendor Data: All technical and maintenance data furnished to Tulsa Combustion by its component vendors.
9. Specification Sheets: The technical specifications that were used to purchase major components and instrumentation.

The following items are not included:

1. Calculations: Tulsa Combustion will perform calculations. They will not be subject to formal review.
2. Shop details/fabrication drawings
3. Foundation design
4. Wire and conduit schedules

The following items are to be provided by the customer unless otherwise specified in this proposal:

1. Shipment of all material from Point of Manufacture
2. Interconnecting piping, conduit and wire
3. Fuel and labor for cure of refractory (supervised by Tulsa Combustion)

CLARIFICATIONS*: STANDARDS FOR PROPOSED EQUIPMENT*

Unless otherwise specified in this Proposal, the following standards will apply to the proposed equipment:

1. WELDING: Per ASME SECTION IX Standards
2. Pressure vessels over 8" are constructed to ASME SECTION VIII and stameped , below 6" diametr they are considered piping and constructed to ANSI B 31.3
3. PIPING MATERIAL: A-106 or A-53B. Unless specifically called out in this proposal, piping 1.5" or smaller will be field-fabricated by others from materials supplied by Tulsa Combustion.
4. CARBON STEEL: A-572-50 or equal. A-500 for structural pipe
5. INSPECTION AND TESTING:
    a. The following items are not provided for:
        - Hydrostatic test except as called out belwo
        - PMI
        - Hardness
        - Charpy tests
    b. The following tests will be performed:
        - X ray as required by ASME code calculations only
        - Hydro Tests as required by ASME code or B31.3

2. Project Schedule

Initial Drawings for Approval:	1-2 weeks after the acceptance of a purchase order.
Shipment of Flare:	10-14 weeks after approved drawings for any options listed

3. Pricing and Commercial Terms

-85ft OAH Self-Supported Flare

$89,489.00 USD

-Alternative – 85ft OAH Self-Supported Flare with KO drum at base of flare

$99,156.00 USD

-20ft OAH Truck/Tank Flare

$9,632.00 USD

Payment Schedule

Payments required by Tulsa Combustion to keep the project in a neutral cash flow will be due according the completion of milestones as follows:

- 30 % on Acceptance of a Purchase Order – Net 0
- 30% on Submittal of Initial Drawings for Approval – Net 15
- 30% on Completion of Fabrication – Net 15
- 10% on Shipment or Notification Equipment is Ready – Net 15

All progress payments are net 15 days, except the initial payment that is due with the Purchase Order.

Terms of Sale

Tulsa Combustion's standard Terms of Sale appear on the following pages.

Zeeco S.O. No. **31974**

Customer **Saulsbury Industries**

Customer PO No. **10231-80312**

FL-2850

This manual covers the component description, installation, operation and maintenance of the below description.

- (1) 40' Ft tall enclosed ground flare stack EGF-7.5-40 with Proflame Flame Scanner
- 10hp Blower
- VFD for customer control
- (2) HSLF-HEI electronic ignition pilot with status monitoring thermocouple.
- HEI ignition and pilot thermocouple wire in flex conduit to connect to the pilot ignition and monitoring rack.
- (1) HEIC pilot ignition and monitoring system mounted on a free standing rack
- (1) 6" Protego DA-SB-300/150-IIA-P1,1

Installation, Operation and Maintenance Manual

For Information, Service or Repair Please Contact:

Zeeco, Inc.
22151 East 91st Street
Broken Arrow, OK 74014 USA

Phone: 918-258-8551
Fax: 918-251-5519

World Wide Web: www.zeeco.com
E-Mail: sales@zeeco.com

Customer Process Data Sheet

Process Conditions -- English Units

Client: Saulsbury	Zeeco Ref.: 31974	Date:	1-Jun-17
Location: Loving, NM	Client Ref.: Lucid Road Runner	Rev.	AS SOLD

	Mol %					
	Scen. 1 (1101 lb/hr)	Scen. 2 (191 lb/hr)	Scen. 1 + Scen. 2 (1292 lb/hr)	Scen. 2 (191 lb/hr)	Scen. 3 (1740 lb/hr)	Scen. 2 + Scen. 3 (1931 lb/hr)
METHANE		98.20	42.85	98.20		30.34
ETHANE		0.38	0.17	0.38		0.12
PROPANE	0.03	0.01	0.02	0.01	0.47	0.33
BUTANE	27.48	0.01	15.49	0.01	53.74	37.14
PENTANE	48.22		27.18		35.39	24.45
HEXANE	13.66		7.70		8.19	5.66
HEPTANE	3.77		2.12		2.09	1
OCTANE	0.24		0.13		0.12	0
NONANE	3.33		1.88			
DECANE						
DODECANE						
TRIDECANE						
CYCLOPENTANE						
ETHYLENE						
PROPYLENE						
BUTYLENE						
ACETYLENE						
BENZENE	1.16		0.66			
TOLUENE	0.32		0.18			
XYLENE	0.06		0.03			
CARBON MONOXIDE						
CARBON DIOXIDE		0.00	0.00	0.00		0.00
HYDROGEN SULFIDE						
SULFUR DIOXIDE						
AMMONIA						
AIR						
HYDROGEN						
OXYGEN						
NITROGEN	1.74	1.40	1.59	1.40		0.43
WATER						
BUTADIENE						
METHANOL						
Total	**100**	**100**	**100**	**100**	**100**	**100**
Mol. Wt.	72.61	16.27	48.03	16.27	66.27	50.82
L. H. V. (BTU/SCF):	3,691	899	2,473	899	3,407	2,632.2
Temperature (Deg. F):	120.0	75.0	100.4	75.0	90.0	85.4
Avail. Static Pressure (psig):	0.75	0.75	0.75	0.75	0.75	0.75
Flow Rate (lbs/hr):	1,101	191	1,292	191	1,740	1,931
Smokeless Rate (lbs/hr):	1,101	191	1,292	191	1,740	1,931

UTILITIES REQUIREMENTS

Utility Requirements

Client:	Saulsbury	Zeeco Ref.:	31974	Date:	1-Jun-17
Location:	Loving, NM	Client Ref.:	Lucid Road Runner	Rev.	AS SOLD

Pilot Gas

# Pilots:	2
Total Fuel Gas:	130 Scfh @ 15 psig or 58 Scfh Propane @ 7 psig

Electricity

Control Panel:	120V / 60 Hz / 1 Phase
Blower Motor:	460V / 60 Hz / 3 Phase

Recommended Flare Purge Rate

Flare Tip Size:	6
Seal Type:	Velocity Seal
Purge Rate:	30 Scfh of a gas that will not go to dew point at operating temperatures

Zeeco Spare Parts

Spare Parts for Start-up and Two Years Operation

Client:	Zeeco Ref.: Standard List	Date: 1-Jan-14
Location:	Client Ref.:	Rev.

Part No.	Qty	Description	Unit Price	Delivery (Weeks)
	1	Pilot Temperature Switch		4
	1	Pilot Thermocouple		4
	1	HSLF-Z-T/C Pilot Assembly		4
	1	Electric Ignitor Probe Assembly		4
	1	HEI Ignition Module		4
	1	Pilot Light Bulb		2
	1	Pressure Gauge (Pilot Fuel Gas)		2

Net Price: U. S. Dollars

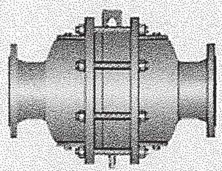
Minimum Invoice:

F.O.B. Point: Shop Door - Broken Arrow, OK, USA

Terms: Net 30 Days

Notes:
1. Prices are subject to change without notice.
2. The spare part items and quantities listed above are preliminary and are subject to change upon determination of final scope of supply.

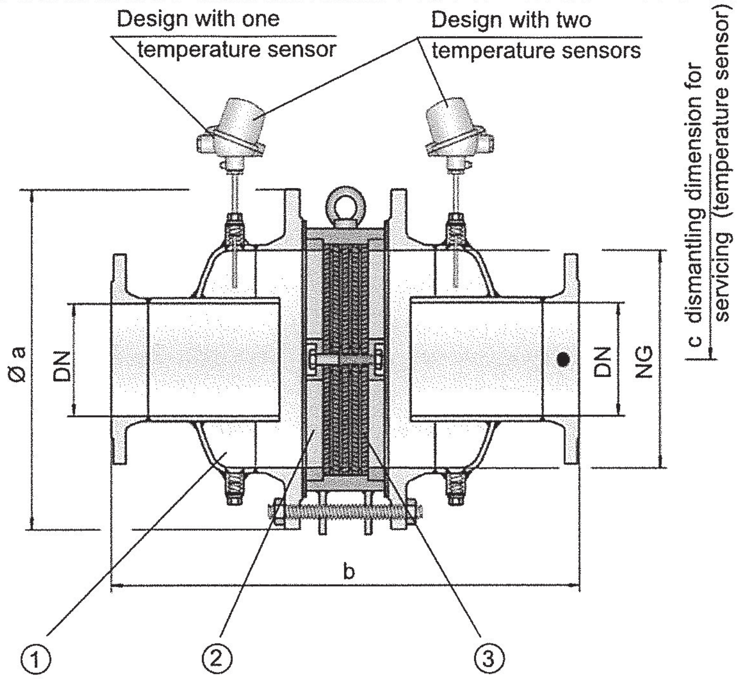
Protego



In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design with shock tube, bidirectional

PROTEGO® DA-SB



● Connection to the protected side (only for type DA-SB-T-...)

Function and Description

The in-line detonation flame arresters type PROTEGO® DA-SB are the newest generation of flame arresters. On the basis of fluid dynamic, explosion dynamics calculation and decades of experience from field tests, a product line was developed that offers minimum pressure loss and maximum safety. The flame arrester uses the *Shock Wave Guide Tube Effect (SWGTE)* to separate the flame front and shock wave. The result is an in-line detonation arrester without a classic shock absorber; in addition the use of FLAMEFILTER® discs is minimized.

The devices are symmetrical and offer bidirectional flame arresting for deflagrations and stable detonations. The arrester essentially consists of two housing parts with an integrated shock tube (1) and the PROTEGO® flame arrester unit (2) in the center. The PROTEGO® flame arrester unit is modular and consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® cage. The number of FLAMEFILTER® discs and their gap size depends on the arrester's conditions of use.

By indicating the operating parameters such as temperature, pressure and explosion group, and the composition of the fluid, the optimum detonation arrester can be selected from a series of approved devices. The PROTEGO® DA-SB flame arresters are available for all explosion groups.

The standard design can be used up to an operating temperature of +60°C / 140°F and an absolute operating pressure up to 1.1 bar / 15.9 psi. Numerous devices with special approval can be obtained for higher presssures (see table 3) and higher temperatures.

Type-approved in accordance with the current ATEX Directive and EN ISO 16852 as well as other international standards.

Special Features and Advantages

- optimized performance from the patented *Shock Wave Guide Tube Effect (SWGTE)*
- less number of FLAMEFILTER® discs from the use of the patented shock tube *(SWGTE)*
- modular flame arrester unit enables each individual FLAMEFILTER® discs to be replaced and cleaned
- different series allow increase of FLAMEFILTER® size for given flange connection resulting in lower pressure drop across the device
- service-friendly design
- expanded application range for higher operating temperatures and pressures
- bidirectional operation as well as any direction of flow and installation position
- installation of temperature sensors are possible
- minimum pressure loss and associated low operating and life-cycle cost
- cost efficient spare parts

Design Types and Specifications

There are four different designs available:

Basic in-line detonation flame arrester	**DA-SB - [–] - [–]**
In-line detonation flame arrester with integrated temperature sensor* as additional protection against short time burning from one side	**DA-SB - [T] - [–]**
In-line detonation flame arrester with two integrated temperature sensors* for additional protection against short time burning from both sides	**DA-SB-[TB] - [–]**
In-line detonation flame arrester with heating jacket	**DA-SB - [H] - [ ]**

Additional special flame arresters upon request

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)

Table 1: Dimensions — Dimensions in mm / inches

To select nominal width/nominal size (NG/DN) - combination, please use the flow capacity charts on the following pages

Additional nominal width/nominal size (NG/DN) - combinations for improved flow capacity upon request

standard (special sizes up to NG 2000/80“, DN 1000/40“ available)

NG		150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1000 40"	1200 48"	1600 64"
DN		≤ 50 2“	65, 80 2 ½“, 3“	≤ 100 4“	≤ 150 6“	≤ 200 8“	≤ 250 10“	≤ 300 12“	≤ 350 14“	≤ 400 16“	≤ 500 20“	≤ 600 24“	800 32“
a		285 / 11.22	285 / 11.22	340 / 13.39	445 / 17.52	565 / 22.24	670 / 26.38	780 / 30.71	895 / 35.24	1015 / 39.96	1230 / 48.43	1455 / 57.28	1915 / 75.39
b	IIA-P1,1	388 / 15.28	388 / 15.28	476 / 18.74	626 / 24.65	700 / 27.56	800 / 31.50*	1000 / 39.37*	1200 / 47.24	1400 / 55.12	1600 / 62.99	1800 / 70.87	2200/ 86.61**
b	IIA-P1,4-X3	400 / 15.75	400 / 15.75	488 / 19.21	626 / 24.65	724 / 28.50	800 / 31.50	1000 / 39.37	1200 / 47.24	1400 / 55.12			
b	IIB3-P1,1	400 / 15.75	412 / 16.22	500 / 19.69	650 / 25.59	724 / 28.50	824 / 32.44	1000 / 39.37	1200 / 47.24	1400 / 55.12	1600 / 62.99	1800 / 70.87	
b	IIB3-P1,4-X3	412 / 16.22	412 / 16.22	512 / 20.16	650 / 25.59	724 / 28.50	824 / 32.44	1000 / 39.37	1200 / 47.24	1400 / 55.12			
b	IIC-P1,1	400 / 15.75	400 / 15.75	500 / 19.69	638 / 25.12	700 / 27.56	788 / 31.02	1000 / 39.37***	1200 / 47.24***	1400 / 55.12***			
c		500 / 19.69	500 / 19.69	520 / 20.47	570 / 22.44	620 / 24.41	670 / 26.38	720 / 28.35	770 / 30.31	820 / 32.28	950 / 37.40	1050 / 41.34	1250 / 49.21

* dimension b only for P1.4 / 20.3

** dimension b only for P1.2 / 17.4

*** EN 12874

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	
> 0,90 mm	IIA	D	Special approvals upon request
≥ 0,65 mm	IIB3	C	
< 0,50 mm	IIC	B	

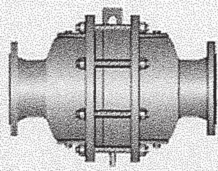
Table 3: Selection of max. operating pressure

		NG	150 6“	150 6“	200 8“	300 12“	400 16“	500 20“	600 24“	700 28“	800 32“	1000 40“	1200 48“	1600 64“
		DN	≤ 50 2“	65, 80 2 ½“, 3“	≤ 100 4“	≤ 150 6“	≤ 200 8“	≤ 250 10“	≤ 300 12“	≤ 350 14“	≤ 400 6“	≤ 500 20“	≤ 600 24“	800 32“
Expl. Gr.	IIA	P_{max}	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	1.4 / 20.3	1.4 / 20.3	1.4 / 20.3	1.1 / 15.9	1.1 / 15.9	1.2 / 17.4
Expl. Gr.	IIB3	P_{max}	1.4 / 20.3	1.4 / 20.3	1.4 / 20.3	1.8 / 26.1	1.8 / 26.1	1.8 / 26.1	1.8 / 26.1	1.4 / 20.3	1.4 / 20.3	1.1 / 15.9	1.1 / 15.9	
Expl. Gr.	IIC	P_{max}	2.2 / 31.9	2.2 / 31.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / * 15.9	1.1 / * 15.9	1.1 / * 15.9			

P_{max} = maximum allowable operating pressure in bar / psi absolut, higher operating pressure upon request

in-between size up to P_{max} upon request

* capacity charts upon request



In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design with shock tube, bidirectional

PROTEGO® DA-SB

Table 4: Specification of max. operating temperature			
≤ 60°C / 140°F	≤ 200°C / 392°F	Tmaximum allowable operating temperature in °C	higher operating temperatures upon request
-	X3	Designation	

Table 5: Material selection for housing				
Design	A	B	C	The housing is also available in Steel with ECTFE coating.
Housing Heating jacket (DA-SB-(T)-H-...)	Steel Steel	Stainless Steel Stainless Steel	Hastelloy Stainless Steel	
Gasket	PTFE	PTFE	PTFE	
Flame arrester unit	A, B	B, C, D	D	

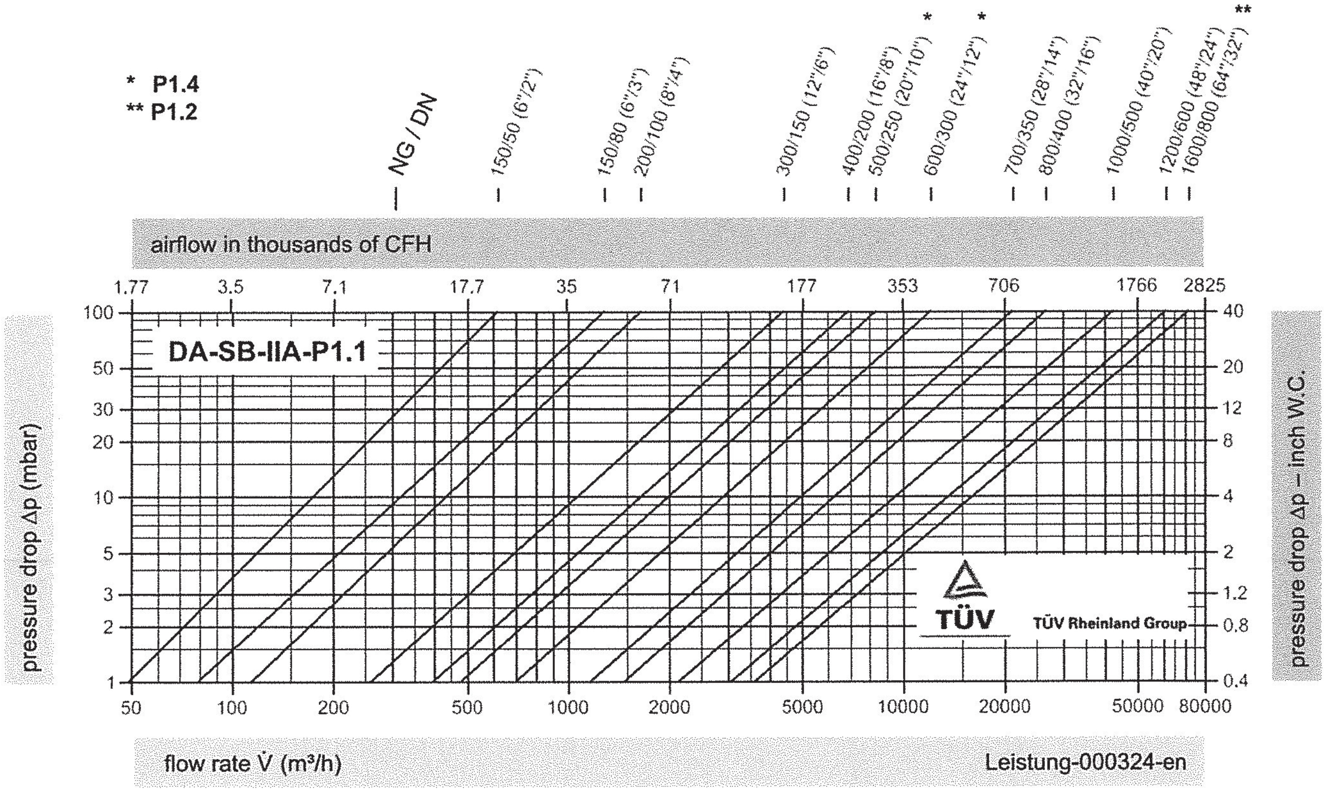
Special materials upon request

Table 6: Material combinations of the flame arrester unit					
Design	A	B	C	D	*the FLAMEFILTER® are also available in the materials Tantalum, Inconel, Copper, etc. when the listed housing and cage materials are used.
FLAMEFILTER® cage	Steel	Stainless Steel	Stainless Steel	Hastelloy	
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	

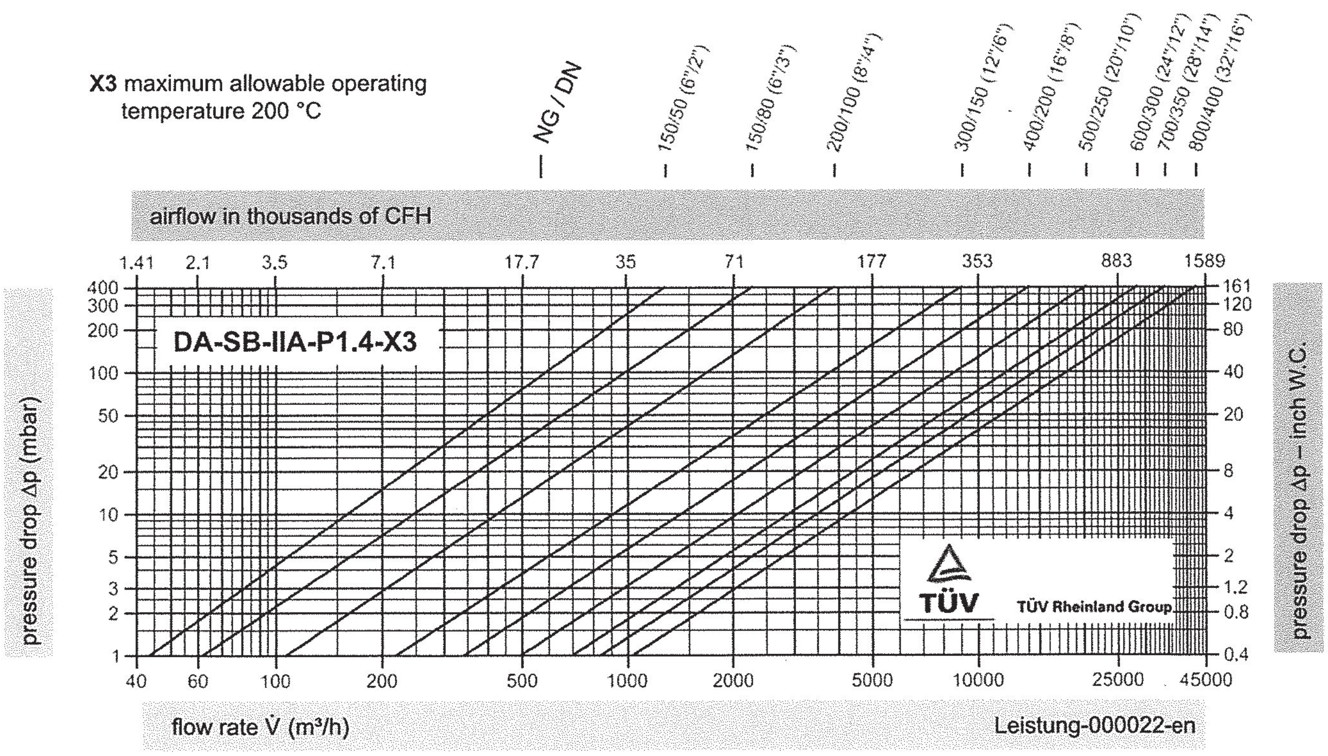
Special materials upon request

Table 7: Flange connection type	
EN 1092-1; Form B1	other types upon request
ASME B16.5; 150 lbs RFSF	

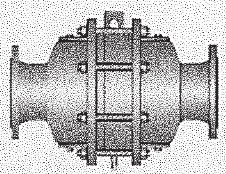
* P1.4
** P1.2



X3 maximum allowable operating temperature 200 °C



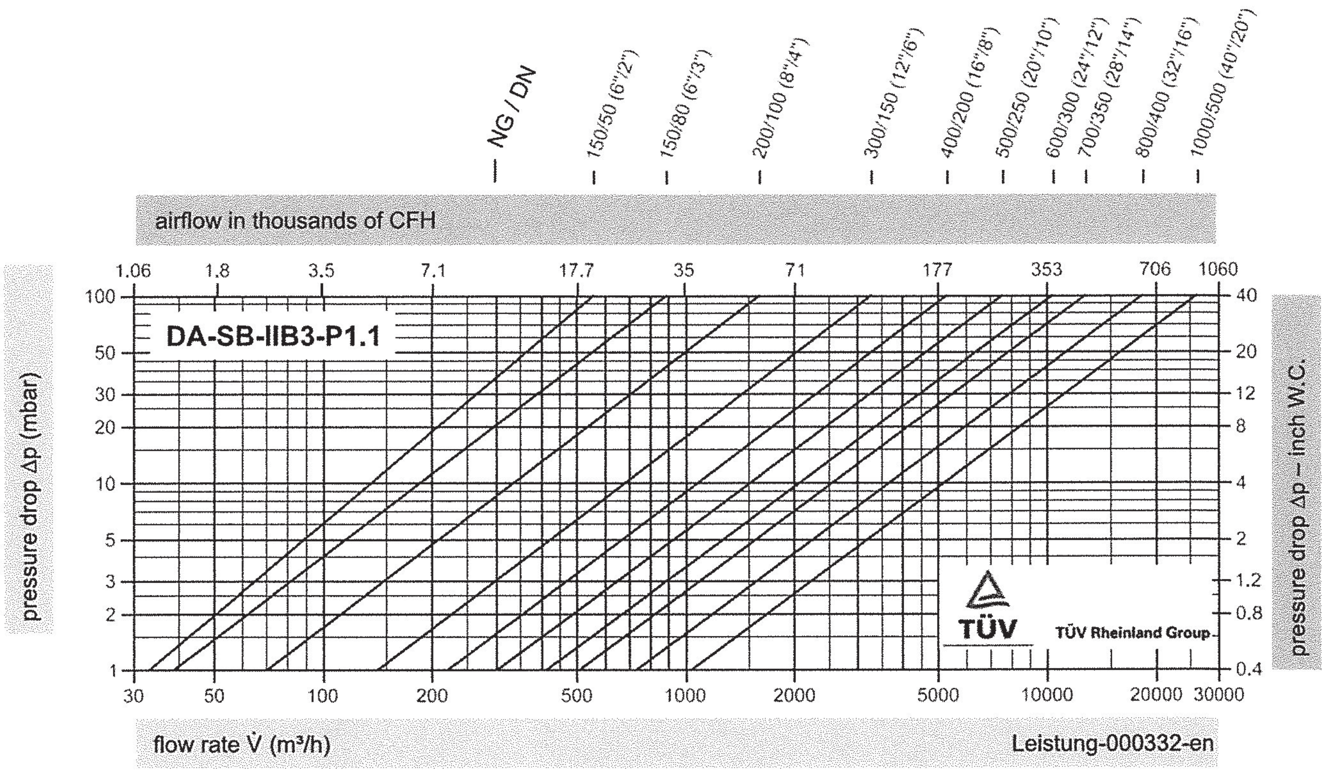
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.
Volume flow V̇ in (m³/h) and CFH refer to the standard reference conditions of air ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Vol. 1: "Technical Fundamentals".



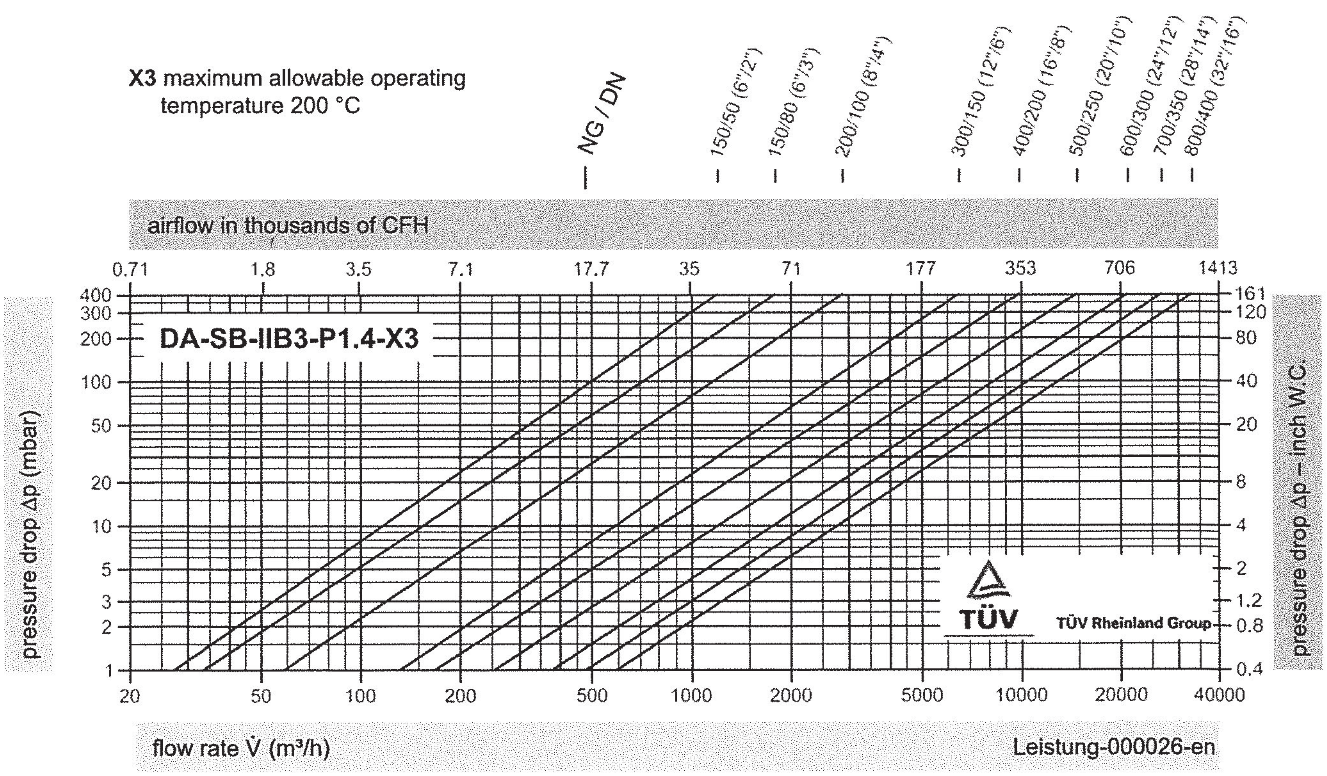
In-Line Detonation Flame Arrester

Flow Capacity Charts

PROTEGO® DA-SB



X3 maximum allowable operating temperature 200 °C



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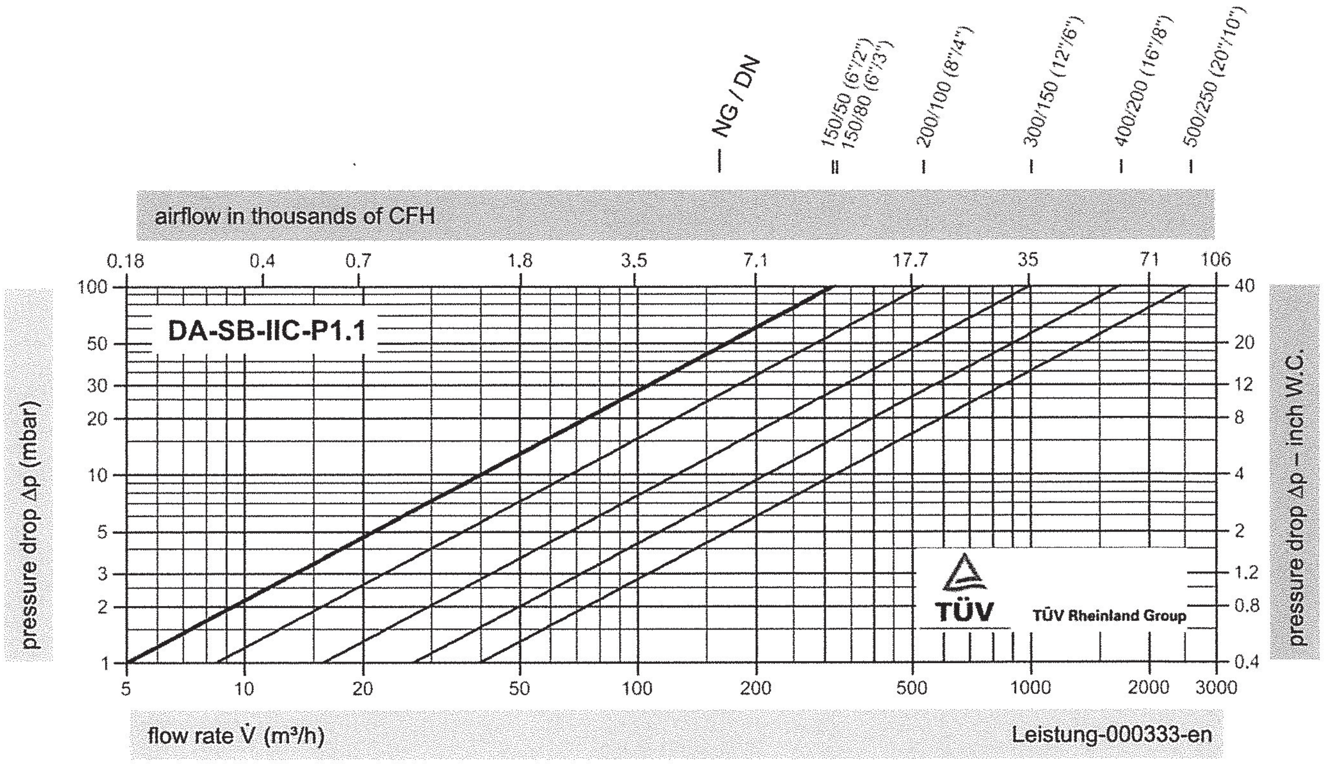
Conversion to other densities and temperatures refer to Vol. 1: "Technical Fundamentals".


NG / DN
150/50 (6"/2")
150/80 (6"/3")
200/100 (8"/4")
300/150 (12"/6")
400/200 (16"/8")
500/250 (20"/10")
airflow in thousands of CFH
0.18
0.4
0.7
1.8
3.5
7.1
17.7
35
71
106
DA-SB-IIC-P1.1
pressure drop Δp (mbar)
100
50
30
20
10
5
3
2
1
pressure drop Δp – inch W.C.
40
20
12
8
4
2
1.2
0.8
0.4
TÜV
TÜV Rheinland Group
5
10
20
50
100
200
500
1000
2000
3000
flow rate V̇ (m³/h)
Leistung-000333-en

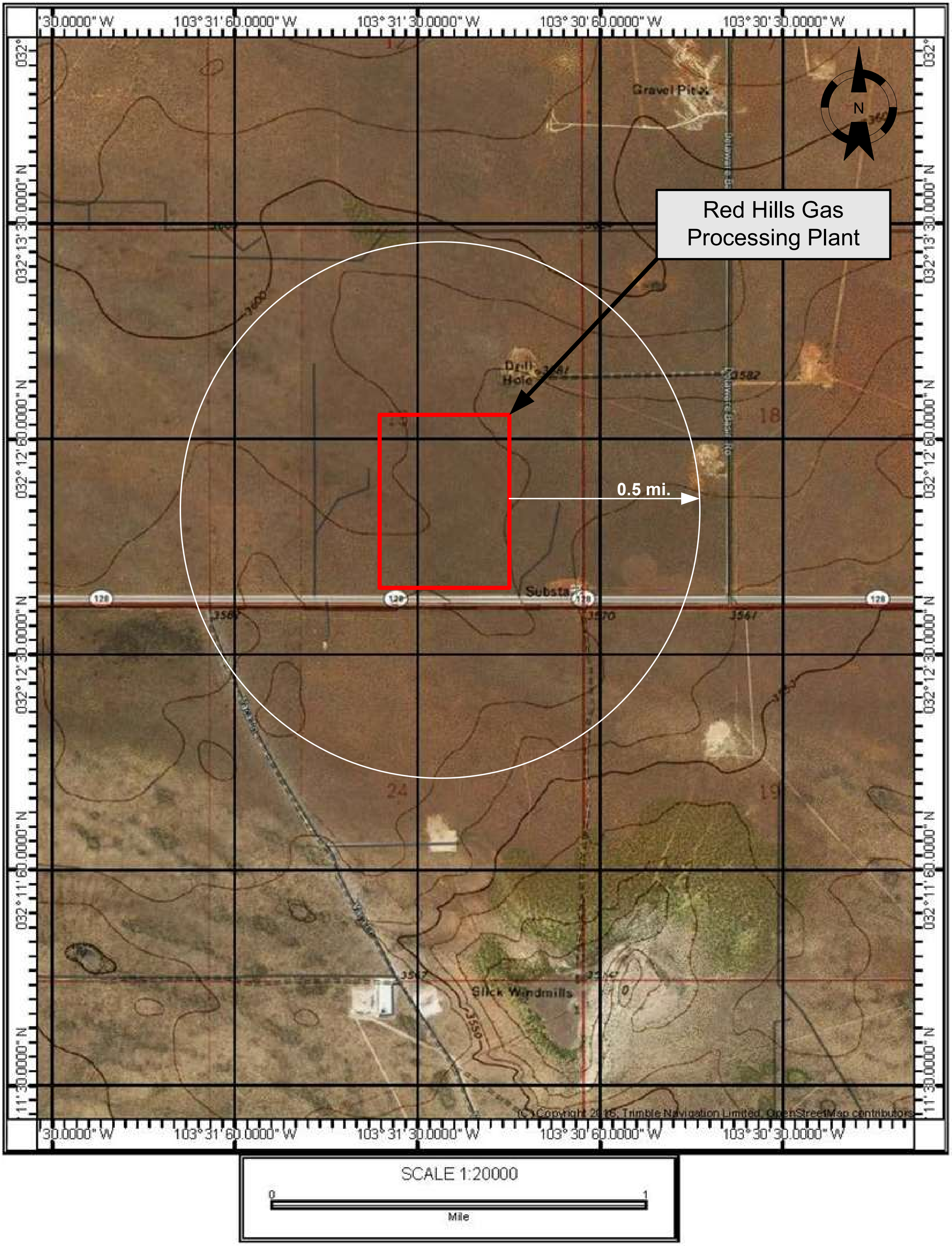
Section 8

Map(s)

A map such as a 7.5 minute topographic quadrangle showing the exact location of the source. The map shall also include the following:

The UTM or Longitudinal coordinate system on both axes	An indicator showing which direction is north
A minimum radius around the plant of 0.8km (0.5 miles)	Access and haul roads
Topographic features of the area	Facility property boundaries
The name of the map	The area which will be restricted to public access
A graphical scale	

A map is attached to this application.



ALLIANT ENVIRONMENTAL, LLC	**Area Map**	**Lucid Energy Delaware, LLC**

Scale:	Drawn by:	Date:		Project No.:	File Name:	Figure:
1:20,000	MDF	10/29/2021	**Red Hills Gas Processing Plant** N 32° 12' 38" Latitude W 103° 31' 26" Longitude	097-013	**Red Hills Area Map**	Section 8
	Chk'd by:	Date:				

Section 9

Proof of Public Notice

(for NSR applications submitting under 20.2.72 or 20.2.74 NMAC)
(This proof is required by: 20.2.72.203.A.14 NMAC "Documentary Proof of applicant's public notice")

Public notice is not required for this application as this is a Title V renewal application.

Section 10

Written Description of the Routine Operations of the Facility

A written description of the routine operations of the facility. Include a description of how each piece of equipment will be operated, how controls will be used, and the fate of both the products and waste generated. For modifications and/or revisions, explain how the changes will affect the existing process. In a separate paragraph describe the major process bottlenecks that limit production. The purpose of this description is to provide sufficient information about plant operations for the permit writer to determine appropriate emission sources.

The Red Hills Gas Processing Plant is an existing natural gas processing plant located in Lea County, NM. The primary function of the plant is to remove CO_2 and water from sweet field gas so that the gas can meet pipeline specifications. The plant has been designated a primary Standard Industrial Classification (SIC) Code of 1311.

The gas will be treated to remove acid gases (H_2S and CO_2) dehydrated to remove water and processed to remove C2+ hydrocarbons from the gas stream. Several plant systems will be involved to perform these functions.

Slug Catcher / Separator
A slug catcher has been installed at the front of Train 1 to catch and separate any free hydrocarbon liquids and water present in the inlet pipeline gas stream. It is capable of handling large slugs of liquid brought into the plant from pipeline pigging operations. This equipment acts as a three-phase separator to separate the free hydrocarbons, gas to be processed, and any water that may condensed in the pipeline after field dehydration. A separate inlet system consisting of a series of separators and slug catchers will be associated with Train 2, and Train 3, 4, 5, and 6.

Propane Refrigeration
The propane refrigeration system works in tandem with the overhead stabilization system to remove heavier hydrocarbons in the gas stream in order to increase cryogenic efficiencies later in the process. Typically, the gas stream is refrigerated to just above -200°F and C4+ components are dropped out of the process gas in varying efficiencies so the cryogenic equipment can concentrate on the lighter C2 and C3 components.

Stabilizer Overhead / Compressor
The overhead stabilization system is in place to assist in increasing plant efficiencies of Natural Gas Liquid (NGL) production and to lower the Reid Vapor Pressure (RVP) of the pipeline liquids and condensate after they are dropped out of the gas stream. Through a process that chills and compresses the gas from the inlet system, remaining vapors are separated off the refrigeration stream and are processed so the RVP is lowered to 9. Both the condensate from the refrigeration section of the plant and the hydrocarbon liquids out of the slug catcher are combined, stabilized, and sent to the tank farm for truck or pipeline sales. Any remaining vapors are recycled back to the front of the stabilization process. The liquid in the tank farm is then stable and thus, does not give off significant vapors. The tank farm is equipped with a fuel gas blanket for further protection.

Amine Treating
The amine units are designed to remove CO_2 and H_2S from the natural gas stream to meet pipeline specifications. In addition, carbon dioxide can freeze in the cryogenic unit, forming dry ice and forcing the shutdown of the facility. Amine treating is an exothermic chemical reaction process. The treating solution is a mixture of RO water and approximately 28-35% DEA (diethanolamine). This aqueous mixture is regenerated and reused. Lean DEA solution is pumped to the top of the contactor and allowed to flow downward. Wet gas is fed into the bottom of the contactor and flows upward. As the lean DEA solution flows down through the contactor, it comes into contact with the wet gas. The CO_2 reacts with the amine to form an amine carbonate. The reacted amine, known as “sour” or “rich” amine, and the processed (“sweet”) gas continues to the dehydration system. Emissions from amine units 1-EP-4 and 2-EP-4 are controlled by the thermal oxidizer unit EP-5. Emissions from amine units 2.5-EP-4 and 5.5-EP-1d are controlled by Acid Gas Injection Wells (AGI) #1 and #2, respectively. During AGI compressor downtime, the controlled emissions are handled by Emergency AGI Flares, units 2.5-EP-5 and 5.5-EP-1b. Emissions from amine unit, 3-EP-4, are routed to the thermal oxidizer unit, EP-6. Emissions from amine unit, 4-EP-4, are routed to the thermal oxidizer unit, EP-8. Emissions from amine units, 5-EP-1f and 6-EP-1f, are routed to the thermal oxidizer unit, EP-10.

Hot Oil System

The hot oil system at the plant is used to provide heat to certain processes within the facility. The system will circulate hot oil and deliver 50.0 MMBTU/hr to other processes. It consists of the following components:

- Natural Gas-Fired Heater – This provides heat input into the system by burning natural gas and circulating the oil through the heater. The heater also has a convection section that assists in heating the regeneration gas for the molecular sieves.
- Hot Oil Pumps – These pumps circulate the required amount of hot oil through the system.
- Hot Oil Surge Tank – This tank provides expansion volume for the system. As the system heats up, the liquid will expand. This tank allows for the liquid to expand without spilling out of the system.
- Heat Exchangers – A series of exchangers, mainly the amine reboilers, glycol reboilers and regeneration gas heat exchangers that remove heat from the hot oil system and transfer it to the respective process.

Glycol Dehydration

Triethylene glycol (TEG) dehydration is used to remove water from the natural gas stream and is accomplished by reducing the inlet water dew point (temperature at which vapor begins to condense into a liquid) to the outlet dew point temperature which will contain a specified amount of water. Water vapor is absorbed by the TEG solution. The wet gas is brought into contact with dry "lean" glycol in a countercurrent contactor tower. Water vapor is absorbed in the glycol and consequently, its dew point reduces. Wet gas passing through the contactor tower is dehydrated, then passed to the mol sieves. The wet (or "rich") glycol then flows from the absorber to a regeneration system in which it is partially decompressed, then heated to remove water vapor, resulting in "lean" glycol that is reintroduced to the contactor tower. Emissions from glycol dehydrator units, 1-EP-3, and 2a-EP-3, are controlled by thermal oxidizer unit, EP-5. Emissions from the other glycol dehydrator units, 3-EP-3, and 4-EP-3, are controlled by thermal oxidizer units, EP-6, and EP-8, respectively. Emissions from glycol dehydrator units, 5-EP-1e and 6-EP-1e, are controlled by thermal oxidizer, EP-10.

Molecular Sieve Dehydration

Molecular sieve dehydration is used upstream of the cryogenic units to achieve a gas stream dew point of -150°F. The process uses two molecular sieve vessels with one vessel in service absorbing moisture from the gas stream and the other vessel in the regeneration mode. During the regeneration mode, hot, dry gas (regen gas) is passed up through the vessel to drive off the absorbed moisture from the molecular sieve. The gas comes from the discharge of the residue compressors, and it is passed through a heat exchanger (heated by hot oil) and a heater to achieve a temperature of approximately 500°F. After the gas passes through the bed, it is cooled in an air-cooled exchanger. The water in the gas condenses and is separated from the gas stream in a separator. The regen gas can be routed to the sales gas stream, depending on the water content of the gas.

Cryogenic Unit

The cryogenic unit is designed to liquefy natural gas components from the sweet, dehydrated inlet gas by removing work (heat) from the gas by means of the turbo expander. The cryogenic unit recovers natural gas liquids (NGL) by cooling the gas stream to extremely cold temperatures (-150°F and lower) and condensing components such as ethane, propane, butanes and heavier. The gas is cooled by a series of heat exchangers and by rapidly lowering the pressure of the gas from around 760 PSIG to approximately 190 PSIG. Once the gas has passed through the system of heat exchangers and expansion, it is re-compressed using the energy obtained from expanding the gas. The gas is sent to residue compressors and pipelined out of the facility. In case the compressors are shut in, the gas is temporarily sent to the emergency flares.

Storage and Loading Operations

The natural gas liquids will be stored in up to five pressurized 90,000-gallon tanks, also called bullets. These tanks are not a source of regulated pollutants. The tank loading will take place via a pressurized, closed loop system. Unloading is done directly into a pipeline. The controls for tanks are listed below:

- Condensate tanks 1-T-1 through 1-T-6 are controlled by the enclosed combustion devices, EP-7
- Sour slop tanks, 2-T-1, and 2-T-2, are controlled by the sour slop tank control flare, EP-9
- Condensate tanks 3-T-1 through 3-T-6, are controlled by the enclosed combustion devices, EP-10
- Sour Water tanks 4-T-1 and 4-T-2 are controlled by the sour slop tank control flare, EP-13.

Flares

The plant flares are used during startup, shutdown, maintenance and upset conditions. The only steady state operations associated with these flares are from the pilot and purge gas streams. SSM emissions from the plant flare result from maintenance activities per manufacturer-recommended or other preventative maintenance schedules. These maintenance activities include, but are not limited to compressor catalyst changes, blowdowns for associated maintenance throughout the facility, instrument calibrations, and process safety device maintenance.

Emergency AGI Flare

When the AGI well is inoperable due to maintenance or upset conditions, acid gas will be flared for limited periods at the acid gas flare. Under startup, shutdown, maintenance, and upset conditions the AGI well could be offline. During times when the AGI well is down, the sour gas will be sent to the acid gas flare. The AGI Flare units, 2.5-EP-5 and 5.5-EP-5 will also control in-condensable and flash tank emissions from the amine vent units, 2.5-EP-4, and 5.5-EP-5.

Section 11

Source Determination

Source submitting under 20.2.70, 20.2.72, 20.2.73, and 20.2.74 NMAC

Sources applying for a construction permit, PSD permit, or operating permit shall evaluate surrounding and/or associated sources (including those sources directly connected to this source for business reasons) and complete this section. Responses to the following questions shall be consistent with the Air Quality Bureau's permitting guidance, Single Source Determination Guidance, which may be found on the Applications Page in the Permitting Section of the Air Quality Bureau website.

Typically, buildings, structures, installations, or facilities that have the same SIC code, that are under common ownership or control, and that are contiguous or adjacent constitute a single stationary source for 20.2.70, 20.2.72, 20.2.73, and 20.2.74 NMAC applicability purposes. Submission of your analysis of these factors in support of the responses below is optional, unless requested by NMED.

A. Identify the emission sources evaluated in this section (list and describe)**:**

B. Apply the 3 criteria for determining a single source:

SIC Code: Surrounding or associated sources belong to the same 2-digit industrial grouping (2-digit SIC code) as this facility, OR surrounding or associated sources that belong to different 2-digit SIC codes are support facilities for this source.

☑**Yes** ☐ **No**

Common Ownership or Control: Surrounding or associated sources are under common ownership or control as this source.

☑ **Yes** ☐ **No**

Contiguous or Adjacent: Surrounding or associated sources are contiguous or adjacent with this source.

☑ **Yes** ☐ **No**

C. Make a determination:

☑ The source, as described in this application, constitutes the entire source for 20.2.70, 20.2.72, 20.2.73, or 20.2.74 NMAC applicability purposes. If in "A" above you evaluated only the source that is the subject of this application, all "**YES**" boxes should be checked. If in "A" above you evaluated other sources as well, you must check **AT LEAST ONE** of the boxes "**NO**" to conclude that the source, as described in the application, is the entire source for 20.2.70, 20.2.72, 20.2.73, and 20.2.74 NMAC applicability purposes.

☐ The source, as described in this application, **does not** constitute the entire source for 20.2.70, 20.2.72, 20.2.73, or 20.2.74 NMAC applicability purposes (A permit may be issued for a portion of a source). The entire source consists of the following facilities or emissions sources (list and describe):

Section 12

Section 12.A

PSD Applicability Determination for All Sources

(Submitting under 20.2.72, 20.2.74 NMAC)

This section is not applicable as this is a Title V renewal application submitted under 20.2.70 NMAC.

Section 13

Determination of State & Federal Air Quality Regulations

This section lists each state and federal air quality regulation that may apply to your facility and/or equipment that are stationary sources of regulated air pollutants.

Not all state and federal air quality regulations are included in this list. Go to the Code of Federal Regulations (CFR) or to the Air Quality Bureau's regulation page to see the full set of air quality regulations.

Required Information for Specific Equipment:
For regulations that apply to specific source types, in the 'Justification' column **provide any information needed to determine if the regulation does or does not apply**. **For example**, to determine if emissions standards at 40 CFR 60, Subpart IIII apply to your three identical stationary engines, we need to know the construction date as defined in that regulation; the manufacturer date; the date of reconstruction or modification, if any; if they are or are not fire pump engines; if they are or are not emergency engines as defined in that regulation; their site ratings; and the cylinder displacement.

Required Information for Regulations that Apply to the Entire Facility:
See instructions in the 'Justification' column for the information that is needed to determine if an 'Entire Facility' type of regulation applies (e.g. 20.2.70 or 20.2.73 NMAC).

Regulatory Citations for Regulations That Do Not, but Could Apply:
If there is a state or federal air quality regulation that does not apply, but you have a piece of equipment in a source category for which a regulation has been promulgated, you must **provide the low level regulatory citation showing why your piece of equipment is not subject to or exempt from the regulation. For example** if you have a stationary internal combustion engine that is not subject to 40 CFR 63, Subpart ZZZZ because it is an existing 2 stroke lean burn stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions, your citation would be 40 CFR 63.6590(b)(3)(i). **We don't want a discussion of every non-applicable regulation, but if it is possible a regulation could apply, explain why it does not. For example,** if your facility is a power plant, you do not need to include a citation to show that 40 CFR 60, Subpart OOO does not apply to your non-existent rock crusher.

Regulatory Citations for Emission Standards:
For each unit that is subject to an emission standard in a source specific regulation, such as 40 CFR 60, Subpart OOO or 40 CFR 63, Subpart HH, include the low level regulatory citation of that emission standard. Emission standards can be numerical emission limits, work practice standards, or other requirements such as maintenance. **Here are examples:** a glycol dehydrator is subject to the general standards at 63.764C(1)(i) through (iii); an engine is subject to 63.6601, Tables 2a and 2b; a crusher is subject to 60.672(b), Table 3 and all transfer points are subject to 60.672(e)(1)

Federally Enforceable Conditions:
All federal regulations are federally enforceable. All Air Quality Bureau State regulations are federally enforceable except for the following: affirmative defense portions at 20.2.7.6.B, 20.2.7.110(B)(15), 20.2.7.11 through 20.2.7.113, 20.2.7.115, and 20.2.7.116; 20.2.37; 20.2.42; 20.2.43; 20.2.62; 20.2.63; 20.2.86; 20.2.89; and 20.2.90 NMAC. Federally enforceable means that EPA can enforce the regulation as well as the Air Quality Bureau and federally enforceable regulations can count toward determining a facility's potential to emit (PTE) for the Title V, PSD, and nonattainment permit regulations.

INCLUDE ANY OTHER INFORMATION NEEDED TO COMPLETE AN APPLICABILITY DETERMINATION OR THAT IS RELEVENT TO YOUR FACILITY'S NOTICE OF INTENT OR PERMIT.

EPA Applicability Determination Index for 40 CFR 60, 61, 63, etc: http://cfpub.epa.gov/adi/

Table for State Regulations:

State Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification: (You may delete instructions or statements that do not apply in the justification column to shorten the document.)
20.2.1 NMAC	General Provisions	Yes	Facility	General Provisions apply to Notice of Intent, Construction, and Title V permit applications.
20.2.3 NMAC	Ambient Air Quality Standards NMAAQS	Yes	Facility	This site is in compliance with the Federal and New Mexico ambient air quality standards. Air dispersion modeling was completed for the July 2019 NSR permit application.
20.2.7 NMAC	Excess Emissions	Yes	Facility	This regulation establishes requirements for the facility if operations at the facility result in any excess emissions. The owner or operator will operate the source at the facility having an excess emission, to the extent practicable, including associated air pollution control equipment, in a manner consistent with good air pollution control practices for minimizing emissions. The facility will notify the NMED of any excess emission per 20.2.7.110 NMAC.
20.2.23 NMAC	Fugitive Dust Control	No	N/A	This regulation may apply if, this is an application for a notice of intent (NOI) per 20.2.73 NMAC, if the activity or facility is a fugitive dust source listed at 20.2.23.108.A NMAC, **and** if the activity or facility is located in an area subject to a mitigation plan pursuant to 40 CFR 51.930. As of January 2019, the only areas of the State subject to a mitigation plan per 40 CFR 51.930 are in Doña Ana and Luna Counties. As this site is a permitted facility located in Lea County, NM, this regulation does not apply.
20.2.33 NMAC	Gas Burning Equipment - Nitrogen Dioxide	No	N/A	This facility does not have gas burning equipment with a heat input greater than 1,000,000 MMBtu.
20.2.34 NMAC	Oil Burning Equipment: NO_2	No	N/A	This facility does not have oil burning equipment **(external combustion emission sources, such as oil-fired boilers and heaters)** having a heat input of greater than 1,000,000 million British Thermal Units per year per unit.
20.2.35 NMAC	Natural Gas Processing Plant – Sulfur	Yes	Facility	This regulation establishes sulfur emission standards for natural gas processing plants. The proposed facility meets the definition of a new natural gas processing plant under this regulation and is subject to the requirements of this regulation [20.2.35.7 (B) NMAC]. The facility will comply with all requirements under 20.2.35 NMAC as applicable.
20.2.37 and 20.2.36 NMAC	Petroleum Processing Facilities and Petroleum Refineries	N/A	N/A	**These regulations were repealed by the Environmental Improvement Board. If you had equipment subject to 20.2.37 NMAC before the repeal, your combustion emission sources are now subject to 20.2.61 NMAC.**
20.2.38 NMAC	Hydrocarbon Storage Facility	No	N/A	This regulation could apply to storage tanks at petroleum production facilities, processing facilities, tanks batteries, or hydrocarbon storage facilities. This facility does not meet any of the applicability determinations under 20.2.38 NMAC; therefore, this regulation does not apply.
20.2.39 NMAC	Sulfur Recovery Plant - Sulfur	No	N/A	This regulation could apply to sulfur recovery plants that are **not** part of petroleum or natural gas processing facilities. As this site is a natural gas processing facility, this regulation does not apply.
20.2.50 NMAC	Oil and Gas Sector – Ozone Precursor Pollutants	Yes	EP-7, EP-12, EP-5, EP-6, EP-8, EP-10, FUG (Train 2-4), FUG-1 (Train 1), 1.5-EP-3, 4-EP-3, 5-EP-1e, 6-EP-1e, 1-Load, 3-Load, 4-Load, 5-	113 – The facility does not have any applicable units. Therefore, this regulation does not apply. 114 – This facility has electric engines with reciprocating compressors. Thus, this rule applies to the facility. 115 – The control devices and closed vent systems at this facility are used to comply with the requirements of this rule; therefore, they are subject to the requirements of this rule. 116 – This facility will have equipment leaks and fugitive emissions. Thus, it will comply with this regulation. 117 – This facility is a natural gas processing plant. Thus, it is not subject to this rule.

State Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification: (You may delete instructions or statements that do not apply in the justification column to shorten the document.)
			Load, 1-EP-1, 1.5-EP-1g, 2-EP-1b, 2-EP-1h, 2a-EP-1d, 2.5-EP-1d, 3-EP-1d, 3-EP-1h, 4-EP-1d, 4-EP-1h, 5-EP-1a, 5-EP-1b, 6-EP-1a, 6-EP-1b, 5.5-EP-1a.	118 – This facility has less than 2 tpy VOC emissions. Thus, this rule does not apply to the facility. 119 – This facility has heater and reboiler units with a capacity greater than 20 MMBtu/hr. Therefore, this rule is applicable to this facility. 120 – This facility is connected to a pipeline. Thus, this rule does not apply to the facility. 121 – This facility does not have any pig launching and receiving. Therefore, this facility is not subject to this subpart. 122 – All pneumatic controllers and pumps are air controlled. Thus, the facility is not subject to this rule. 123 – This facility has less than 2 tpy maximum allowable VOC emissions. Thus, it is not subject to this subpart. 124 – The facility does not have any applicable activities. Therefore, this regulation does not apply. 125 – The facility does not qualify for a small business. Thus, this regulation is not applicable. 126 – The facility does not have any applicable activities. Therefore, this regulation does not apply. 127 – The facility does not have any applicable activities. Therefore, this regulation does not apply.
20.2.61.109 NMAC	Smoke & Visible Emissions	Yes	Stationary Combustion Equipment	This regulation that limits opacity to 20% applies to Stationary Combustion Equipment, such as engines, boilers, heaters, and flares unless your equipment is subject to another state regulation that limits particulate matter such as 20.2.19 NMAC (see 20.2.61.109 NMAC). The listed equipment must comply with this regulation.
20.2.70 NMAC	Operating Permits	Yes	Facility	This facility is a Title V major source and operates under Title V permit number P278-M1.
20.2.71 NMAC	Operating Permit Fees	Yes	Facility	If 20.2.70 NMAC applies, then 20.2.71 NMAC applies. All operating permit fees will be paid, as required.
20.2.72 NMAC	Construction Permits	Yes	Facility	This facility is subject to 20.2.72 NMAC and currently operates under NSR permit number 4310-M5.
20.2.73 NMAC	NOI & Emissions Inventory Requirements	Yes	Facility	All facilities that are a Title V Major Source as defined at 20.2.70.7.R NMAC, are subject to Emissions Inventory Reporting.
20.2.74 NMAC	Permits – Prevention of Significant Deterioration (PSD)	Yes	Facility	This facility is a PSD major source and currently operates under NSR permit number 4310-M5.
20.2.75 NMAC	Construction Permit Fees	No	N/A	As this is a Title V permit application, construction permit fees do not apply.
20.2.77 NMAC	New Source Performance	Yes	Units subject to 40 CFR 60	This is a stationary source which is subject to the requirements of 40 CFR Part 60.

State Regulation Citation	Title	Applies ? Enter Yes or No	Unit(s) or Facility	Justification: (You may delete instructions or statements that do not apply in the justification column to shorten the document.)
20.2.78 NMAC	Emission Standards for HAPS	No	N/A	This facility emits hazardous air pollutants but none of which are subject to the requirements of 40 CFR Part 61.
20.2.79 NMAC	Permits – Nonattainment Areas	No	N/A	This facility is not located in a non-attainment area and therefore it is not subject to this regulation.
20.2.80 NMAC	Stack Heights	No	N/A	This regulation establishes requirements for the evaluation of stack heights and other dispersion techniques. This regulation does not apply as all stacks at the facility follow good engineering practice.
20.2.82 NMAC	MACT Standards for source categories of HAPS	Yes	Units Subject to 40 CFR 63	This regulation applies to all sources emitting hazardous air pollutants, which are subject to the requirements of 40 CFR Part 63.

Applicable Federal Regulations:

Federal Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification:
40 CFR 50	NAAQS	No	N/A	The modeling and conditions developed from the modeling are the applicable requirements to demonstration compliance with the NAAQs.
NSPS 40 CFR 60, Subpart A	General Provisions	Yes	Units subject to 40 CFR 60	Applies if any other Subpart in 40 CFR 60 applies.
NSPS 40 CFR60.40a, Subpart Da	Subpart Da, Performance Standards for **Electric Utility Steam Generating Units**	No	N/A	This regulation establishes standards of performance for electric utility steam generating units. This regulation does not apply because the facility does not operate any electric utility steam generating units.
NSPS 40 CFR60.40b Subpart Db	**Electric Utility Steam Generating Units**	No	N/A	This regulation does not apply because the facility does not operate any electric utility steam generating units.

Federal Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification:
40 CFR 60.40c, Subpart Dc	Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units	Yes	1-EP-1, 1.5-EP-1g, 4-EP-1g, 2-EP-1b, 2-EP-1h, 2a-EP-1d, 2.5-EP-1d, EP-5, EP-6, EP-8, 3-EP-1b, 3-EP-1d, 3-EP-1h, 4-EP-1a, 4-EP-1b, 4-EP-1d, 4-EP-1e, 4-EP-1h, 5-EP-1a, 5-EP-1b, 5-EP-1d, 6-EP-1a, 6-EP-1b, 6-EP-1d, 7-EP-1d, 5.5-EP-1a, EP-11	The listed units are steam generating units for which construction, modification or reconstruction is commenced after June 9, 1989 and that have a maximum design heat input capacity of 29 MW (100 MMBtu/hr) or less, but greater than or equal to 2.9 MW (10 MMBtu/hr).
NSPS 40 CFR 60, Subpart 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	No	N/A	Except as provided in paragraph (b) of this section, the affected facility to which this subpart applies is each storage vessel with a storage capacity greater than 151,416 liters (40,000 gallons) that is used to store petroleum liquids for which construction is commenced after May 18, 1978 and prior to July 23, 1984. The condensate tanks at this facility were constructed after July 23, 1984, therefore, this subpart does not apply.
NSPS 40 CFR 60, Subpart Kb	Standards of Performance for **Volatile Organic Liquid Storage Vessels** (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced **After** July 23, 1984	No	1-T-1, 1-T-2, 1-T-3, 1-T-4, 1-T-5, 1-T-6, 3-T-1, 3-T-2, 3-T-3, 3-T-4, 3-T-5, 3-T-6	Except as provided in paragraph (b) of this section, the affected facility to which this subpart applies is each storage vessel with a capacity greater than or equal to 75 cubic meters (m^3) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984. The tanks at this facility have a design capacity greater than or equal to 75 m^3 but less than 151 m^3 storing a liquid with a maximum true vapor pressure more than 15.0 kPa.
NSPS 40 CFR 60.330 Subpart GG	**Stationary Gas Turbines**	No	N/A	There are no turbines onsite; therefore, this regulation does not apply.
NSPS 40 CFR 60, Subpart KKK	Leaks of VOC from **Onshore Gas Plants**	No	N/A	Affected Facility with Leaks of VOC from Onshore Gas Plants. Any affected facility under paragraph (a) of this section that commences construction, reconstruction, or modification after January 20, 1984 and on or before August 23, 2011, is subject to the requirements of this subpart. As this site was constructed after August 23, 2011, Subpart KKK is not applicable.

Federal Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification:
NSPS 40 CFR Part 60 Subpart LLL	Standards of Performance for **Onshore Natural Gas Processing**: SO_2 Emissions	No	N/A	This regulation applies to onshore natural gas processing facilities which commence construction, reconstruction, or modification after January 20, 1984 and on or before August 23, 2011. As this site was constructed after August 23, 2011, Subpart LLL does not apply.
NSPS 40 CFR Part 60 Subpart OOOO	Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution for which construction, modification or reconstruction commenced after August 23, 2011 and before September 18, 2015	Yes	1-EP-4, FUG (Train 1), reciprocating compressors	This regulation establishes emission standards and compliance schedule for the control of volatile organic compounds (VOC) emissions from affected facilities that commence construction, modification, or reconstruction after August 23, 2011 and before September 18, 2015. Since the facility has equipment that was constructed or modified after August 23, 2011 and before September 18, 2015, pneumatic devices and equipment leaks are subject to this regulation. Amine Units, reciprocating compressors, and fugitive equipment leaks constructed between August 24, 2011 and September 18, 2015 are subject to this regulation. The owner will comply with any applicable requirements under this subpart. Some of the condensate tanks at the facility are pressurized and do not meet the definition of a storage vessel in this regulation. All atmospheric condensate storage tanks are exempt from this regulation as they have less than 6 tpy VOC per affected unit. [40 CFR 60.5395]. Sweetening units located at onshore natural gas processing plants are an affected unit. [40 CFR 60.5365(g)(1)]. Leak standards will apply to new and modified units at this facility as per [40 CFR 60.5400]. The pneumatic devices located at the facility will not be continuous gas bleed and therefore will not have applicable requirements under this regulation [40 CFR 60.5365(d)(3)]. This facility uses pneumatic air devices.
NSPS 40 CFR Part 60 Subpart OOOOa	Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced **After** September 18, 2015	Yes	2-EP-4, 2.5-EP-4, 3-EP-4, 4-EP-4, 5-EP-1f, 6-EP-1f, FUG (Train 2-4), FUG-1	This regulation applies to amine units and fugitive equipment leaks which commenced construction after September 18, 2015. Some of the condensate tanks at the facility are pressurized and do not meet the definition of a storage vessel in this regulation. All atmospheric condensate storage tanks are exempt from this regulation as they have less than 6 tpy VOC per affected unit. [40 CFR 60.5365a].
NSPS 40 CFR 60 Subpart IIII	Standards of performance for Stationary Compression Ignition Internal Combustion Engines	No	N/A	Not applicable as there are no compression ignition engines included in this permit.
NSPS 40 CFR Part 60 Subpart JJJJ	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines	Yes	1-Gen-1	This regulation establishes standards of performance for stationary spark ignition internal combustion engines. The Caterpillar CG137 engine, unit 1-GEN-1, at this facility is subject to NSPS JJJJ as it commenced construction after June 12, 2006 and was manufactured on or after July 1, 2007 [§60.4230(a)(4)(i)].
NSPS 40 CFR 60 Subpart TTTT	Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units	No	N/A	The facility does not operate an affected source under this subpart.

Federal Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification:
NSPS 40 CFR 60 Subpart UUUU	Emissions Guidelines for Greenhouse Gas Emissions and Compliance Times for Electric Utility Generating Units	No	N/A	The facility does not operate an affected source under this subpart.
NSPS 40 CFR 60, Subparts WWW, XXX, Cc, and Cf	Standards of performance for Municipal Solid Waste (MSW) Landfills	No	N/A	This facility is not an MSW landfill.
NESHAP 40 CFR 61 Subpart A	General Provisions	No	N/A	NSPS 40 CFR 61 does not apply to the facility because the facility does not emit or have the triggering substances on site and/or the facility is not involved in the triggering activity. The facility is not subject to this regulation. None of the subparts of Part 61 apply to the facility.
NESHAP 40 CFR 61 Subpart E	National Emission Standards for **Mercury**	No	N/A	The provisions of this subpart are applicable to those stationary sources which process mercury ore to recover mercury, use mercury chlor-alkali cells to produce chlorine gas and alkali metal hydroxide, and incinerate or dry wastewater treatment plant sludge. This facility is not involved in these activities. This regulation does not apply.
NESHAP 40 CFR 61 Subpart V	National Emission Standards for **Equipment Leaks** (Fugitive Emission Sources)	No	N/A	This regulation establishes national emission standards for equipment leaks (fugitive emission sources). The facility does not have equipment that operates in volatile hazardous air pollutant (VHAP) service [40 CFR Part 61.240]. The regulated activities subject to this regulation do not take place at this facility. The facility is not subject to this regulation.
MACT 40 CFR 63, Subpart A	General Provisions	Yes	Units Subject to 40 CFR 63	Applies if any other Subpart in 40 CFR 63 applies.
MACT 40 CFR 63.760 Subpart HH	**Oil and Natural Gas Production Facilities**	**Yes**	1-EP-3, 2a-EP-3, 3-EP-3, 4-EP-3, 5-EP-1e, 6-EP-1e, FUG, FUG-1	This regulation establishes national emission standards for hazardous air pollutants from oil and natural gas production facilities. The facility is a major source of HAPs and meets the definition of a natural gas processing plant. The dehydrators will have a natural gas flow rate equal to or greater than 85 thousand standard cubic feet. The dehydrators that comply with the 1 tpy control option under 63.765(b)(1)(ii) are considered large dehydrators under MACT HH. The units will comply with applicable closed vent and control requirements, along with monitoring, recordkeeping, and reporting requirements, as applicable. Fugitive components must comply with requirements under NSPS Subpart OOOO or OOOOa but there are still some reporting requirements that may apply under MACT Subpart HH. The owner will comply with any applicable requirements under Subpart HH for this site.
MACT 40 CFR 63 Subpart HHH	National Emissions Standards for Hazardous Air Pollutants from **Natural Gas Transmission and Storage facilities**	No	N/A	This subpart applies to owners and operators of natural gas transmission and storage facilities that transport or store natural gas prior to entering the pipeline to a local distribution company or to a final end user (if there is no local distribution company), and that are major sources of hazardous air pollutants (HAP) emissions as defined in §63.1271. This regulation does not apply because this facility is not a natural gas transmission or storage facility as defined in this regulation [40 CFR Part 63.1270(a)].
MACT 40 CFR 63 Subpart DDDDD	National Emission Standards for Hazardous Air Pollutants for Major Industrial, Commercial, and Institutional	Yes	1-EP-1, 1.5-EP-1g, 4-EP-1g, 2-EP-1a, 2-EP-1b, 2-EP-1e, 2-EP-1h, 2a-EP-1d,	The facility is a major source of HAPS. The units listed will be subject to MACT 40 CFR 63 Subpart DDDDD as they will be constructed after the June 4, 2010 applicability date. The boilers and process heaters will be combusting natural gas. The owner will comply with all applicable MACT DDDDD requirements

Federal Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification:
	Boilers & Process Heaters		2.5-EP-1d, 3-EP-1a, 3-EP-1b, 3-EP-1d, 3-EP-1e, 3-EP-1h, 4-EP-1a, 4-EP-1b, 4-EP-1d, 4-EP-1e, 4-EP-1h, 5 -EP-1a, 5-EP-1b, 5-EP-1c, 5-EP-1d, 5.5-EP-1a, 6-EP-1a, 6-EP-1b, 6-EP-1c, 6-EP-1d, 7-EP-1c, 7-EP-1d	
MACT 40 CFR 63 Subpart UUUUU	National Emission Standards for Hazardous Air Pollutants Coal & Oil Fire Electric Utility Steam Generating Unit	No	N/A	See 63.9980 (known as the MATs rule)
MACT 40 CFR 63 Subpart ZZZZ	National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (**RICE MACT**)	Yes	1-Gen-1	The generator engine (1-Gen-1) at this facility is subject to ZZZZ as new stationary RICE located at a major source. The engine must meet the requirements of MACT ZZZZ by meeting the requirements of NSPS JJJJ. No other requirements under this part apply.
40 CFR 64	**Compliance Assurance Monitoring**	Yes	2-EP-4, 3-EP-4, 4-EP-4, 5-EP-1f, 6-EP-1f, 1-EP-3, 2a-EP-3, 3-EP-3, 4-EP-3, 5-EP-1e, 6-EP-1e, 1-LOAD, 3-LOAD, 2.5-EP-4	This regulation defines compliance assurance monitoring (CAM). This regulation applies to the listed amine units and glycol dehydration units because the units have potential pre-control device emissions that are equal to or greater than 100 percent of the amount, in tons per year, required for a source to be classified as a major source. The units currently in operation are included in the site's CAM plan, which is being updated with this application, and can be found in Section 19. The owner will comply with all applicable requirements under 40 CFR Part 64.
40 CFR 68	**Chemical Accident Prevention**	Yes	Facility	The facility is an affected facility, as it will use flammable process chemicals such as propane at quantities greater than the thresholds. The facility will develop and maintain an RMP for these chemicals.

Federal Regulation Citation	Title	Applies? Enter Yes or No	Unit(s) or Facility	Justification:
Title IV – Acid Rain 40 CFR 72	**Acid Rain**	No	N/A	This regulation does not apply as this facility does not generate commercial electric power or electric power for sale.
Title IV – Acid Rain 40 CFR 73	**Sulfur Dioxide** Allowance Emissions	No	N/A	This regulation does not apply as this facility does not generate commercial electric power or electric power for sale.
Title IV-Acid Rain 40 CFR 75	**Continuous Emissions Monitoring**	No	N/A	This regulation does not apply as this facility does not generate commercial electric power or electric power for sale.
Title IV – Acid Rain 40 CFR 76	**Acid Rain** Nitrogen Oxides **Emission Reduction Program**	No	N/A	This regulation does not apply as this facility does not generate commercial electric power or electric power for sale.
Title VI – 40 CFR 82	Protection of **Stratospheric Ozone**	No	N/A	Not applicable as this facility does not meet any of the following: **(40 CFR 82.1 and 82.100)** produce, transform, destroy, import, or export a controlled substance or import or export a controlled product; **(40 CFR 82.30)** if you perform service on a motor vehicle for consideration when this service involves the refrigerant in the motor vehicle air conditioner; **(40 CFR 82.80)** if you are a department, agency, and instrumentality of the United States subject to Federal procurement requirements; **(82.150)** if you service, maintain, or repair appliances, dispose of appliances, refrigerant reclaimers, **if you are an owner or operator of an appliance**, if you are a manufacturer of appliances or of recycling and recovery equipment, if you are an approved recycling and recovery equipment testing organization, and/or if you sell or offer for sell or purchase class I or class I refrigerants.

Section 14

Operational Plan to Mitigate Emissions

(Submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

☑ **Title V Sources** (20.2.70 NMAC)**:** By checking this box and certifying this application the permittee certifies that it has developed an **Operational Plan to Mitigate Emissions During Startups, Shutdowns, and Emergencies** defining the measures to be taken to mitigate source emissions during startups, shutdowns, and emergencies as required by 20.2.70.300.D.5(f) and (g) NMAC. This plan shall be kept on site to be made available to the Department upon request. This plan should not be submitted with this application.

☑ **NSR** (20.2.72 NMAC)**, PSD** (20.2.74 NMAC) **& Nonattainment** (20.2.79 NMAC) **Sources:** By checking this box and certifying this application the permittee certifies that it has developed an **Operational Plan to Mitigate Source Emissions During Malfunction, Startup, or Shutdown** defining the measures to be taken to mitigate source emissions during malfunction, startup, or shutdown as required by 20.2.72.203.A.5 NMAC. This plan shall be kept on site to be made available to the Department upon request. This plan should not be submitted with this application.

☑ **Title V** (20.2.70 NMAC)**, NSR** (20.2.72 NMAC)**, PSD** (20.2.74 NMAC) **& Nonattainment** (20.2.79 NMAC) **Sources:** By checking this box and certifying this application the permittee certifies that it has established and implemented a Plan to Minimize Emissions During Routine or Predictable Startup, Shutdown, and Scheduled Maintenance through work practice standards and good air pollution control practices as required by 20.2.7.14.A and B NMAC. This plan shall be kept on site or at the nearest field office to be made available to the Department upon request. This plan should not be submitted with this application.

Section 15

Alternative Operating Scenarios

(Submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

Alternative Operating Scenarios: Provide all information required by the department to define alternative operating scenarios. This includes process, material and product changes; facility emissions information; air pollution control equipment requirements; any applicable requirements; monitoring, recordkeeping, and reporting requirements; and compliance certification requirements. Please ensure applicable Tables in this application are clearly marked to show alternative operating scenario.

Construction Scenarios: When a permit is modified authorizing new construction to an existing facility, NMED includes a condition to clearly address which permit condition(s) (from the previous permit and the new permit) govern during the interval between the date of issuance of the modification permit and the completion of construction of the modification(s). There are many possible variables that need to be addressed such as: Is simultaneous operation of the old and new units permitted and, if so for example, for how long and under what restraints? In general, these types of requirements will be addressed in Section A100 of the permit, but additional requirements may be added elsewhere. Look in A100 of our NSR and/or TV permit template for sample language dealing with these requirements. Find these permit templates at: www.env.nm.gov/air-quality/permitting-section-procedures-and-guidance/. Compliance with standards must be maintained during construction, which should not usually be a problem unless simultaneous operation of old and new equipment is requested.

In this section, under the bolded title "Construction Scenarios", specify any information necessary to write these conditions, such as: conservative-realistic estimated time for completion of construction of the various units, whether simultaneous operation of old and new units is being requested (and, if so, modeled), whether the old units will be removed or decommissioned, any PSD ramifications, any temporary limits requested during phased construction, whether any increase in emissions is being requested as SSM emissions or will instead be handled as a separate Construction Scenario (with corresponding emission limits and conditions, etc.

There are no alternative operating scenarios being proposed with this application.

Section 16

Air Dispersion Modeling

1) Minor Source Construction (20.2.72 NMAC) and Prevention of Significant Deterioration (PSD) (20.2.74 NMAC) ambient impact analysis (modeling): Provide an ambient impact analysis as required at 20.2.72.203.A(4) and/or 20.2.74.303 NMAC and as outlined in the Air Quality Bureau's Dispersion Modeling Guidelines found on the Planning Section's modeling website. If air dispersion modeling has been waived for one or more pollutants, attach the AQB Modeling Section modeling waiver approval documentation.
2) SSM Modeling: Applicants must conduct dispersion modeling for the total short term emissions during routine or predictable startup, shutdown, or maintenance (SSM) using realistic worst case scenarios following guidance from the Air Quality Bureau's dispersion modeling section. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on SSM emissions modeling requirements.
3) Title V (20.2.70 NMAC) ambient impact analysis: Title V applications must specify the construction permit and/or Title V Permit number(s) for which air quality dispersion modeling was last approved. Facilities that have only a Title V permit, such as landfills and air curtain incinerators, are subject to the same modeling required for preconstruction permits required by 20.2.72 and 20.2.74 NMAC.

What is the purpose of this application?	Enter an X for each purpose that applies
New PSD major source or PSD major modification (20.2.74 NMAC). See #1 above.	
New Minor Source or significant permit revision under 20.2.72 NMAC (20.2.72.219.D NMAC). See #1 above. **Note:** Neither modeling nor a modeling waiver is required for VOC emissions.	
Reporting existing pollutants that were not previously reported.	
Reporting existing pollutants where the ambient impact is being addressed for the first time.	
Title V application (new, renewal, significant, or minor modification. 20.2.70 NMAC). See #3 above.	**x**
Relocation (20.2.72.202.B.4 or 72.202.D.3.c NMAC)	
Minor Source Technical Permit Revision 20.2.72.219.B.1.d.vi NMAC for like-kind unit replacements.	
Other: i.e. SSM modeling. See #2 above.	
This application does not require modeling since this is a No Permit Required (NPR) application.	
This application does not require modeling since this is a Notice of Intent (NOI) application (20.2.73 NMAC).	
This application does not require modeling according to 20.2.70.7.E(11), 20.2.72.203.A(4), 20.2.74.303, 20.2.79.109.D NMAC and in accordance with the Air Quality Bureau's Modeling Guidelines.	

Check each box that applies:

☐ See attached, approved modeling **waiver for all** pollutants from the facility.
☐ See attached, approved modeling **waiver for some** pollutants from the facility.
☐ Attached in Universal Application Form 4 (UA4) is a **modeling report for all** pollutants from the facility.
☐ Attached in UA4 is a **modeling report for some** pollutants from the facility.
☑ No modeling is required.

This application is for a Title V renewal submitted under 20.2.70.300.B(2) NMAC; therefore, air dispersion modeling is not required with this submittal. Air dispersion modeling was last performed for the July 2019 NSR revision application.

Section 17

Compliance Test History

(Submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

To show compliance with existing NSR permits conditions, you must submit a compliance test history. The table below provides an example.

The generator engine (1-Gen-1) has not yet operated onsite; therefore, no compliance testing has been performed. Per 40 CFR Part 60, Subpart JJJJ, §60.4244(b): "You may not conduct performance tests during periods of startup, shutdown, or malfunction, as specified in § 60.8(c). If your stationary SI internal combustion engine is non-operational, you do not need to startup the engine solely to conduct a performance test; however, you must conduct the performance test immediately upon startup of the engine." Targa Northern Delaware, LLC will perform any required compliance testing once the engine is operating.

Any other compliance testing information will be made available upon request by NMED.

Section 19

Requirements for Title V Program

Who Must Use this Attachment:

* Any major source as defined in 20.2.70 NMAC.
* Any source, including an area source, subject to a standard or other requirement promulgated under Section 111 - Standards of Performance for New Stationary Sources, or Section 112 Hazardous Air Pollutants, of the 1990 federal Clean Air Act ("federal Act"). Non-major sources subject to Sections 111 or 112 of the federal Act are exempt from the obligation to obtain an 20.2.70 NMAC operating permit until such time that the EPA Administrator completes rulemakings that require such sources to obtain operating permits. In addition, sources that would be required to obtain an operating permit solely because they are subject to regulations or requirements under Section 112(r) of the federal Act are exempt from the requirement to obtain an Operating Permit.
* Any Acid Rain source as defined under title IV of the federal Act. The Acid Rain program has additional forms. See www.env.nm.gov/air-quality/air-quality-title-v-operating-permits-guidance-page/. Sources that are subject to both the Title V and Acid Rain regulations are encouraged to submit both applications simultaneously.
* Any source in a source category designated by the EPA Administrator ("Administrator"), in whole or in part, by regulation, after notice and comment.

19.1 - 40 CFR 64, Compliance Assurance Monitoring (CAM) (20.2.70.300.D.10.e NMAC)

Any source subject to 40CFR, Part 64 (Compliance Assurance Monitoring) must submit all the information required by section 64.7 with the operating permit application. The applicant must prepare a separate section of the application package for this purpose; if the information is already listed elsewhere in the application package, make reference to that location. Facilities not subject to Part 64 are invited to submit periodic monitoring protocols with the application to help the AQB to comply with 20.2.70 NMAC. Sources subject to 40 CFR Part 64, must submit a statement indicating your source's compliance status with any enhanced monitoring and compliance certification requirements of the federal Act.

The glycol dehydrators, amine vents, sour slop tanks and fugitive emissions (Units 1-EP-3, 1.5-EP-3, 2-EP-4, 2a-EP-3, 2.5-EP-4, 3-EP-3, 3-EP-4, 4-EP-3, 4-EP-4, 5-EP-1e, 5-EP-1f, 6-EP-1e, 6-EP-1f, 2-T, FUG) have pre-control emissions of VOC greater than 100 tpy. Glycol dehydrator Units 1-EP-3, 1.5-EP-3, 2a-EP-3, 3-EP-3, 4-EP-3, 5-EP-1e, 6-EP-1e, and FUG, however, are subject to MACT HH and are therefore exempt from CAM requirements per 40 CFR 64.2(b)(1)(i). In addition, Unit 1-EP-3 incondensable and flash tank emissions are being routed into the facility fuel system. This is a completely closed-loop system with no emissions.

Storage tanks subject to NSPS OOOO/OOOOa are also exempt from CAM requirements. See Section 13 for a list of equipment subject to HH and OOOO/OOOOa.

Amine Units 1-EP-4 and 1.5-EP-4 do not trigger CAM requirements; however, 2-EP-4, 2.5-EP-4, and 3-EP-4 have pre-controlled H_2S emissions greater than 100 tpy and will therefore be subject to CAM requirements.

The CAM plans for the following units that are currently operating are attached following this section: Units EP-5, EP-6, and EP-8 which control the Facility's amine vents (Units 2-EP-4, 3-EP-4, and 4-EP-4), and EP-8 and EP-10, which control the Facility's amine vents (Units 4-EP-4, 5-EP-1f, and 6-EP-1f) and the acid gas flare (2.5-EP-5) which control Unit 2.5-EP-4.

19.2 - Compliance Status (20.2.70.300.D.10.a & 10.b NMAC)

Describe the facility's compliance status with each applicable requirement at the time this permit application is submitted. This statement should include descriptions of or references to all methods used for determining compliance. This statement should include descriptions of monitoring, recordkeeping and reporting requirements and test methods used to determine compliance with all applicable requirements. Refer to Section 2, Tables 2-N and 2-O of the Application Form as necessary. (20.2.70.300.D.11 NMAC) For facilities with existing Title V permits, refer to most recent Compliance Certification for existing requirements. Address new requirements such as CAM, here, including steps being taken to achieve compliance.

Red Hills Gas Processing Plant is currently undergoing an audit under Appendix D: Voluntary Environmental Disclosure policy. The information regarding the compliance status for each applicable requirement has been disclosed to the NMED's Compliance and Enforcement Division and a schedule has been implemented for compliance demonstration.

19.3 - Continued Compliance (20.2.70.300.D.10.c NMAC)

Provide a statement that your facility will continue to be in compliance with requirements for which it is in compliance at the time of permit application. This statement must also include a commitment to comply with other applicable requirements as they come into effect during the permit term. This compliance must occur in a timely manner or be consistent with such schedule expressly required by the applicable requirement.

As described in Section 19.2, Targa Northern Delaware, LLC states that Red Hills Gas Plant will continue to report the compliance status with each applicable requirements to the NMED's Compliance and Enforcement Division and follow the implemented schedule for compliance demonstration.

In addition, Targa Northern Delaware, LLC will meet additional applicable requirements that become effective during the permit term in a timely manner or on such a time schedule as expressly required by the applicable requirement. In the event that new information affecting the compliance status of Red Hills Gas Plant is discovered, Targa Northern Delaware, LLC will make appropriate notifications and/or take corrective actions as appropriate.

19.4 - Schedule for Submission of Compliance (20.2.70.300.D.10.d NMAC)

You must provide a proposed schedule for submission to the department of compliance certifications during the permit term. This certification must be submitted annually unless the applicable requirement or the department specifies a more frequent period. A sample form for these certifications will be attached to the permit.

The Red Hills current Title V permit, number P278-M1, currently states that an annual compliance certification report is due within 30 days of the end of every 12-month reporting permit. The 12-month reporting period starts on June 1st of each year.

19.5 - Stratospheric Ozone and Climate Protection

In addition to completing the four (4) questions below, you must submit a statement indicating your source's compliance status with requirements of Title VI, Section 608 (National Recycling and Emissions Reduction Program) and Section 609 (Servicing of Motor Vehicle Air Conditioners).

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1. Does your facility have any air conditioners or refrigeration equipment that uses CFCs, HCFCs or other ozone-depleting substances? ☑ **Yes** ☐ **No**

2. Does any air conditioner(s) or any piece(s) of refrigeration equipment contain a refrigeration charge greater than 50 lbs? ☐ **Yes** ☑ **No**

   (If the answer is yes, describe the type of equipment and how many units are at the facility.)

3. Do your facility personnel maintain, service, repair, or dispose of any motor vehicle air conditioners (MVACs) or appliances ("appliance" and "MVAC" as defined at 82. 152)? ☐ **Yes** ☑ **No**

4. Cite and describe which Title VI requirements are applicable to your facility (i.e. 40 CFR Part 82, Subpart A through G.)

Targa Northern Delaware, LLC states that Red Hills does not service, maintain, repair, or dispose of appliances that use Class I or Class II chemicals (chlorofluorocarbons, halon, carbon tetrachloride, methyl chloroform or hydrochlorofluorocarbon). Additionally, motor vehicle air conditioners are not serviced at Red Hills. Therefore, the requirements of Title VI, Sections 608 and 609 of the Clean Air Act are not applicable to this facility.

19.6 - Compliance Plan and Schedule

Applications for sources, which are not in compliance with all applicable requirements at the time the permit application is submitted to the department, must include a proposed compliance plan as part of the permit application package. This plan shall include the information requested below:

A. Description of Compliance Status: (20.2.70.300.D.11.a NMAC)
A narrative description of your facility's compliance status with respect to all applicable requirements (as defined in 20.2.70 NMAC) at the time this permit application is submitted to the department.

B. Compliance plan: (20.2.70.300.D.11.B NMAC)
A narrative description of the means by which your facility will achieve compliance with applicable requirements with which it is not in compliance at the time you submit your permit application package.

C. Compliance schedule: (20.2.70.300D.11.c NMAC)
A schedule of remedial measures that you plan to take, including an enforceable sequence of actions with milestones, which will lead to compliance with all applicable requirements for your source. This schedule of compliance must be at least as stringent as that contained in any consent decree or administrative order to which your source is subject. The obligations of any consent decree or administrative order are not in any way diminished by the schedule of compliance.

D. Schedule of Certified Progress Reports: (20.2.70.300.D.11.d NMAC)
A proposed schedule for submission to the department of certified progress reports must also be included in the compliance schedule. The proposed schedule must call for these reports to be submitted at least every six (6) months.

E. Acid Rain Sources: (20.2.70.300.D.11.e NMAC)
If your source is an acid rain source as defined by EPA, the following applies to you. For the portion of your acid rain source subject to the acid rain provisions of title IV of the federal Act, the compliance plan must also include any additional requirements under the acid rain provisions of title IV of the federal Act. Some requirements of title IV regarding the schedule and methods the source will use to achieve compliance with the acid rain emissions limitations may supersede the requirements of title V and 20.2.70 NMAC. You will need to consult with the Air Quality Bureau permitting staff concerning how to properly meet this requirement.

NOTE: The Acid Rain program has additional forms. See www.env.nm.gov/air-quality/air-quality-title-v-operating-permits-guidance-page/. Sources that are subject to both the Title V and Acid Rain regulations are **encouraged** to submit both applications **simultaneously**.

As described in Section 19.2, Targa Northern Delaware, LLC states that Red Hills Gas Plant will continue to report the compliance status for applicable requirements to the NMED's Compliance and Enforcement Division and follow the proposed schedule for compliance demonstration. A compliance plan and compliance schedule have been provided to the NMED's Compliance and Enforcement Division. The schedule includes a timeline for remedial measures that are planned and a sequence of actions with milestones that will lead to compliance with applicable requirements for this source. Certified Progress Reports are submitted on a monthly basis to NMED's Compliance and Enforcement Division.

In addition, Targa Northern Delaware, LLC states that Red Hills is not an acid rain source as defined at 40 CFR 72.6.

19.7 - 112(r) Risk Management Plan (RMP)

Any major sources subject to section 112(r) of the Clean Air Act must list all substances that cause the source to be subject to section 112(r) in the application. The permittee must state when the RMP was submitted to and approved by EPA.

Targa Northern Delaware, LLC states that Red Hills Gas Plant is subject to 40 CFR 68, Chemical Accident Prevention Provisions. The facility is an affected facility, as it will use flammable process chemicals such as propane at quantities greater than the thresholds. The facility has developed and maintains an RMP for these chemicals. The RMP was submitted to EPA on February 6, 2020 and was approved by EPA on February 6, 2020.

19.8 - Distance to Other States, Bernalillo, Indian Tribes and Pueblos

Will the property on which the facility is proposed to be constructed or operated be closer than 80 km (50 miles) from other states, local pollution control programs, and Indian tribes and pueblos (20.2.70.402.A.2 and 20.2.70.7.B NMAC)?

(If the answer is yes, state which apply and provide the distances.)

Yes. 43 km from Texas; No Indian tribes, pueblos, or local pollution control programs are within 80 km.

19.9 - Responsible Official

Provide the Responsible Official as defined in 20.2.70.7.AD NMAC:

R.O. Name: Jimmy Oxford
Address: 3100 McKinnon Street, Suite 800, Dallas, TX 75201.
Phone: (940) 220-2493
Email: JOxford@targaresources.com

Section 22: Certification

Company Name: Targa Northern Delaware LLC.

I, Jimmy E Oxford, hereby certify that the information and data submitted in this application are true and as accurate as possible, to the best of my knowledge and professional expertise and experience.

Signed this 22nd day of June, 2023, upon my oath or affirmation, before a notary of the State of

Texas.

[signature]
*Signature

6/22/23
Date

Jimmy E Oxford
Printed Name

VP operations
Title

Scribed and sworn before me on this 22 day of June 2023

My authorization as a notary of the State of Tx expires on the

7th day of October, 2023

[signature]
Notary's Signature

6-22-23
Date

Becky Madden
Notary's Printed Name

BECKY MADDEN
Notary Public, State of Texas
Comm. Expires 10-07-2023
Notary ID 128718137

*For Title V applications, the signature must be of the Responsible Official as defined in 20.2.70.7 NMAC.