ALLIANT ENVIRONMENTAL, LLC

November 16, 2021

RECEIVED
NOV 17 2021
Air Quality Bureau

New Mexico Environment Department
Air Quality Bureau, Title V Permitting Section
525 Camino de los Marquez, Suite 1
Santa Fe, NM 87505-1816

RE: Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant
Lea County, New Mexico
Title V Revision Application, Permit Number P-278

Dear Air Quality Bureau:

Alliant Environmental, LLC is submitting this Title V revision application on behalf of Lucid Energy Delaware, LLC (Lucid) for its Red Hills Gas Processing Plant. The Red Hills Gas Processing Plant is currently permitted under NSR Permit number 4310-M5 and Title V Permit number P-278.

With this application, Lucid is proposing to update the Red Hills Gas Processing Plant Title V Permit, number P-278, so that it reflects the most recent revision to the site's NSR Permit, number 4310-M5. These revisions will include Unit IDs changes, serial number updates, operating capacities changes, updated emissions, etc. All equipment to be included in Title V permit number P-278 are listed in the Section 2 Tables.

There is one (1) compact disk included with this submittal (attached to the last page of the two-hole punched application) which includes the entire Title V PDF application, the word documents for forms UA1 and UA3, the excel workbook of form UA2, and an emission calculation spreadsheet.

If you have any questions regarding this submittal or require additional information, please feel free to contact Michael Nowak at (214) 420-4950 or by email at mnowak@lucid-energy.com or Martin Schluep at (505) 205-4819 or by e-mail at mschluep@alliantenv.com.

Sincerely,

ALLIANT ENVIRONMENTAL, LLC

Melissa Fetman
Graduate Environmental Engineer

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	NEW MEXICO ENVIRONMENT DEPARTMENT	RECEIVED NOV 17 2021 Air Quality Bureau AIRS No.:

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. See Section 1-I for submittal instructions for other permits.

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 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 #: **P-278**
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: **Lucid Energy Delaware, LLC**	Phone/Fax: **214-420-4974**	
a	Plant Operator Address: **201 South 4th Street, Artesia, NM 88210**		

b	Plant Operator's New Mexico Corporate ID or Tax ID: **36-4825214**	
3	Plant Owner(s) name(s): **Lucid Energy Delaware, LLC**	Phone/Fax: **214-420-4974**
a	Plant Owner(s) Mailing Address(s): **P.O. Box 158, Artesia, NM 88211-0158**	
4	Bill To (Company): **Lucid Energy Delaware, LLC**	Phone/Fax: **214-420-4974**
a	Mailing Address: **P.O. Box 158, Artesia, NM 88211-0158**	E-mail: **AP@lucid-energy.com**
5	☑ Preparer: **Alliant Environmental, LLC** ☑ Consultant: **Martin Schluep**	Phone/Fax: **505-205-4819**
a	Mailing Address: **7804 Pan American Fwy., Suite 5** **Albuquerque, NM 87109**	E-mail: **mschluep@alliantenv.com**
6	Plant Operator Contact: **Chris Kassen**	Phone/Fax: **214-420-4974**
a	Address: **P.O. Box 158, Artesia, NM 88211-0158**	E-mail: **Ckassen@lucid-energy.com**
7	Air Permit Contact: **Michael Nowak**	Title: **Environmental Air Technician**
a	E-mail: **MNowak@lucid-energy.com**	Phone/Fax: **214-420-4950**
b	Mailing Address: **P.O. Box 158, Artesia, NM 88211-0158**	
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: **P-278**
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: **30.625 MMscfh**	Daily: **735 MMscfd**	Annually: **268,275 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: **30.625 MMscfh**	Daily: **735 MMscfd**	Annually: **268,275 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				
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/aqb/modeling/class1areas.html)? ☑ Yes ☐ No (20.2.72.206.A.7 NMAC) If yes, list all with corresponding distances in kilometers: **43 km from Texas state line.**				
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**				
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: **TBD**					
4	Month and year of anticipated construction completion: **TBD**					
5	Month and year of anticipated startup of new or modified facility: **TBD**					
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: **N/A**	
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): **Matt Eales**	Phone: **832-496-7513**
a	R.O. Title: **Vice President - EHSR**	R.O. e-mail: **meales@lucid-energy.com**
b	R. O. Address: **3100 McKinnon Street #800, Dallas, TX 75201**	
2	Alternate Responsible Official (20.2.70.300.D.2 NMAC): **Mike Latchem**	Phone: **214-420-4950**
a	A. R.O. Title: **President & CEO**	A. R.O. e-mail: **mlatchem@lucid-energy.com**
b	A. R. O. Address: **3100 McKinnon Street #800, Dallas, TX 75201**	
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): **N/A**	
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.): **Lucid Energy Group, LLC**	
a	Address of Parent Company: **3100 McKinnon Street #800, Dallas, TX 75201**	
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.): **Lucid Energy Delaware, LLC and Lucid Artesia Company**	
6	Telephone numbers & names of the owners' agents and site contacts familiar with plant operations: **Air Permit Contact: Michael Nowak** **Phone: 214-420-4950, Email: MNowak@lucid-energy.com**	
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: **States: 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______________________________

Email________________________________

Phone number ________________________

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.

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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 Tip	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	MJ19-423	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	Zeeco	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	2BKU30/50-312	1016-5059A-1	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	HMI	2BKU30/50-312	1016-5059A-2	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

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-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
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	17-09-2126	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	Zeeco	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-8 EP-8	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)	Zeeco	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

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufacturer'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 Classification Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
EP-6	Thermal Oxidizer (TO)	Zeeco	N/A	37954	28 MMBtu/hr	28 MMBtu/hr	2012 2012	N/A EP-6	31000404	☐ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ☑ To Be Modified ˜ To be Replaced	N/A	N/A
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	TBD	TBD	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	TBD	TBD	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	TBD TBD	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

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.
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-6 EP-6	31000301	˜ Existing (unchanged) ˜ To be Removed ☑ New/Additional ˜ Replacement Unit ˜ To be Modified ˜ To be Replaced	N/A	N/A
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-6 EP-6	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

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-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
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	Palmer Palmer Palmer	12F-0067 12F-0067 12F-0067	5t-1938923 5t-1938921 5t-1938922	500 bbl each	500 bbl each	2019 2019	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	TBD	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	TBD	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

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.
5-LOAD	Slop Tanks Loading Emissions	TBD	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
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	1.2 MMBtu/hr	1.2 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	1.84 MMBtu/hr	1.84 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	TBD	TBD	TBD	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	TBD	TBD	TBD	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	TBD	TBD	TBD	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	TBD	TBD	TBD	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	TBD	TBD	TBD	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	TBD	TBD	TBD	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	2012 2012	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

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.
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
										˜ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced		
										˜ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced		

[1] Unit numbers must correspond to unit numbers in the previous permit unless a complete cross reference table of all units in both permits is provided.
[2] Specify dates required to determine regulatory applicability.
[3] To properly account for power conversion efficiencies, generator set rated capacity shall be reported as the rated capacity of the engine in horsepower, not the kilowatt capacity of the generator set.
[4] "4SLB" means four stroke lean burn engine, "4SRB" means four stroke rich burn engine, "2SLB" means two stroke lean burn engine, "CI" means compression ignition, and "SI" means spark ignition

Table 2-B: Insignificant Activities[1] (20.2.70 NMAC) OR Exempted Equipment (20.2.72 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 https://www.env.nm.gov/wp-content/uploads/sites/2/2017/10/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.	Max Capacity	List Specific 20.2.72.202 NMAC Exemption (e.g. 20.2.72.202.B.5)	Date of Manufacture /Reconstruction[2]	For Each Piece of Equipment, Check Onc
			Serial No.	Capacity Units	Insignificant Activity citation (e.g. IA List Item #1.a)	Date of Installation /Construction[2]	
SmT-1	Amine Storage Tank	N/A	N/A	120	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-2	Lube Oil Storage Tank	N/A	N/A	120	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-3	Glycol Storage Tank	N/A	N/A	120	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-4	Oily Wastewater Tank	N/A	N/A	210	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-5	Oil Storage	N/A	N/A	120	20.2.72.202.B.5		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
1-Gen-1	Emergency Generator	Caterpillar	CG137	TBD	20.2.72.202.B.3	24-05-12	☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			WRX00112	TBD			
SmT-6	Wastewater Tank	N/A	N/A	500	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-7	Wastewater Tank	N/A	N/A	500	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-8	Wastewater Tank	N/A	N/A	210	20.2.72.202.B.2		☑ Existing (unchanged) ˜ To be Removed ˜ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-9	Amine Storage Tank	N/A	N/A	210	20.2.72.202.B.2		˜ Existing (unchanged) ˜ To be Removed ☑ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
SmT-10	Glycol Storage Tank	N/A	N/A	210	20.2.72.202.B.2		˜ Existing (unchanged) ˜ To be Removed ☑ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	bbl			
HAUL/ HAUL-1	Haul Road Emissions	N/A	N/A	N/A	20.2.72.202.B.5		˜ Existing (unchanged) ˜ To be Removed ☑ New/Additional ˜ Replacement Unit ˜ To Be Modified ˜ To be Replaced
			N/A	N/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
FX: Fixed Roof	**Mechanical Shoe Seal**	**Liquid-mounted resilient seal**	**Vapor-mounted resilient seal**	**Seal Type**	**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.

Lucid Energy Delaware, LLC (Lucid) 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, Lucid is proposing to update the Red Hills Gas Processing Plant Title V Permit, number P-278, so that it reflects the most recent revision to the site's NSR Permit, number 4310-M5. These revisions will include Unit IDs changes, serial number updates, operating capacities changes, updated emissions, etc. All equipment to be included in Title V permit number P-278 are listed in the Section 2 Tables.

Project Description:

The purpose of this application is to update Title V Permit P278 to match NSR permit 4310-M5, issued December 30, 2019. The most recent revisions to NSR permit 4310-M5 included adding three amine and dehydrator services (Red Hills Gas Processing #4, #5 and #6), three cryogenic process trains (Cryogenic plant #5, #6 and #7), and an acid gas injection system. New contracts executed first, and second quarter of 2019 necessitated the addition of gas processing capacity at Red Hills. Lucid has also received updated forecasts from its producers that showed increment of approximately 300 MMSCFD from the one provided in 2017. The addition of the (3) amine and dehydrator services, (3) cryogenic plants and (1) acid gas injection well, are needed to process the gas from these contracts and are based on the anticipated plans for the facility for the next 2 years.

This modification will meet the increasing demand of natural gas processing, which is necessary to treat the produced gas stream to enable it to meet the natural gas pipeline industry's quality specifications. The new equipment will utilize the latest processing and emissions technology as provided later in this permit application. Lucid is proud to have infrastructure to support southeastern New Mexico's rapidly increasing production and is committed to ensuring world class compliance with New Mexico environmental rules and regulations.

All equipment and their associated emissions are included in the Section 2 Tables of this application.

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.

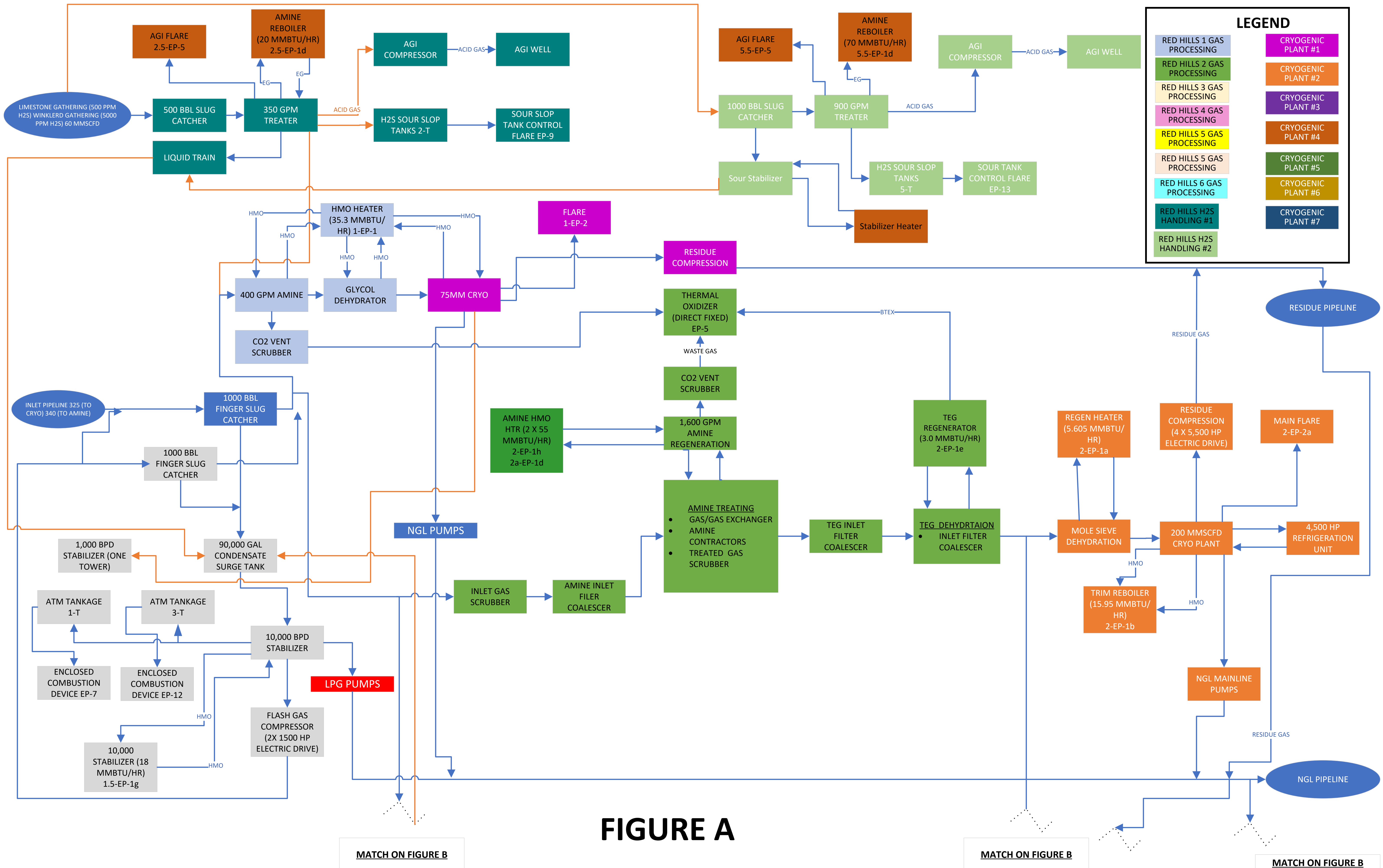
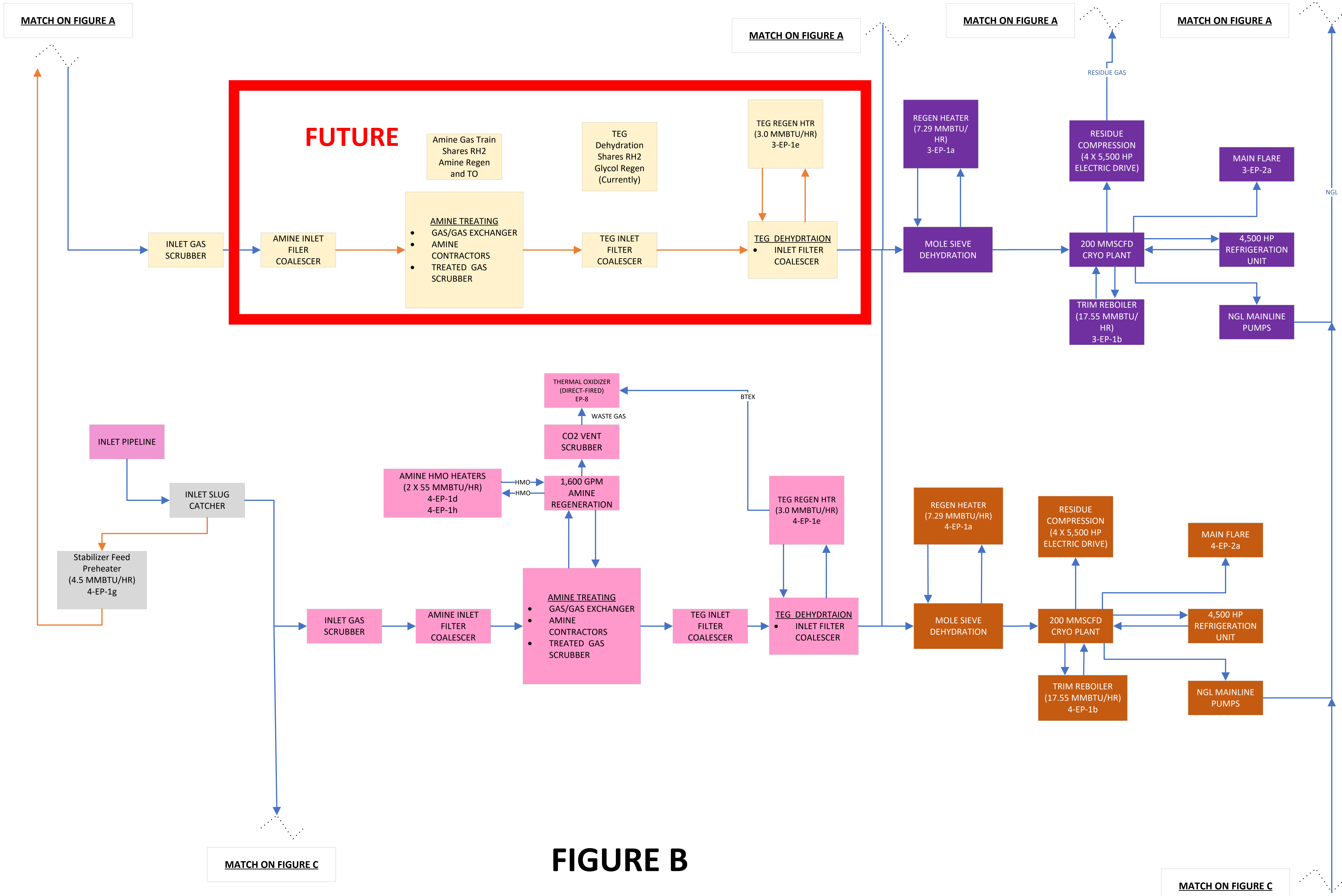

LEGEND
RED HILLS 1 GAS PROCESSING
RED HILLS 2 GAS PROCESSING
RED HILLS 3 GAS PROCESSING
RED HILLS 4 GAS PROCESSING
RED HILLS 5 GAS PROCESSING
RED HILLS 5 GAS PROCESSING
RED HILLS 6 GAS PROCESSING
RED HILLS H2S HANDLING #1
RED HILLS H2S HANDLING #2
CRYOGENIC PLANT #1
CRYOGENIC PLANT #2
CRYOGENIC PLANT #3
CRYOGENIC PLANT #4
CRYOGENIC PLANT #5
CRYOGENIC PLANT #6
CRYOGENIC PLANT #7
AGI FLARE 2.5-EP-5
AMINE REBOILER (20 MMBTU/HR) 2.5-EP-1d
AGI COMPRESSOR
ACID GAS
AGI WELL
EG
LIMESTONE GATHERING (500 PPM H2S) WINKLERD GATHERING (5000 PPM H2S) 60 MMSCFD
500 BBL SLUG CATCHER
350 GPM TREATER
ACID GAS
H2S SOUR SLOP TANKS 2-T
SOUR SLOP TANK CONTROL FLARE EP-9
LIQUID TRAIN
AGI FLARE 5.5-EP-5
AMINE REBOILER (70 MMBTU/HR) 5.5-EP-1d
AGI COMPRESSOR
AGI WELL
1000 BBL SLUG CATCHER
900 GPM TREATER
H2S SOUR SLOP TANKS 5-T
SOUR TANK CONTROL FLARE EP-13
Sour Stabilizer
Stabilizer Heater
HMO
HMO HEATER (35.3 MMBTU/ HR) 1-EP-1
FLARE 1-EP-2
400 GPM AMINE
GLYCOL DEHYDRATOR
75MM CRYO
CO2 VENT SCRUBBER
RESIDUE COMPRESSION
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
AMINE TREATING
GAS/GAS EXCHANGER
AMINE CONTRACTORS
TREATED GAS SCRUBBER
TEG REGENERATOR (3.0 MMBTU/HR) 2-EP-1e
TEG INLET FILTER COALESCER
TEG DEHYDRTAION
INLET FILTER COALESCER
REGEN HEATER (5.605 MMBTU/ HR) 2-EP-1a
MOLE SIEVE DEHYDRATION
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
RESIDUE GAS
200 MMSCFD CRYO PLANT
MAIN FLARE 2-EP-2a
4,500 HP REFRIGERATION UNIT
TRIM REBOILER (15.95 MMBTU/ HR) 2-EP-1b
NGL MAINLINE PUMPS
RESIDUE PIPELINE
NGL PIPELINE
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
INLET GAS SCRUBBER
AMINE INLET FILER COALESCER
ATM TANKAGE 1-T
ATM TANKAGE 3-T
10,000 BPD STABILIZER
LPG PUMPS
ENCLOSED COMBUSTION DEVICE EP-7
ENCLOSED COMBUSTION DEVICE EP-12
FLASH GAS COMPRESSOR (2X 1500 HP ELECTRIC DRIVE)
10,000 STABILIZER (18 MMBTU/HR) 1.5-EP-1g
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)
MAIN FLARE 3-EP-2a
200 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
TRIM REBOILER (17.55 MMBTU/HR) 3-EP-1b
NGL MAINLINE PUMPS
NGL
THERMAL OXIDIZER (DIRECT-FIRED) EP-8
BTEX
WASTE GAS
CO2 VENT SCRUBBER
INLET PIPELINE
AMINE HMO HEATERS (2 X 55 MMBTU/HR) 4-EP-1d 4-EP-1h
HMO
HMO
1,600 GPM AMINE REGENERATION
INLET SLUG CATCHER
TEG REGEN HTR (3.0 MMBTU/HR) 4-EP-1e
REGEN HEATER (7.29 MMBTU/HR) 4-EP-1a
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
MAIN FLARE 4-EP-2a
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
MOLE SIEVE DEHYDRATION
200 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
TRIM REBOILER (17.55 MMBTU/HR) 4-EP-1b
NGL MAINLINE PUMPS
MATCH ON FIGURE C
MATCH ON FIGURE C

FIGURE B

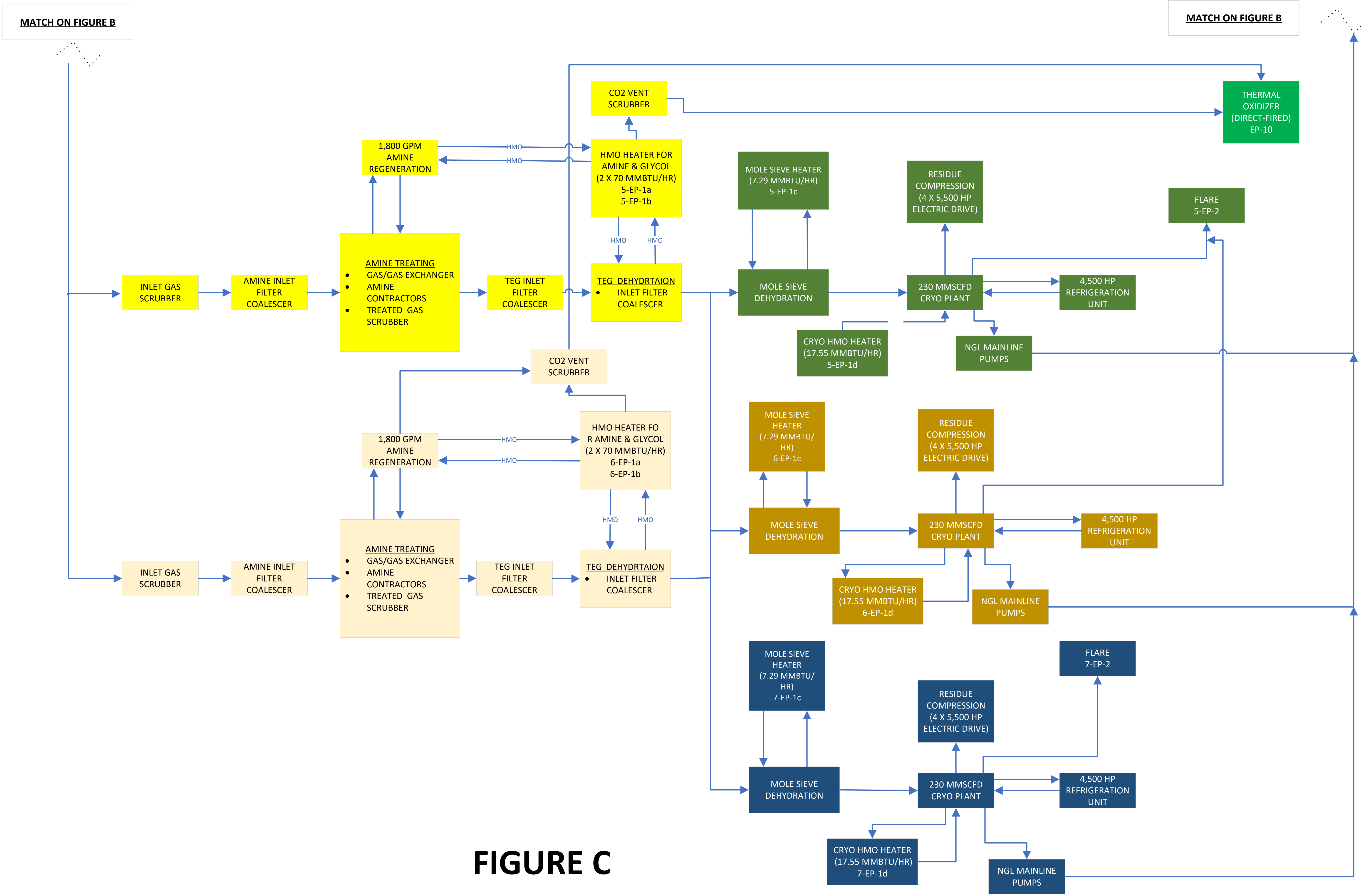

MATCH ON FIGURE B
MATCH ON FIGURE B
CO2 VENT SCRUBBER
THERMAL OXIDIZER (DIRECT-FIRED) EP-10
1,800 GPM AMINE REGENERATION
HMO
HMO
HMO HEATER FOR AMINE & GLYCOL (2 X 70 MMBTU/HR) 5-EP-1a 5-EP-1b
MOLE SIEVE HEATER (7.29 MMBTU/HR) 5-EP-1c
RESIDUE COMPRESSION (4 X 5,500 HP ELECTRIC DRIVE)
FLARE 5-EP-2
HMO
HMO
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
HMO
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)
HMO
HMO
MOLE SIEVE DEHYDRATION
230 MMSCFD CRYO PLANT
4,500 HP REFRIGERATION UNIT
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
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

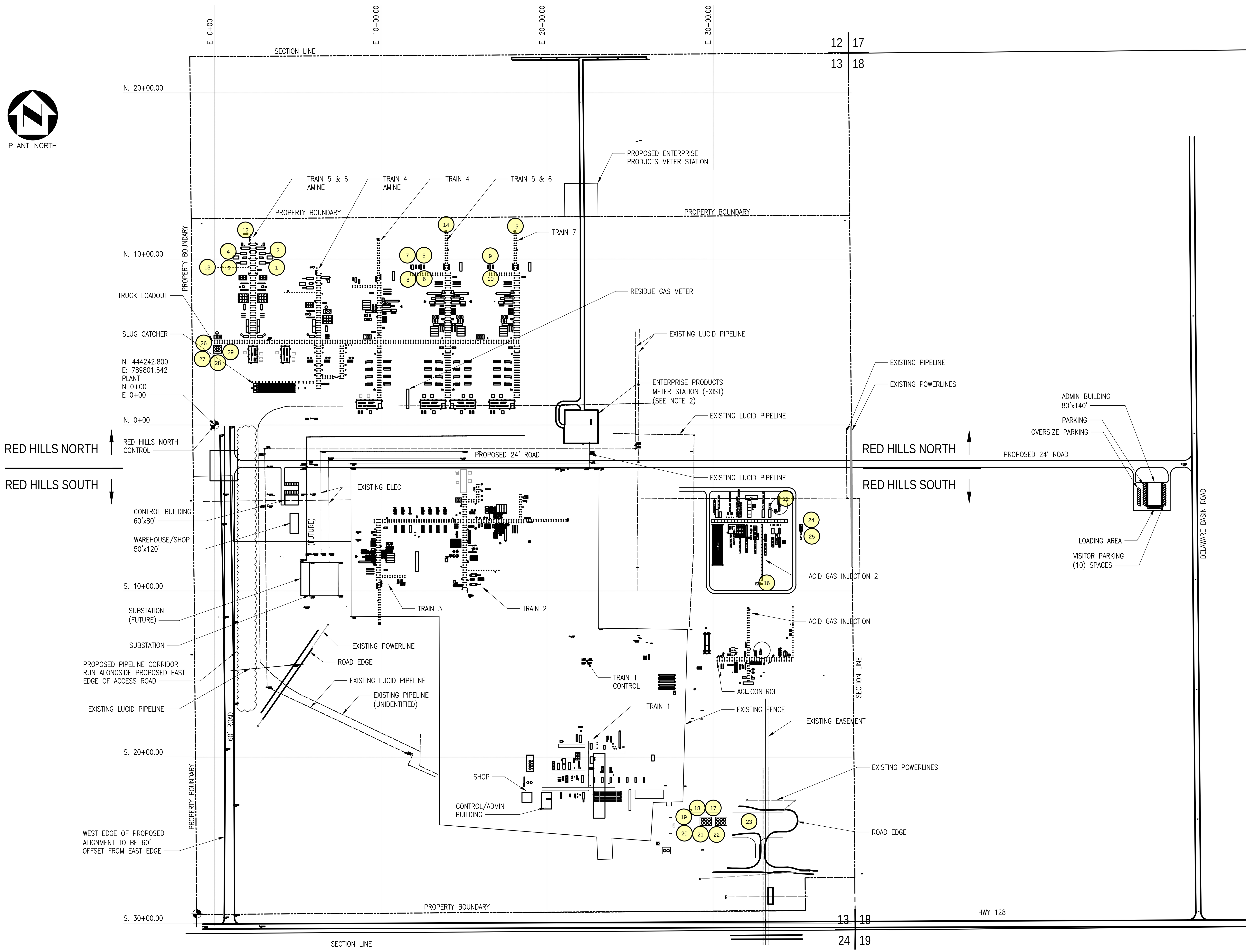
FIGURE C

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 is attached.



LEGEND

- ROAD EDGE
- FENCE
- E — E — ELEC EXISTTRICAL LINES
- 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

DRAWING NO.	TITLE	REV	DATE	BY	APP'D	DESCRIPTION

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 ssomson

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.

Note: the emissions units listed below are the units being added to the Title V permit with this application.

Heaters (Units 5-EP-1c, 5-EP-1d, 6-EP-1c, 6-EP-1d, 7-EP-1c, 7-EP-1d)
NOx, CO, VOC, PM, 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 5-EP-1a, 5-EP-1b, 6-EP-1a, 6-EP-1b and 5.5-EP-1a)
NOx, VOC, PM, 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)
NOx, CO, VOC, PM, 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.

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.

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.

Flare SSM (Units 5-EP-2 and 7-EP-2)
The plant flares are used for flaring during startup, shutdown, maintenance and upset conditions. The only steady state conditions associated with these flares are from the pilot and purge gas streams. 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. NOx 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 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 gas routed to the flare will also be curtailed to half by switching to the backup compressor within 30 minutes or by reducing the inlet flow during SSM operations. 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 assist gas volume is 2 MMscf/d. The SO_2 composition is based on a 98% molar conversion of H_2S to SO_2. NOx and CO emissions for both scenarios are calculated using AP-42 Table 13.5-1 emission factors. Emissions of greenhouse gases are calculated using methodology from 40 CFR Subpart 98.233(n).

Thermal Oxidizes (Unit EP-5 and EP-6)
NOx, 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 Oxidizes (Unit EP-8 and EP-10)
NOx, CO, emissions were calculated 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-12)
NOx, 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)
NOx, 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 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 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 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-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 H2S 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 fromAP-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.

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)

GHG emissions are included in this application, as applicable.

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
		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

		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	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

Oil and Gas Emissions Spreadsheet

Revised 10/2/2014

General Notes

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

Enable Macro Link

Trusted Location Link

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

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

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

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

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

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

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

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

Oil and Gas Site General Information	
Administrative Information	
Company Name	Lucid Energy Delaware, LLC
Facility/Well Name	Red Hills Gas Processing Plant
Field Name	
Nearest City/Town	Jal
API Number/SIC Code	
Latitude/Longitude	
County	Lea
Are you using a Form PI-7, PI-7-CERT, APD-CERT, PI-7 and APD-CERT, or are you using ePermits?	
Customer Number, CNxxxxxxxxx (if known)	
Regulated Entity Number, RNxxxxxxxxx (if known)	
Technical Information	
Natural Gas Site Throughput (MMSCF/day):	494.588
Oil/Condensate Site Throughput (bbl/day):	3129.6
Produced Water Site Throughput (bbl/day):	87
Are there any sour gas streams at this site?	Yes
Is this site currently operational/producing?	Yes
What is the date of the site start of construction or the date that the project changes were implemented (whichever is applicable to this project, anticipated date if in the future)?	
Has this site been registered before?	Yes

Equipment/Processes at Site		
Before entering any numbers into the Equipment/Processes section of the table below, please make sure to review all of the comments in the cells of the table. These should make it clear what numbers need to be entered and where they need to be entered.		
Equipment/Process Types	**How many for this project?**	**How many for this site?**
Fugitives	5	5
IC Engines	0	0
Turbines	0	0
Diesel Engines	0	0
Heaters-Boilers	14	14
Oil / Condensate Tanks	12	12
Produced Water Tanks	4	4
Miscellaneous Tanks	6	6
Loading Jobs	4	4
Glycol Units	2	2
Amine Units	2	2
Vapor Recovery Units	0	0
Flares-Vapor Combustors	6	6
Thermal Oxidizers	3	3
MSS Blowdowns	8	8
MSS FLR Tank Landing Loss	0	0
MSS Tank Non Forced Vent	0	0
MSS Tank Forced Vent Degas	0	0
MSS Defaults	1	1
MSS Paint Blast	0	0
MSS Other	0	0
Other	0	0

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

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

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

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

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

Run

Reset

Next Tab

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Gas and Liquid Analyses

A) Enter information into the yellow boxes.

B) The purpose of this tab is to extract information from a lab analysis that will be used in emission calculations. Unlike the other other tabs which calculate emissions, nothing from this tab gets pulled to the Emissions Summary table. The big pieces of information needed for emissions estimates are the VOC, benzene, and H_2S weight percents. Sampling of gas and liquid streams from appropriate process sampling points is required in order to determine composition or other properties needed to estimate emissions such as heat content, specific gravity, and vapor pressure. It is essential that stream lab analyses/reports include a measurement of H_2S, individual HAPs, and at least all those hydrocarbons up to at least 10 carbon atoms per molecule (C10+).

C) There are two boxes on the left, for gas and liquid analyses, which take component weight percent inputs and there are two boxes on the right, for gas and liquid analyses, which take component mole percent inputs. You can either fill out the weight percent box <u>OR</u> the mole percent box, depending on what informaton you have available to you.

The boxes are set up in the following arrangement:

Gas Analysis Wt% Inputs	Gas Analysis Mol% Inputs
Liquid Analysis Wt% Inputs	Liquid Analysis Mol% Inputs

D) <u>If weight percents are provided on the lab report, use the boxes on the left.</u> If only mole percents are provided on the lab report, use the boxes on the right.

E) Make sure to select whether you are inputting weight percents or mole percents from the pull down menus below.

F) If you are using the weight percent boxes (left two), in addition to the component weight percents, you need to enter the gas molecular weight (molecular weight of the total sample) and the gas and liquid H_2S content in parts per million by volume (H_2S ppmv). This will allow for the calcultion of the gas specific gravity and the long tons of sulfur per day in the gas, and the determination of sweet versus sour gas.

G) If you are using the mole percent boxes (right two), in addition to the component mole percents, you need to enter a real value, specific to this sample, for the molecular weight of the deacnes plus (C10+) fraction. You may use the default values listed below for the moleclar weights of the other hexanes (C6), other heptanes (C7), other ocatnes (C8), and nonanes (C9) fractions, unless you have a more accurate number. If you enter number other than the default, you need to explain where the number came from and why it is appropriate to use.

H) What is expected to be inlcuded on these tables is the the inlet gas and liquid streams (the liquid would most likely be sampled from a separator if there is separation at the site). These tables can also be used for any sampled gas and liquid streams as needed. If needed, make a copy of this tab.

I) Use the box provided below for entering any notes necessary.

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

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

Gas Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample
VOC weight% = 0.0000
VOC weight fraction = 0.0000

VOC content of hydrocarbon fraction only
VOC weight% = #DIV/0!
VOC weight fraction = #DIV/0!

Hydrogen Sulfide

H2S weight% = 0.0000
H2S weight fraction = 0.00E+00
H2S ppm_V =
H2S ppm_{WT} = 0.00
H_2S grains/100 SCF = 0.0000
SWEET GAS

Constants:
453.59237 mol/lb-mol
0.06479891 grams/grain
385.48 scf/lb-mol
34.08188 g/mol, lb/lb-mol
H2S mw

Benzene

Benzene content of total sample
Benzene weight% = 0.0000
Benzene weight fraction = 0.0000

Benzene content of hydrocarbon fraction only
Benzene weight% = #DIV/0!
Benzene weight fraction = #DIV/0!

Gas Molecular Weight =
Gas Specific Gravity = 0.00

Constants:
28.97 air mw
385.48 scf/lb-mol

Gas Throughput (MMscf/day)= 494.588

Long Tons Sulfur Compounds per Day = 0

Gas Analysis - Use if the Inputs are Mole Percents

Analysis Identifier/Name	Inlet Gas
Where was the sample taken?	Amine inlet
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	Site Specific, ProMax
Where in the process was the sample taken?	Inlet at the Amine process
What is the temperature and pressure of the sample (include units)?	70 F @ 914.696 psia
Who analyzed the sample?	ProMax
Date of sample:	6/17/2019

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	weight %
hydrogen	0.0000	2.01588	0	0.0000
helium	0.0000	4.0026	0	0.0000
nitrogen	2.1268	28.01340	60	2.6186
CO2	5.6291	44.00950	248	10.8883
H2S	0.0002	34.08188	0	0.0003
methane (C1)	72.0489	16.04246	1156	50.8010
ethane (C2)	10.8894	30.06904	327	14.3912
propane (C3)	5.7037	44.09562	252	11.0541
butanes (C4)	2.3766	58.12220	138	6.0711
pentanes (C5)	0.7628	72.14878	55	2.4190
benzene	0.0142	78.110000	1	0.0488
other hexanes (C6)	0.4215	86.18000	36	1.5966
toluene	0.0043	92.140000	0	0.0174
other heptanes (C7)	0.0114	100.20000	1	0.0501
ethylbenzene	0.0002	106.170000	0	0.0011
xylenes (o, m, p)	0.0011	106.170000	0	0.0052
other octanes (C8)	0.0046	114.23000	1	0.0231
nonanes (C9)	0.0021	128.26000	0	0.0118
decanes plus (C10+)	0.0030	18.01528	0	0.0024
Totals:	99.9999	22.75	2275	100.00

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample
VOC weight% = 21.3005
VOC weight fraction = 0.2130

VOC content of hydrocarbon fraction only
VOC weight% = 24.6270
VOC weight fraction = 0.2463

Hydrogen Sulfide

H2S weight% = 0.0003
H2S weight fraction = 3.00E-06
H2S ppm_V = 2
H2S ppm_{WT} = 3.00
H_2S grains/100 SCF = 0.1238
SWEET GAS

Constants:
453.59237 mol/lb-mol
0.06479891 grams/grain
385.48 scf/lb-mol

Benzene

Benzene content of total sample
Benzene weight% = 0.0488
Benzene weight fraction = 0.0005

Benzene content of hydrocarbon fraction only
Benzene weight% = 0.0564
Benzene weight fraction = 0.0006

Gas Molecular Weight = 22.75
Gas Specific Gravity = 0.79

Constants:
28.97 air mw
385.48 scf/lb-mol

Gas Throughput (MMscf/day)= 494.588

Long Tons Sulfur Compounds per Day = 0.0390431

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

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

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

Liquid Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	0.0000
VOC weight fraction =	0.0000

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Benzene content of hydrocarbon fraction only

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

Liquid Analysis - Use if the Inputs are Mole Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

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

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

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

Benzene content of hydrocarbon fraction only

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Gas and Liquid Analyses

A) Enter information into the yellow boxes.

B) The purpose of this tab is to extract information from a lab analysis that will be used in emission calculations. Unlike the other other tabs which calculate emissions, nothing from this tab gets pulled to the Emissions Summary table. The big pieces of information needed for emissions estimates are the VOC, benzene, and H_2S weight percents. Sampling of gas and liquid streams from appropriate process sampling points is required in order to determine composition or other properties needed to estimate emissions such as heat content, specific gravity, and vapor pressure. It is essential that stream lab analyses/reports include a measurement of H_2S, individual HAPs, and at least all those hydrocarbons up to at least 10 carbon atoms per molecule (C10+).

C) There are two boxes on the left, for gas and liquid analyses, which take component weight percent inputs and there are two boxes on the right, for gas and liquid analyses, which take component mole percent inputs. You can either fill out the weight percent box <u>OR</u> the mole percent box, depending on what informaton you have available to you.

The boxes are set up in the following arrangement:

Gas Analysis Wt% Inputs	Gas Analysis Mol% Inputs
Liquid Analysis Wt% Inputs	Liquid Analysis Mol% Inputs

D) <u>If weight percents are provided on the lab report, use the boxes on the left.</u> If only mole percents are provided on the lab report, use the boxes on the right.

E) Make sure to select whether you are inputting weight percents or mole percents from the pull down menus below.

F) If you are using the weight percent boxes (left two), in addition to the component weight percents, you need to enter the gas molecular weight (molecular weight of the total sample) and the gas and liquid H_2S content in parts per million by volume (H_2S ppmv). This will allow for the calcultion of the gas specific gravity and the long tons of sulfur per day in the gas, and the determination of sweet versus sour gas.

G) If you are using the mole percent boxes (right two), in addition to the component mole percents, you need to enter a real value, specific to this sample, for the molecular weight of the deacnes plus (C10+) fraction. You may use the default values listed below for the moleclar weights of the other hexanes (C6), other heptanes (C7), other ocatnes (C8), and nonanes (C9) fractions, unless you have a more accurate number. If you enter number other than the default, you need to explain where the number came from and why it is appropriate to use.

H) What is expected to be inlcuded on these tables is the the inlet gas and liquid streams (the liquid would most likely be sampled from a separator if there is separation at the site). These tables can also be used for any sampled gas and liquid streams as needed. If needed, make a copy of this tab.

I) Use the box provided below for entering any notes necessary.

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

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

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	0.0000
VOC weight fraction =	0.0000

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

H2S weight% =	0.0000
H2S weight fraction =	0.00E+00
H2S ppm$_V$ =	
H2S ppm$_{WT}$=	0.00
H_2S grains/100 SCF =	0.0000
	SWEET GAS

Constants:

453.59237	mol/lb-mol
0.06479891	grams/grain
385.48	scf/lb-mol
34.08188	g/mol, lb/lb-mol
	H2S mw

Benzene

Benzene content of total sample

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Benzene content of hydrocarbon fraction only

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

Gas Molecular Weight =	
Gas Specific Gravity =	0.00
Gas Throughput (MMscf/day)=	494.588
Long Tons Sulfur Compounds per Day =	0

Constants:

28.97	air mw
385.48	scf/lb-mol

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

Component	**mole %**	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	**weight %**
hydrogen	0.0000	2.01588	0	0.0000
helium	0.0000	4.0026	0	0.0000
nitrogen	3.3400	28.01340	94	5.5630
CO2	0.0100	44.00950	0	0.0262
H2S	0.0030	34.08188	0	0.0061
methane (C1)	94.0500	16.04246	1509	89.7065
ethane (C2)	2.5400	30.06904	76	4.5410
propane (C3)	0.0600	44.09562	3	0.1573
butanes (C4)		58.12220	0	0.0000
pentanes (C5)		72.14878	0	0.0000
benzene		78.110000	0	0.0000
other hexanes (C6)		86.18000	0	0.0000
toluene		92.140000	0	0.0000
other heptanes (C7)		100.20000	0	0.0000
ethylbenzene		106.170000	0	0.0000
xylenes (o, m, p)		106.170000	0	0.0000
other octanes (C8)		114.23000	0	0.0000
nonanes (C9)		128.26000	0	0.0000
decanes plus (C10+)		142.28000	0	0.0000
Totals:	100.0030	16.82	1682	100.00

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	0.1573
VOC weight fraction =	0.0016

VOC content of hydrocarbon fraction only

VOC weight% =	0.1666
VOC weight fraction =	0.0017

Hydrogen Sulfide

H2S weight% =	0.0061
H2S weight fraction =	6.08E-05
H2S ppm$_V$ =	30
H2S ppm$_{WT}$=	60.79
H_2S grains/100 SCF =	1.8567
	SOUR GAS

Constants:

453.59237	mol/lb-mol
0.06479891	grams/grain
385.48	scf/lb-mol

Benzene

Benzene content of total sample

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Benzene content of hydrocarbon fraction only

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Gas Molecular Weight =	16.82
Gas Specific Gravity =	0.58
Gas Throughput (MMscf/day)=	494.588
Long Tons Sulfur Compounds per Day =	0.5856467

Constants:

28.97	air mw
385.48	scf/lb-mol

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

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

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

Liquid Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	0.0000
VOC weight fraction =	0.0000

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Benzene content of hydrocarbon fraction only

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

Liquid Analysis - Use if the Inputs are Mole Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

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

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

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

Benzene content of hydrocarbon fraction only

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Gas and Liquid Analyses

A) Enter information into the yellow boxes.

B) The purpose of this tab is to extract information from a lab analysis that will be used in emission calculations. Unlike the other other tabs which calculate emissions, nothing from this tab gets pulled to the Emissions Summary table. The big pieces of information needed for emissions estimates are the VOC, benzene, and H_2S weight percents. Sampling of gas and liquid streams from appropriate process sampling points is required in order to determine composition or other properties needed to estimate emissions such as heat content, specific gravity, and vapor pressure. It is essential that stream lab analyses/reports include a measurement of H_2S, individual HAPs, and at least all those hydrocarbons up to at least 10 carbon atoms per molecule (C10+).

C) There are two boxes on the left, for gas and liquid analyses, which take component weight percent inputs and there are two boxes on the right, for gas and liquid analyses, which take component mole percent inputs. You can either fill out the weight percent box <u>OR</u> the mole percent box, depending on what informaton you have available to you.

The boxes are set up in the following arrangement:

Gas Analysis Wt% Inputs	Gas Analysis Mol% Inputs
Liquid Analysis Wt% Inputs	Liquid Analysis Mol% Inputs

D) <u>If weight percents are provided on the lab report, use the boxes on the left.</u> If only mole percents are provided on the lab report, use the boxes on the right.

E) Make sure to select whether you are inputting weight percents or mole percents from the pull down menus below.

F) If you are using the weight percent boxes (left two), in addition to the component weight percents, you need to enter the gas molecular weight (molecular weight of the total sample) and the gas and liquid H_2S content in parts per million by volume (H_2S ppmv). This will allow for the calcultion of the gas specific gravity and the long tons of sulfur per day in the gas, and the determination of sweet versus sour gas.

G) If you are using the mole percent boxes (right two), in addition to the component mole percents, you need to enter a real value, specific to this sample, for the molecular weight of the deacnes plus (C10+) fraction. You may use the default values listed below for the moleclar weights of the other hexanes (C6), other heptanes (C7), other ocatnes (C8), and nonanes (C9) fractions, unless you have a more accurate number. If you enter number other than the default, you need to explain where the number came from and why it is appropriate to use.

H) What is expected to be inlcuded on these tables is the the inlet gas and liquid streams (the liquid would most likely be sampled from a separator if there is separation at the site). These tables can also be used for any sampled gas and liquid streams as needed. If needed, make a copy of this tab.

I) Use the box provided below for entering any notes necessary.

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

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

Gas Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample
VOC weight% = 0.0000
VOC weight fraction = 0.0000

VOC content of hydrocarbon fraction only
VOC weight% = #DIV/0!
VOC weight fraction = #DIV/0!

Hydrogen Sulfide
H2S weight% = 0.0000
H2S weight fraction = 0.00E+00
H2S ppm_V =
H2S ppm_{WT}= 0.00
H_2S grains/100 SCF = 0.0000
SWEET GAS

Constants:
453.59237 mol/lb-mol
0.06479891 grams/grain
385.48 scf/lb-mol
34.08188 g/mol, lb/lb-mol
H2S mw

Benzene

Benzene content of total sample
Benzene weight% = 0.0000
Benzene weight fraction = 0.0000

Benzene content of hydrocarbon fraction only
Benzene weight% = #DIV/0!
Benzene weight fraction = #DIV/0!

Gas Molecular Weight =
Gas Specific Gravity = 0.00

Constants:
28.97 air mw
385.48 scf/lb-mol

Gas Throughput (MMscf/day)= 494.588

Long Tons Sulfur Compounds per Day = 0

Gas Analysis - Use if the Inputs are Mole Percents

Analysis Identifier/Name	Mole Sieve Stream
Where was the sample taken?	Promax
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	Site Specific
Where in the process was the sample taken?	Mole sieve stream
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	6/17/2019

Component	**mole %**	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	**weight %**
hydrogen	0.0000	2.01588	0	0.0000
helium	0.0000	4.0026	0	0.0000
nitrogen	2.2762	28.01340	64	3.0033
CO2	0.0071	44.00950	0	0.0148
H2S	0.0000	34.08188	0	0.0000
methane (C1)	76.8491	16.04246	1233	58.0669
ethane (C2)	11.5013	30.06904	346	16.2887
propane (C3)	5.9246	44.09562	261	12.3048
butanes (C4)	2.3778	58.12220	138	6.5092
pentanes (C5)	0.7102	72.14878	51	2.4134
benzene	0.0091	78.110000	1	0.0335
other hexanes (C6)	0.3201	86.18000	28	1.2995
toluene	0.0019	92.140000	0	0.0083
other heptanes (C7)	0.0064	100.20000	1	0.0304
ethylbenzene	0.0001	106.170000	0	0.0003
xylenes (o, m, p)	0.0003	106.170000	0	0.0015
other octanes (C8)	0.0023	114.23000	0	0.0122
nonanes (C9)	0.0004	128.26000	0	0.0024
decanes plus (C10+)	0.0129	18.01528	0	0.0110
Totals:	99.9999	21.23	2123	100.00

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample
VOC weight% = 22.6264
VOC weight fraction = 0.2263

VOC content of hydrocarbon fraction only
VOC weight% = 23.3305
VOC weight fraction = 0.2333

Hydrogen Sulfide
H2S weight% = 0.0000
H2S weight fraction = 0.00E+00
H2S ppm_V = 0
H2S ppm_{WT}= 0.00
H_2S grains/100 SCF = 0.0000
SWEET GAS

Constants:
453.59237 mol/lb-mol
0.06479891 grams/grain
385.48 scf/lb-mol

Benzene

Benzene content of total sample
Benzene weight% = 0.0335
Benzene weight fraction = 0.0003

Benzene content of hydrocarbon fraction only
Benzene weight% = 0.0345
Benzene weight fraction = 0.0003

Gas Molecular Weight = 21.23
Gas Specific Gravity = 0.73

Constants:
28.97 air mw
385.48 scf/lb-mol

Gas Throughput (MMscf/day)= 494.588

Long Tons Sulfur Compounds per Day = 0

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

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

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

Liquid Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	0.0000
VOC weight fraction =	0.0000

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Benzene content of hydrocarbon fraction only

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

Liquid Analysis - Use if the Inputs are Mole Percents

Analysis Identifier/Name	900 gpm compressor
What site is the sample from?	
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	
Where in the process was the sample taken?	
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	weight %
hydrogen		2.01588	0	#DIV/0!
helium		4.0026	0	#DIV/0!
nitrogen		28.01340	0	#DIV/0!
CO2		44.00950	0	#DIV/0!
H2S		34.08188	0	#DIV/0!
methane (C1)		16.04246	0	#DIV/0!
ethane (C2)		30.06904	0	#DIV/0!
propane (C3)		44.09562	0	#DIV/0!
butanes (C4)		58.12220	0	#DIV/0!
pentanes (C5)		72.14878	0	#DIV/0!
benzene		78.110000	0	#DIV/0!
other hexanes (C6)		86.18000	0	#DIV/0!
toluene		92.140000	0	#DIV/0!
other heptanes (C7)		100.20000	0	#DIV/0!
ethylbenzene		106.170000	0	#DIV/0!
xylenes (o, m, p)		106.170000	0	#DIV/0!
other octanes (C8)		114.23000	0	#DIV/0!
nonanes (C9)		128.26000	0	#DIV/0!
decanes plus (C10+)		18.01600	0	#DIV/0!
Totals:	0.0000	0.00	0	#DIV/0!

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

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

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

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

Benzene content of hydrocarbon fraction only

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

Enter any notes here:	

Lucid Energy Delaware, LLC
Red Hills Gas Processing Plant

Gas and Liquid Analyses

A) Enter information into the yellow boxes.

B) The purpose of this tab is to extract information from a lab analysis that will be used in emission calculations. Unlike the other other tabs which calculate emissions, nothing from this tab gets pulled to the Emissions Summary table. The big pieces of information needed for emissions estimates are the VOC, benzene, and H_2S weight percents. Sampling of gas and liquid streams from appropriate process sampling points is required in order to determine composition or other properties needed to estimate emissions such as heat content, specific gravity, and vapor pressure. It is essential that stream lab analyses/reports include a measurement of H_2S, individual HAPs, and at least all those hydrocarbons up to at least 10 carbon atoms per molecule (C10+).

C) There are two boxes on the left, for gas and liquid analyses, which take component weight percent inputs and there are two boxes on the right, for gas and liquid analyses, which take component mole percent inputs. You can either fill out the weight percent box <u>OR</u> the mole percent box, depending on what informaton you have available to you.

The boxes are set up in the following arrangement:

Gas Analysis Wt% Inputs	Gas Analysis Mol% Inputs
Liquid Analysis Wt% Inputs	Liquid Analysis Mol% Inputs

D) <u>If weight percents are provided on the lab report, use the boxes on the left.</u> If only mole percents are provided on the lab report, use the boxes on the right.

E) Make sure to select whether you are inputting weight percents or mole percents from the pull down menus below.

F) If you are using the weight percent boxes (left two), in addition to the component weight percents, you need to enter the gas molecular weight (molecular weight of the total sample) and the gas and liquid H_2S content in parts per million by volume (H_2S ppmv). This will allow for the calcultion of the gas specific gravity and the long tons of sulfur per day in the gas, and the determination of sweet versus sour gas.

G) If you are using the mole percent boxes (right two), in addition to the component mole percents, you need to enter a real value, specific to this sample, for the molecular weight of the deacnes plus (C10+) fraction. You may use the default values listed below for the moleclar weights of the other hexanes (C6), other heptanes (C7), other ocatnes (C8), and nonanes (C9) fractions, unless you have a more accurate number. If you enter number other than the default, you need to explain where the number came from and why it is appropriate to use.

H) What is expected to be inlcuded on these tables is the the inlet gas and liquid streams (the liquid would most likely be sampled from a separator if there is separation at the site). These tables can also be used for any sampled gas and liquid streams as needed. If needed, make a copy of this tab.

I) Use the box provided below for entering any notes necessary.

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

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

Gas Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample
VOC weight% = 0.0000
VOC weight fraction = 0.0000

VOC content of hydrocarbon fraction only
VOC weight% = #DIV/0!
VOC weight fraction = #DIV/0!

Hydrogen Sulfide
H2S weight% = 0.0000
H2S weight fraction = 0.00E+00
H2S ppm$_V$ =
H2S ppm$_{WT}$= 0.00
H_2S grains/100 SCF = 0.0000
SWEET GAS

Constants:
453.59237 mol/lb-mol
0.06479891 grams/grain
385.48 scf/lb-mol
34.08188 g/mol, lb/lb-mol
H2S mw

Benzene

Benzene content of total sample
Benzene weight% = 0.0000
Benzene weight fraction = 0.0000

Benzene content of hydrocarbon fraction only
Benzene weight% = #DIV/0!
Benzene weight fraction = #DIV/0!

Gas Molecular Weight =
Gas Specific Gravity = 0.00

Constants:
28.97 air mw
385.48 scf/lb-mol

Gas Throughput (MMscf/day)= 494.588

Long Tons Sulfur Compounds per Day = 0

Gas Analysis - Use if the Inputs are Mole Percents

Analysis Identifier/Name	AGI Flare - 900 gpm
Where was the sample taken?	Promax
If the sample is from a representaive site, explain how this sampled stream is representative of the similar stream at this site (use the notes box provided below if more space is needed).	Site Specific
Where in the process was the sample taken?	AGI #2 Compressor
What is the temperature and pressure of the sample (include units)?	
Who analyzed the sample?	
Date of sample:	

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	weight %
hydrogen	0.0000	2.01588	0	0.0000
helium	0.0000	4.0026	0	0.0000
nitrogen	0.0002	28.01340	0	0.0001
CO2	80.1854	44.00950	3529	86.3047
H2S	12.5711	34.08188	428	10.4783
methane (C1)	0.0908	16.04246	1	0.0356
ethane (C2)	0.0259	30.06904	1	0.0190
propane (C3)	0.0167	44.09562	1	0.0180
butanes (C4)	0.0046	58.12220	0	0.0065
pentanes (C5)	0.0020	72.14878	0	0.0035
benzene	0.0000	78.110000	0	0.0000
other hexanes (C6)	0.0027	86.18000	0	0.0056
toluene	0.0000	92.140000	0	0.0000
other heptanes (C7)		100.20000	0	0.0000
ethylbenzene		106.170000	0	0.0000
xylenes (o, m, p)		106.170000	0	0.0000
other octanes (C8)		114.23000	0	0.0000
nonanes (C9)		128.26000	0	0.0000
decanes plus (C10+)	7.1010	18.01528	128	3.1286
Totals:	100.0002	40.89	4089	100.00

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample
VOC weight% = 3.1622
VOC weight fraction = 0.0316

VOC content of hydrocarbon fraction only
VOC weight% = 98.3022
VOC weight fraction = 0.9830

Hydrogen Sulfide
H2S weight% = 10.4783
H2S weight fraction = 1.05E-01
H2S ppm$_V$ = 125711
H2S ppm$_{WT}$= 104782.79
H_2S grains/100 SCF = 7780.1897
SOUR GAS

Constants:
453.59237 mol/lb-mol
0.06479891 grams/grain
385.48 scf/lb-mol

Benzene

Benzene content of total sample
Benzene weight% = 0.0000
Benzene weight fraction = 0.0000

Benzene content of hydrocarbon fraction only
Benzene weight% = 0.0000
Benzene weight fraction = 0.0000

Gas Molecular Weight = 40.89
Gas Specific Gravity = 1.41

Constants:
28.97 air mw
385.48 scf/lb-mol

Gas Throughput (MMscf/day)= 494.588

Long Tons Sulfur Compounds per Day = 2454.0743

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

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

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

Liquid Analysis - Use if the Inputs are Weight Percents

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

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

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

VOC weight% =	0.0000
VOC weight fraction =	0.0000

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

Benzene weight% =	0.0000
Benzene weight fraction =	0.0000

Benzene content of hydrocarbon fraction only

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

Liquid Analysis - Use if the Inputs are Mole Percents

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

Component	mole %	Molecular Weight (grams/mole, lb/lb-mol)	grams per 100 moles of gas	weight %
hydrogen		2.01588	0	#DIV/0!
helium		4.0026	0	#DIV/0!
nitrogen		28.01340	0	#DIV/0!
CO2		44.00950	0	#DIV/0!
H2S		34.08188	0	#DIV/0!
methane (C1)		16.04246	0	#DIV/0!
ethane (C2)		30.06904	0	#DIV/0!
propane (C3)		44.09562	0	#DIV/0!
butanes (C4)		58.12220	0	#DIV/0!
pentanes (C5)		72.14878	0	#DIV/0!
benzene		78.110000	0	#DIV/0!
other hexanes (C6)		86.18000	0	#DIV/0!
toluene		92.140000	0	#DIV/0!
other heptanes (C7)		100.20000	0	#DIV/0!
ethylbenzene		106.170000	0	#DIV/0!
xylenes (o, m, p)		106.170000	0	#DIV/0!
other octanes (C8)		114.23000	0	#DIV/0!
nonanes (C9)		128.26000	0	#DIV/0!
decanes plus (C10+)		18.01600	0	#DIV/0!
Totals:	0.0000	0.00	0	#DIV/0!

VOC (Non-methane, Non-ethane hydrocarbons)

VOC content of total sample

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

VOC content of hydrocarbon fraction only

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

Hydrogen Sulfide

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

Benzene

Benzene content of total sample

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

Benzene content of hydrocarbon fraction only

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

Enter any notes here:	

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

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
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) 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
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-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	0.388552	1.70186
NOx	50	-	3.431	15.029	3.532295	15.47145
CO	-	0.05	3.500	15.330	3.602941	15.78088
PM_{10}	7.6	-	0.522	2.284	0.536909	2.351661
$PM_{2.5}$	5.7	-	0.391	1.713	0.402682	1.763746
SO_2	0.6	-	0.348	1.526	0.358594	1.570642

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**	assumptions:		
SO_2 produced (lb/hr) =	**0.3483**	SO2 MW	64.06	lb/lb-mole
SO_2 produced (tpy) =	**1.5258**	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	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, <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	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, 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	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).
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	5.5-EP-1b	
Name	AGI 2 Reboiler	
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	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, 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) =	**0.0224**
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, <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) =	**0.1177**
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, <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 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, 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 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 – Strea	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 – Strea	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 – Strea	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 – Strea	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 – Strea	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 – Strea	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:	

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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

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.

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)

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)

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:

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

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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.

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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)

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:

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

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:

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

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

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

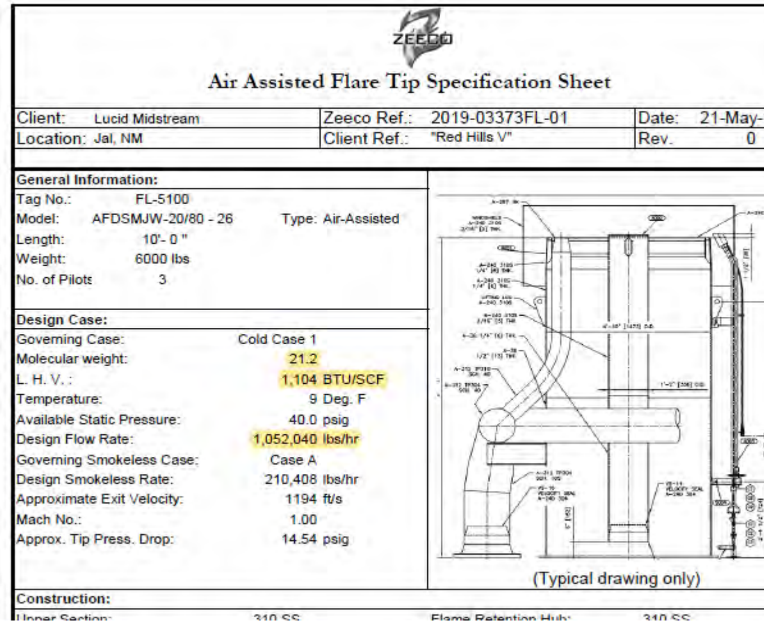
$$Residual\ H2S\ pph = \frac{Weight\ \%\ H2S}{100}\ x\frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas\left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right)\ x\ \frac{MW\ of\ SO2}{MW\ \ of\ H2S}\ \ x\ \ Flare\ efficiency$$

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:

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

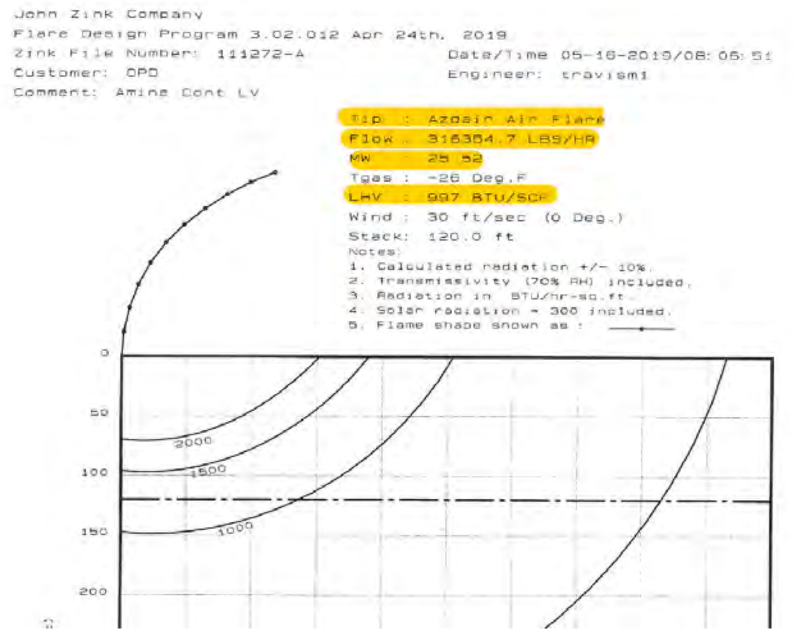
$$= \frac{Weight\ \%\ H2S}{100}\ x \frac{1}{385}\left(\frac{lb-mole}{scf}\right) x\ MW\ of\ gas \left(\frac{lb}{lb-mole}\right) x\ flowrate\ of\ gas\ \left(\frac{scf}{hr}\right) x\ \frac{MW\ of\ SO2}{MW\ of\ H2S}\ x\ Flare\ efficiency$$

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 Group - Red Hills Gas Processing Plant
Emergency Cryo Flare

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

Fuel Data

Flare Pilot	350	scf/hr	Max design	
	0.00035	MMscf/hr		
	1020.00	Btu/scf	Pipeline Gas, HHV	
	0.357	MMBtu/hr		
Sweep Gas	0.000	Mscf/day	Design	
	0.0000	Mscf/hr	Mscf/d / 24 hr/day	
	0.00E+00	MMscf/hr	Mscf/hr / 1000	
	1020.00	Btu/scf	Pipeline Gas, HHV	
	0.0000	MMBtu/hr	MMscf/hr * Btu/scf	
Flared Gas - Short Term	9.608	MMscf/hr	Effective hourly flowrate	
	3,005	Btu/scf		
	28,871	MMBtu/hr	Hourly heat rate = Heating value * Effective hourly flow rate.	
	12	hr/yr	Hours of operation	
Flared Gas - Annual	346446.45	MMscf/yr	Estimated Maximum annual SSM flow rate. Not a requested limit; for calculation only.	
Flare Design	803.65	scf/hr		
	40.88	lb/lb-mole	Molecular weight	
	149.0	Btu/scf	Heating value	
	385.0	scf/lb-mole	Molar volume	
	1000000.0	btu/MMBtu		
	0.1	MMBtu/hr	Flare design rate	
	50%			
	0.060	MMBtu/hr	Limited Design rate	
Pilot+ Sweep Gas only	16.8		Pilot & Sweep gas molecular weight	Mol. wt. of methane, the dominant species
	2.50E+04	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	2.01E+04		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	0.1417	m	Effective stack diameter (D)	$D = (10^{-6}q_n)^{1/2}$
Pilot+Flared Gas+ Assist gas	40.88	g/mol	weighted-averaged Flared gas molecular weight	
	4.19E+03	cal/sec	Heat release (q)	MMBtu/hr * 10^6 * 252 cal/Btu ÷ 3600 sec/hr
	2.90E+03		q_n	$q_n = q(1-0.048(MW)^{1/2})$
	0.054	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-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

Flare / Vapor Combustor HAPs

Emission Unit EPN	Name	Flare Efficiency	Hours of Operation (hrs/hr)	Benzene		Toluene		Ethylbenzene		n-Hexane		Xylene		2,2,4-Trimethylpentane	
				lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	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)

Compositio n	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
CHEMTHERN	0.0

Combustor Inlet Gas Analysis

Compositio n	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

Compositio n	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).

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	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 %

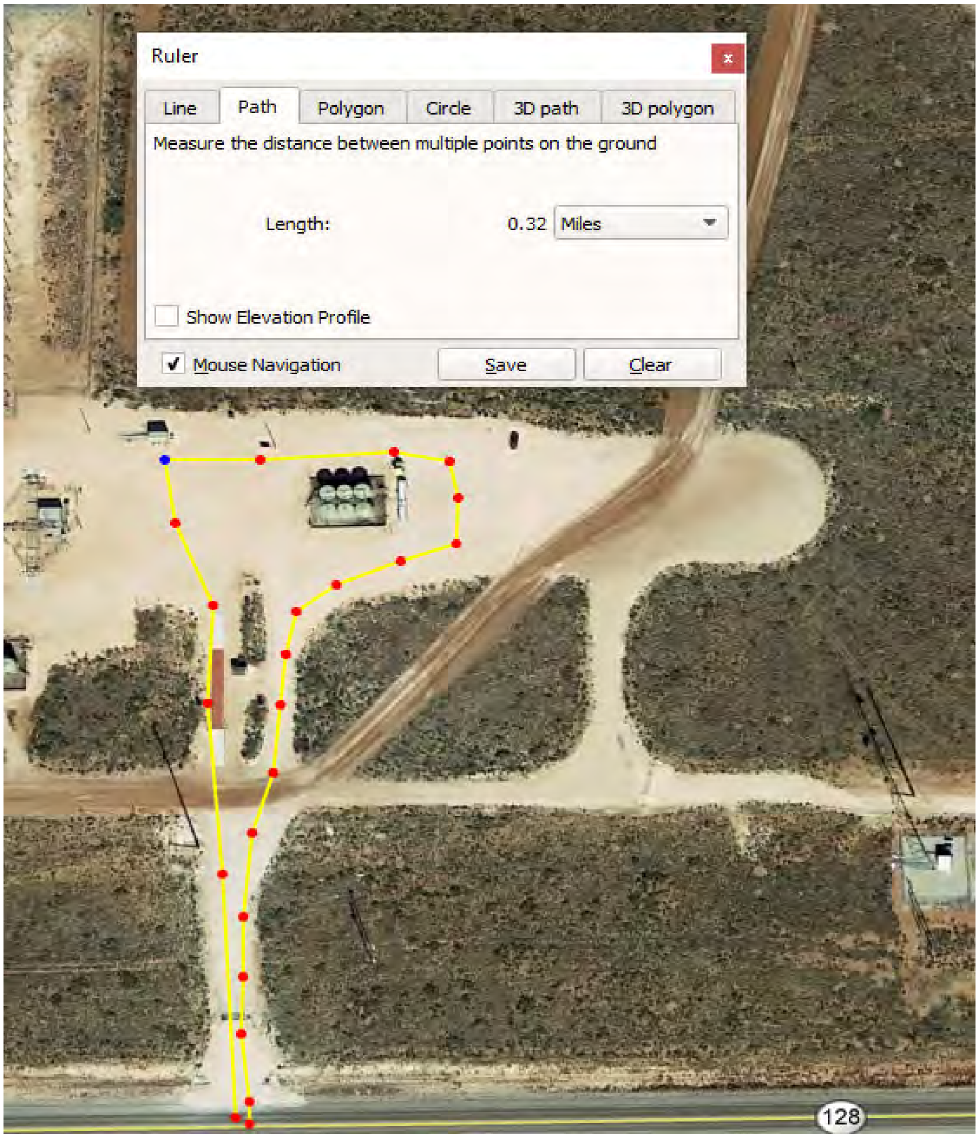
AP-42 Figure 13.2.2-1 - Annual wet days

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)


Ruler
Line
Path
Polygon
Circle
3D path
3D polygon
Measure the distance between multiple points on the ground
Length:
0.32
Miles
Show Elevation Profile
Mouse Navigation
Save
Clear
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	
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)

Ruler
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3D polygon
Measure the distance between multiple points on the ground
Length:
0.75
Miles
Show Elevation Profile
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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 %

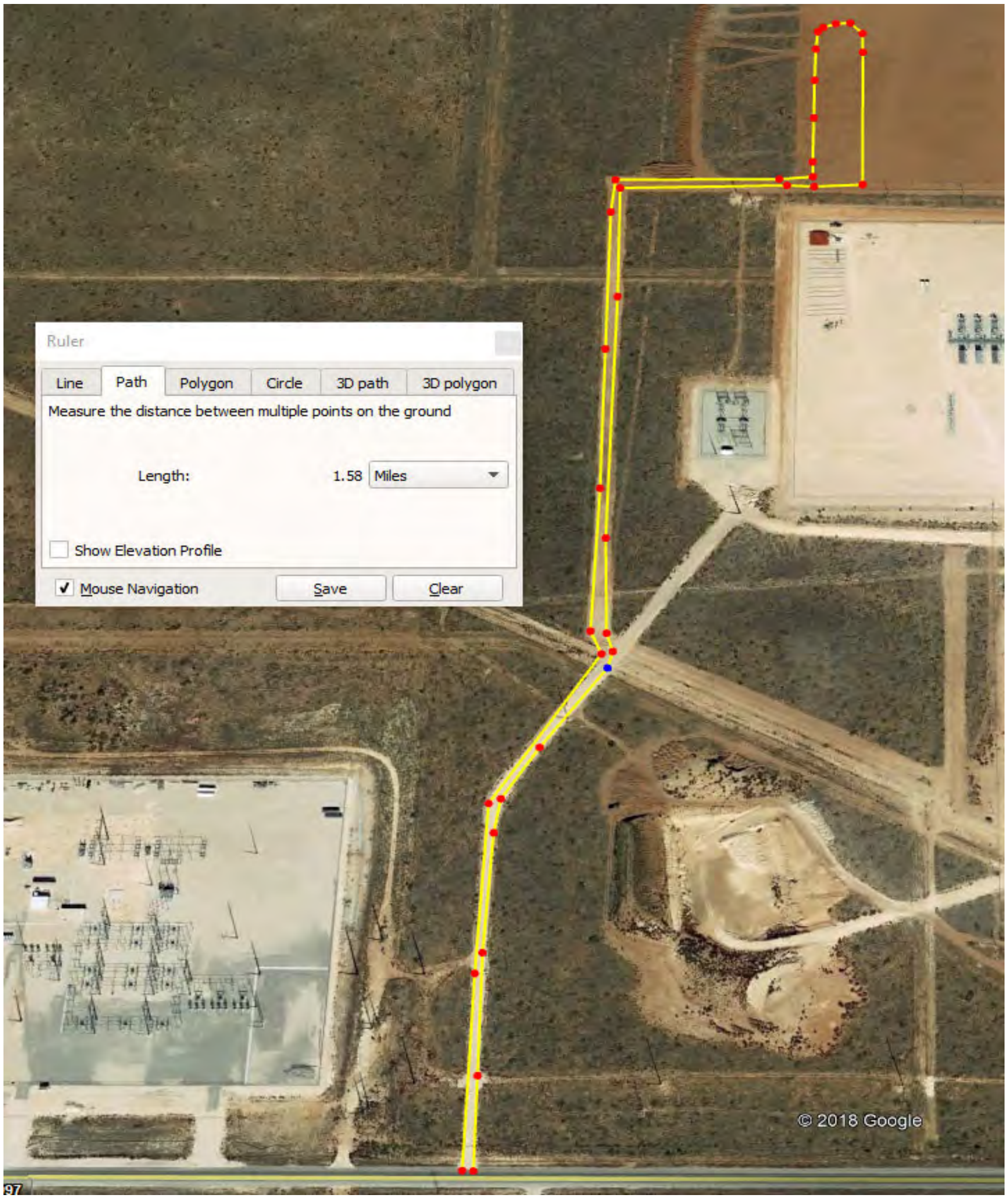
AP-42 Figure 13.2.2-1 - Annual wet days

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
Show Elevation Profile
Mouse Navigation
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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

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 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 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

Amine Vents (Units 4-EP-4, 5-EP-1f, and 6-EP-1f)
- ProMax

Glycol Dehydrators (Units 4-EP-3, 5-EP-1e, and 6-EP-1e)
- ProMax

Thermal Oxidizes (Unit EP-5, EP-6, EP-8 and EP-10)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- Manufacturer's specifications
- 40 CFR Part 98 methodology
- 40 CFR 98 Tables C-1 and C-2 Emission Factors

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

Enclosed Combustion Device (Unit EP-12)
- AP-42 Tables 1.4-1 and 1.4-2 from AP-42
- 40 CFR Part 98 methodology

Condensate Storage Tank (Unit 3-T)
- ProMax

Sour Water Tanks (Unit 4-T)
- Promax

Slop Tanks (Unit 5-T)
- Promax

Loading Emissions (Units 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-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

2019

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

Acid Gas Removal Units Using Modeling Software GHG Emissions & Data

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

$$E_{s,CH4} = V_s * X_{CH4} * \left[(1-\eta) * Z_L + Z_U\right] \qquad \text{(Eq. W-19)}$$

$$E_{s,CO2} = V_s * X_{CO2} + \sum_{j=1}^{5}\left(\eta * V_s * Y_j * R_j * Z_L\right) \qquad \text{(Eq. W-20)}$$

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 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 Stacks GHG Emissions & Data

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. $CO_2[lb/10^6 \text{ scf}] = (3.67)$ (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:

$$E_{ext} = E\ [(365 - P)/365] \quad (2)$$

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;

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
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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.

<u>Aggregate Handling and Storage Pile Emission Calculations</u>

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.

<u>Haul Road Emissions and Control Measure Efficiencies</u>

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
Chemical Engineering Consultants
P.O. Box 4747 Bryan, Texas 77805
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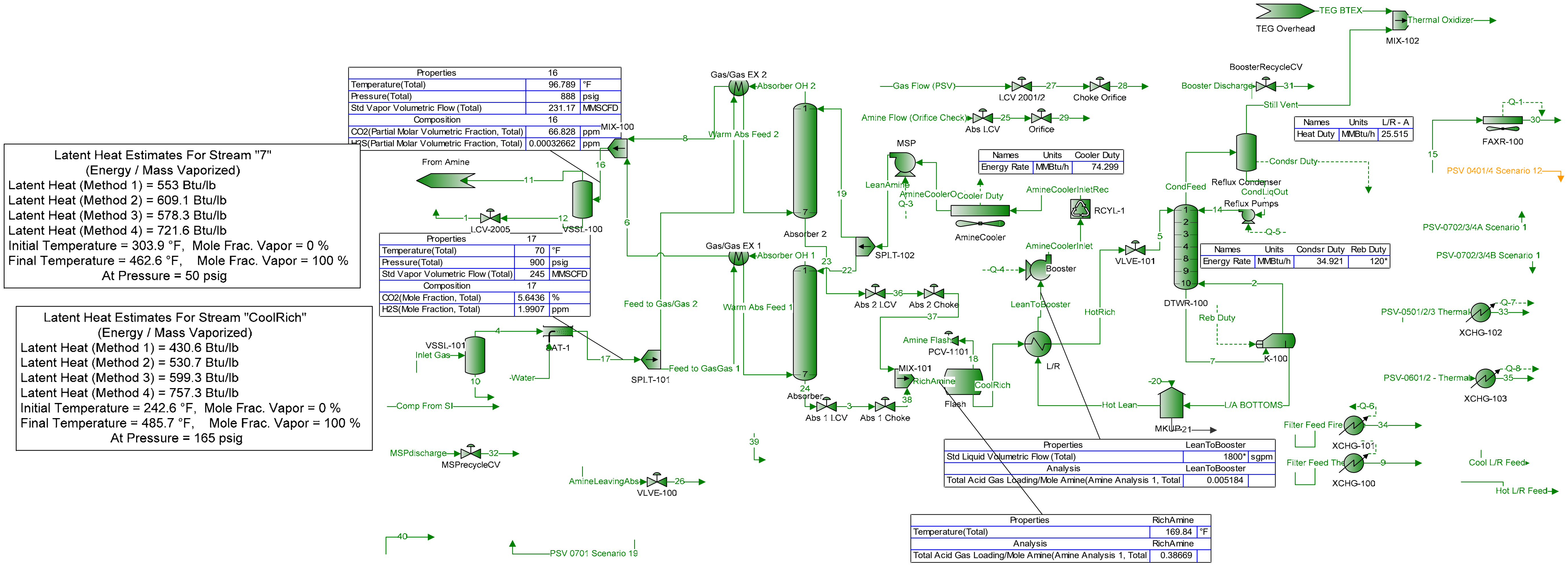
Report Navigator can be activated via the ProMax Navigator Toolbar.
An asterisk (*), throughout the report, denotes a user specified value.
A question mark (?) after a value, throughout the report, denotes an extrapolated or approximate value.



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
C10	0	0	0	3.91907E-08	0	0	0	4.33362E-08
Cyclopentane	2.47925	2.47925	0.0100533	0.00301954	0	0	0	0.00343635
Benzene	1.29138	1.29138	0.0242688	0.0436625	0	0	0	0.0507267
Cyclohexane	1.35475	1.35475	0.00599613	0.00149402	0	0	0	0.00160972
Methylcyclohexane	0.462856	0.462856	0.000928577	0.000148281	0	0	0	0.000161618
2,2,4-Trimethylpentane	0.189462	0.189462	8.90102E-05	1.32458E-05	0	0	0	1.24714E-05
Toluene	0.289505	0.289505	0.00456262	0.00625242	0	0	0	0.00731328
Ethylbenzene	0.0102902	0.0102902	0.000121758	0.000108439	0	0	0	0.000131350
p-Xylene	0.0472345	0.0472345	0.000606585	0.000654600	0	0	0	0.000825665
H2O	27.3547	27.3545	3.56962	9900.91	24597.2	24597.2	24597.2	11189.4
MDEA	0.0113181	0.0113180	0.000519312	1639.89	3130.04	3130.04	3130.04	1610.94
Piperazine	0.0487917	0.0487914	0.000104078	277.726	824.797	824.797	824.797	117.279
TEG	0	0	0	0	0	0	0	0
Mass Fraction	%	%	%	%	%	%	%	%
N2	2.99607	2.99607	0.742156	0.000970142	0	0	0	0.00109472
C1	57.9387	57.9387	41.1126	0.0509277	0	0	0	0.0558200
CO2	0.0153229	0.0153228	27.5409	8.30306	0.101593	0.101529	0.101529	6.30777
C2	16.2608	16.2608	13.5504	0.0248041	0	0	0	0.0272584
H2S	7.05525E-08	7.05519E-08	0.000861694	0.178622	7.16858E-06	1.39064E-05	1.39064E-05	0.139527
C3	12.2897	12.2897	7.27130	0.0136886	0	0	0	0.0147842
iC4	1.96542	1.96542	0.822857	0.00116990	0	0	0	0.00122811
nC4	4.53866	4.53866	2.48616	0.00377477	0	0	0	0.00407763
iC5	1.18546	1.18546	0.252578	0.000283686	0	0	0	0.000322664
nC5	1.16356	1.16356	0.328401	0.000424614	0	0	0	0.000473333
C6	1.25989	1.25989	0.245403	0.000115761	0	0	0	0.000125719
C7	0.0135114	0.0135114	0.00118226	4.05048E-06	0	0	0	4.45989E-06
C8	0.00428246	0.00428246	0.000402322	5.37102E-07	0	0	0	5.58852E-07
C9	0.00239420	0.00239420	4.59099E-05	2.69576E-08	0	0	0	2.95089E-08
C10	0	0	0	1.28180E-09	0	0	0	1.42746E-09
Cyclopentane	0.0645327	0.0645327	0.0584569	4.86801E-05	0	0	0	5.57933E-05
Benzene	0.0374377	0.0374376	0.157170	0.000783995	0	0	0	0.000917312
Cyclohexane	0.0423156	0.0423156	0.0418387	2.89034E-05	0	0	0	3.13630E-05
Methylcyclohexane	0.0168668	0.0168668	0.00755914	3.34676E-06	0	0	0	3.67370E-06
2,2,4-Trimethylpentane	0.00803220	0.00803220	0.000842983	3.47810E-07	0	0	0	3.29802E-07
Toluene	0.00990000	0.00989998	0.0348545	0.000132427	0	0	0	0.000155997
Ethylbenzene	0.000405454	0.000405454	0.00107173	2.64639E-06	0	0	0	3.22831E-06
p-Xylene	0.00186114	0.00186114	0.00533922	1.59752E-05	0	0	0	2.02931E-05
H2O	0.182899	0.182897	5.33172	41.0019	49.8984	49.8985	49.8985	46.6671
MDEA	0.000500553	0.000500549	0.00513064	44.9202	42	42	42	44.4406
Piperazine	0.00155979	0.00155978	0.000743272	5.49905	8	8	8	2.33865
TEG	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
N2	8072.61	8072.61	8.95140	4.22033	0	0	0	4.72868
C1	156110	156110	495.873	221.547	0	0	0	241.116
CO2	41.2859	41.2856	332.181	36120.2	902.197	901.636	901.636	27246.6
C2	43813.1	43813.1	163.436	107.904	0	0	0	117.744
H2S	0.000190097	0.000190095	0.0103932	777.047	0.0636609	0.123496	0.123496	602.690
C3	33113.3	33113.3	87.7017	59.5487	0	0	0	63.8610
iC4	5295.62	5295.62	9.92476	5.08933	0	0	0	5.30485
nC4	12229.0	12229.0	29.9865	16.4211	0	0	0	17.6134
iC5	3194.12	3194.12	3.04643	1.23410	0	0	0	1.39376
nC5	3135.09	3135.09	3.96095	1.84717	0	0	0	2.04458
C6	3394.65	3394.65	2.95989	0.503588	0	0	0	0.543048
C7	36.4052	36.4052	0.0142597	0.0176205	0	0	0	0.0192646
C8	11.5387	11.5387	0.00485255	0.00233652	0	0	0	0.00241398
C9	6.45094	6.45094	0.000553736	0.000117271	0	0	0	0.000127465
C10	0	0	0	5.57612E-06	0	0	0	6.16595E-06
Cyclopentane	173.877	173.877	0.705068	0.211769	0	0	0	0.241001
Benzene	100.872	100.872	1.89568	3.41056	0	0	0	3.96236
Cyclohexane	114.015	114.015	0.504632	0.125736	0	0	0	0.135473
Methylcyclohexane	45.4460	45.4460	0.0911733	0.0145592	0	0	0	0.0158687
2,2,4-Trimethylpentane	21.6420	21.6420	0.0101675	0.00151305	0	0	0	0.00142459
Toluene	26.6745	26.6745	0.420392	0.576088	0	0	0	0.673834
Ethylbenzene	1.09246	1.09245	0.0129265	0.0115124	0	0	0	0.0139448
p-Xylene	5.01465	5.01465	0.0643981	0.0694956	0	0	0	0.0876567
H2O	492.802	492.799	64.3078	178368	443125	443126	443126	201580
MDEA	1.34869	1.34868	0.0618824	195413	372983	372983	372983	191963
Piperazine	4.20270	4.20268	0.00896486	23922.1	71044.4	71044.4	71044.4	10101.9
TEG	0	0	0	0	0	0	0	0

Process Streams	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)
Composition Status:	Solved	Solved	Solved	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	XCHG-101	XCHG-100	LCV 2001/2
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%
N2	0	2.32932*	0.000228050	7.44150E-09	3.89530E-05	2.56212E-05	2.14370	2.14370	3.89530E-05	3.89530E-05	2.40733
C1	0	65.8365*	0.0767438	4.83949E-06	0.00796813	0.00862197	72.4728	72.4728	0.00796813	0.00796813	66.8596
CO2	0.0719833	4.04992*	44.7562	0.106289	4.71280	5.09046	5.64356	5.64356	4.71280	4.71280	7.01930
C2	0	14.1416*	0.0208359	1.46587E-06	0.00244757	0.00234085	10.8559	10.8559	0.00244757	0.00244757	13.3982
H2S	0.0148149	0.201997*	0.00163418	9.48707E-06	0.174438	0.000189267	0.000199066	0.000199066	0.174438	0.174438	0.189476
C3	0	8.52034*	0.00639993	3.45703E-07	0.000719089	0.000719019	5.59129	5.59129	0.000719088	0.000719088	7.16831
iC4	0	0.921240*	0.000451155	1.53648E-08	3.44222E-05	5.06869E-05	0.678089	0.678089	3.44222E-05	3.44222E-05	0.665291
nC4	0	2.40539*	0.00186921	9.59161E-08	0.000156625	0.000210002	1.56644	1.56644	0.000156625	0.000156625	1.59214
iC5	0	0.505745*	6.74901E-05	1.74648E-09	4.71535E-06	7.58249E-06	0.329313	0.329313	4.71534E-06	4.71534E-06	0.258535
nC5	0	0.615927*	0.000118275	3.77841E-09	8.93854E-06	1.32881E-05	0.323284	0.323284	8.93853E-06	8.93853E-06	0.288010
C6	0	0.347000*	6.01635E-05	1.08753E-09	1.23832E-06	6.75937E-06	0.293009	0.293009	1.23832E-06	1.23832E-06	0.0903727
C7	0	0.0414209*	1.29512E-07	1.35141E-12	2.07833E-08	1.45507E-08	0.00270174	0.00270174	2.07833E-08	2.07833E-08	0.00629454
C8	0	0.00838527*	5.06223E-08	4.53688E-13	2.53692E-09	5.68745E-09	0.000751181	0.000751181	2.53692E-09	2.53692E-09	0.000654576
C9	0	0.00442518*	1.23701E-09	3.31948E-15	2.82415E-11	1.38979E-10	0.000373969	0.000373969	2.82414E-11	2.82414E-11	0.000143201
C10	0	0.000849262*	0	0	5.74214E-13	0	0	0	5.74213E-13	5.74213E-13	1.48107E-05
Cyclopentane (C5)	0	0.0223896*	7.65373E-05	1.27005E-08	3.60424E-06	8.59831E-06	0.0184797	0.0184797	3.60424E-06	3.60424E-06	0.00923258
Benzene	0	0.0148534*	0.00625730	3.03166E-05	0.000194736	0.000701249	0.0104744	0.0104744	0.000194737	0.000194737	0.00402785
Cyclohexane (C6)	0	0.0148534*	6.65295E-05	9.63487E-09	1.79560E-06	7.47411E-06	0.0101029	0.0101029	1.79560E-06	1.79560E-06	0.00365125
Methylcyclohexane (C7)	0	0.00654299*	4.49327E-06	3.08399E-10	9.29348E-08	5.04806E-07	0.00344525	0.00344525	9.29347E-08	9.29347E-08	0.000956189
2,2,4-Trimethylpentane(C8)	0	0.00252858*	1.02808E-07	6.05945E-13	1.31324E-09	1.15506E-08	0.00140895	0.00140895	1.31324E-09	1.31324E-09	0.000397351
Toluene	0	0.00435682*	0.00116618	4.25187E-06	2.38996E-05	0.000130774	0.00231541	0.00231541	2.38997E-05	2.38997E-05	0.000649196
Ethylbenzene	0	0.000236630*	2.45595E-05	7.29308E-08	4.17853E-07	2.75504E-06	8.00344E-05	8.00344E-05	4.17855E-07	4.17855E-07	1.77231E-05
p-Xylene	0	0.00113008*	0.000160623	7.14087E-07	2.66294E-06	1.80046E-05	0.000373540	0.000373540	2.66295E-06	2.66295E-06	8.21479E-05
H2O	88.4765	0.00303745*	55.1015	99.8433	84.1979	81.7320	0.0519006	0.0519006	84.1979	84.1979	0.0372768
MDEA	9.75051	0*	0.0163670	0.0315733	9.29598	10.4193	0	0	9.29598	9.29598	0
Piperazine	1.68614	0*	0.00974440	0.0187978	1.60724	2.74527	0	0	1.60724	1.60724	0
TEG	0	0*	0	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	lbmol/h	lbmol/h	lbmol/h
N2	0	562.661*	0.00769693	1.30196E-07	0.0112222	0.00769680	288.333	288.333	0.000214386	5.96195E-06	319.797
C1	0	15903.2*	2.59019	8.46713E-05	2.29559	2.59010	9747.80	9747.80	0.0438543	0.00121956	8881.85
CO2	4.94290	978.283*	1510.57	1.85962	1357.74	1529.21	759.074	759.074	25.9379	0.721319	932.467
C2	0	3416.00*	0.703234	2.56468E-05	0.705137	0.703209	1460.15	1460.15	0.0134707	0.000374614	1779.87
H2S	1.01729	48.7936*	0.0551554	0.000165985	50.2549	0.0568574	0.0267749	0.0267749	0.960057	0.0266986	25.1706
C3	0	2058.14*	0.216005	6.04839E-06	0.207167	0.215999	752.045	752.045	0.00395766	0.000110060	952.262
iC4	0	222.531*	0.0152270	2.68821E-07	0.00991690	0.0152267	91.2048	91.2048	0.000189450	5.26849E-06	88.3795
nC4	0	581.036*	0.0630880	1.67814E-06	0.0451232	0.0630863	210.691	210.691	0.000862021	2.39723E-05	211.505
iC5	0	122.166*	0.00227787	3.05562E-08	0.00135847	0.00227784	44.2935	44.2935	2.59519E-05	7.21707E-07	34.3446
nC5	0	148.781*	0.00399191	6.61067E-08	0.00257516	0.00399185	43.4826	43.4826	4.91952E-05	1.36809E-06	38.2602
C6	0	83.8200*	0.00203058	1.90273E-08	0.000356757	0.00203057	39.4106	39.4106	6.81537E-06	1.89532E-07	12.0054
C7	0	10.0055*	4.37116E-06	2.36442E-11	5.98761E-06	4.37114E-06	0.363391	0.363391	1.14385E-07	3.18099E-09	0.836187
C8	0	2.02551*	1.70856E-06	7.93769E-12	7.30877E-07	1.70855E-06	0.101036	0.101036	1.39625E-08	3.88288E-10	0.0869560
C9	0	1.06893*	4.17504E-08	5.80773E-14	8.13628E-09	4.17503E-08	0.0502999	0.0502999	1.55433E-10	4.32250E-12	0.0190233
C10	0	0.205144*	0	0	1.65429E-10	0	0	0	3.16031E-12	8.78863E-14	0.00196750
Cyclopentane	0	5.40834*	0.00258322	2.22208E-07	0.00103837	0.00258300	2.48557	2.48557	1.98367E-05	5.51648E-07	1.22649
Benzene	0	3.58794*	0.211191	0.000530417	0.0561026	0.210660	1.40884	1.40884	0.00107178	2.98054E-05	0.535073
Cyclohexane	0	3.58794*	0.00224545	1.68571E-07	0.000517305	0.00224528	1.35887	1.35887	9.88246E-06	2.74825E-07	0.485043
Methylcyclohexane	0	1.58050*	0.000151653	5.39572E-09	2.67742E-05	0.000151648	0.463396	0.463396	5.11487E-07	1.42241E-08	0.127023
2,2,4-Trimethylpentane	0	0.610793*	3.46989E-06	1.06016E-11	3.78340E-07	3.46988E-06	0.189508	0.189508	7.22772E-09	2.00999E-10	0.0527854
Toluene	0	1.05242*	0.0393598	7.43904E-05	0.00688540	0.0392854	0.311429	0.311429	0.000131537	3.65798E-06	0.0862412
Ethylbenzene	0	0.0571594*	0.000828911	1.27599E-06	0.000120382	0.000827635	0.0107649	0.0107649	2.29975E-06	6.39548E-08	0.00235439
p-Xylene	0	0.272979*	0.00542120	1.24936E-05	0.000767184	0.00540871	0.0502421	0.0502421	1.46561E-05	4.07579E-07	0.0109128
H2O	6075.44	0.733713*	1859.74	1746.85	24257.1	24552.9	6.98078	6.98078	463.402	12.8869	4.95197
MDEA	669.541	0*	0.552405	0.552404	2678.14	3130.02	0	0	51.1625	1.42280	0
Piperazine	115.782	0*	0.328884	0.328884	463.040	824.699	0	0	8.84580	0.245996	0
TEG	0	0*	0	0	0	0	0	0	0	0	0
Mass Fraction	%	%	%	%	%	%	%	%	%	%	%
N2	0	2.69306*	0.000215234	1.15251E-08	3.66590E-05	2.26071E-05	2.66673	2.66673	3.66590E-05	3.66590E-05	2.86277
C1	0	43.5902*	0.0414792	4.29228E-06	0.00429439	0.00435669	51.6292	51.6292	0.00429439	0.00429439	45.5324
CO2	0.109062	7.35603*	66.3613	0.258614	6.96787	7.05639	11.0293	11.0293	6.96787	6.96787	13.1137
C2	0	17.5497*	0.0211080	2.43688E-06	0.00247246	0.00221703	14.4956	14.4956	0.00247246	0.00247246	17.1022
H2S	0.0173821	0.284123*	0.00187640	1.78756E-05	0.199722	0.000203173	0.000301271	0.000301271	0.199722	0.199722	0.274126
C3	0	15.5061*	0.00950794	8.42783E-07	0.00106525	0.000998653	10.9486	10.9486	0.00106525	0.00106525	13.4183
iC4	0	2.20986*	0.000883453	4.93726E-08	6.72131E-05	9.27932E-05	1.75016	1.75016	6.72131E-05	6.72131E-05	1.64149
nC4	0	5.77003*	0.00366029	3.08213E-07	0.000305828	0.000384455	4.04302	4.04302	0.000305828	0.000305828	3.92833
iC5	0	1.50595*	0.000164053	6.96641E-09	1.14292E-05	1.72314E-05	1.05508	1.05508	1.14292E-05	1.14292E-05	0.791832
nC5	0	1.83404*	0.000287500	1.50715E-08	2.16656E-05	3.01975E-05	1.03577	1.03577	2.16655E-05	2.16655E-05	0.882109
C6	0	1.23414*	0.000174675	5.18133E-09	3.58502E-06	1.83471E-05	1.12128	1.12128	3.58501E-06	3.58501E-06	0.330602
C7	0	0.171296*	4.37220E-07	7.48654E-12	6.99625E-08	4.59239E-08	0.0120218	0.0120218	6.99624E-08	6.99624E-08	0.0267747
C8	0	0.0395314*	1.94819E-07	2.86516E-12	9.73543E-09	2.04631E-08	0.00381039	0.00381039	9.73542E-09	9.73542E-09	0.00317409
C9	0	0.0234237*	5.34519E-09	2.35376E-14	1.21685E-10	5.61439E-10	0.00212990	0.00212990	1.21685E-10	1.21685E-10	0.000779663
C10	0	0.00498702*	0	0	2.74471E-12	0	0	0	2.74471E-12	2.74471E-12	8.94561E-05
Cyclopentane	0	0.0648065*	0.000180847	4.92449E-08	8.49200E-06	1.89939E-05	0.0575527	0.0575527	8.49200E-06	8.49200E-06	0.0274872
Benzene	0	0.0478844*	0.0164672	0.000130923	0.000511018	0.00172531	0.0363327	0.0363327	0.000511021	0.000511021	0.0133560
Cyclohexane	0	0.0515918*	0.000188640	4.48297E-08	5.07675E-06	1.98126E-05	0.0377572	0.0377572	5.07675E-06	5.07675E-06	0.0130446
Methylcyclohexane	0	0.0265141*	1.48637E-05	1.67409E-09	3.06551E-07	1.56118E-06	0.0150218	0.0150218	3.06551E-07	3.06551E-07	0.00398546
2,2,4-Trimethylpentane	0	0.0119207*	3.95656E-07	3.82671E-12	5.03957E-09	4.15583E-08	0.00714695	0.00714695	5.03957E-09	5.03957E-09	0.00192679
Toluene	0	0.0165677*	0.00362011	2.16590E-05	7.39785E-05	0.000379525	0.00947367	0.00947367	7.39789E-05	7.39789E-05	0.00253923
Ethylbenzene	0	0.00103682*	8.78449E-05	4.28065E-07	1.49032E-06	9.21273E-06	0.000377318	0.000377318	1.49032E-06	1.49032E-06	7.98742E-05
p-Xylene	0	0.00495157*	0.000574519	4.19131E-06	9.49767E-06	6.02065E-05	0.00176103	0.00176103	9.49771E-06	9.49771E-06	0.000370223
H2O	54.8736	0.00225840*	33.4442	99.4437	50.9585	46.3780	0.0415206	0.0415206	50.9585	50.9585	0.0285079
MDEA	40	0*	0.0657088	0.208006	37.2141	39.1070	0	0	37.2141	37.2141	0
Piperazine	5	0*	0.0282783	0.0895171	4.65091	7.44812	0	0	4.65091	4.65091	0
TEG	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
N2	0	15762.1*	0.215617	3.64723E-06	0.314373	0.215613	8077.20	8077.20	0.00600568	0.000167014	8958.61
C1	0	255127*	41.5530	0.00135834	36.8269	41.5517	156379	156379	0.703531	0.0195648	142487
CO2	217.534	43053.7*	66479.5	81.8411	59753.6	67299.9	33406.5	33406.5	1141.52	31.7449	41037.4
C2	0	102716*	21.1456	0.000771175	21.2028	21.1448	43905.4	43905.4	0.405052	0.0112643	53518.8
H2S	34.6703	1662.93*	1.87974	0.00565692	1712.73	1.93775	0.912513	0.912513	32.7196	0.909912	857.837
C3	0	90755.0*	9.52486	0.000266707	9.13515	9.52460	33161.9	33161.9	0.174515	0.00485317	41990.6
iC4	0	12934.0*	0.885026	1.56245E-05	0.576392	0.885010	5301.03	5301.03	0.0110112	0.000306216	5136.81
nC4	0	33771.1*	3.66681	9.75372E-05	2.62266	3.66671	12245.8	12245.8	0.0501025	0.00139332	12293.1
iC5	0	8814.11*	0.164345	2.20459E-06	0.0980123	0.164343	3195.72	3195.72	0.00187240	5.20703E-05	2477.92
nC5	0	10734.4*	0.288012	4.76952E-06	0.185795	0.288007	3137.22	3137.22	0.00354937	9.87059E-05	2760.43
C6	0	7223.22*	0.174986	1.63968E-06	0.0307436	0.174985	3396.22	3396.22	0.000587317	1.63329E-05	1034.57
C7	0	1002.57*	0.000437999	2.36919E-09	0.000599970	0.000437996	36.4125	36.4125	1.14616E-05	3.18742E-07	83.7875
C8	0	231.371*	0.000195166	9.06711E-10	8.34870E-05	0.000195165	11.5412	11.5412	1.59491E-06	4.43536E-08	9.93285
C9	0	137.096*	5.35470E-06	7.44871E-12	1.04352E-06	5.35469E-06	6.45122	6.45122	1.99351E-08	5.54383E-10	2.43984
C10	0	29.1883*	0	0	2.35375E-08	0	0	0	4.49654E-10	1.25046E-11	0.279939
Cyclopentane	0	379.303*	0.181169	1.55841E-05	0.0728239	0.181153	174.320	174.320	0.00139121	3.86887E-05	86.0170
Benzene	0	280.260*	16.4965	0.0414319	4.38228	16.4551	110.047	110.047	0.0837184	0.00232816	41.7955
Cyclohexane	0	301.959*	0.188976	1.41868E-05	0.0435361	0.188961	114.362	114.362	0.000831702	2.31292E-05	40.8210
Methylcyclohexane	0	155.183*	0.0148902	5.29784E-07	0.00262885	0.0148897	45.4991	45.4991	5.02209E-05	1.39661E-06	12.4719
2,2,4-Trimethylpentane	0	69.7700*	0.000396361	1.21100E-09	4.32173E-05	0.000396360	21.6472	21.6472	8.25612E-07	2.29598E-08	6.02960
Toluene	0	96.9680*	3.62655	0.00685421	0.634409	3.61970	28.6946	28.6946	0.0121197	0.000337040	7.94613
Ethylbenzene	0	6.06833*	0.0880013	0.000135466	0.0127803	0.0878659	1.14285	1.14285	0.000244153	6.78976E-06	0.249954
p-Xylene	0	28.9808*	0.575542	0.00132638	0.0814481	0.574216	5.33396	5.33396	0.00155597	4.32706E-05	1.15856
H2O	109451	13.2181*	33503.7	31470.0	436999	442327	125.761	125.761	8348.31	232.162	89.2112
MDEA	79783.9	0*	65.8258	65.8257	319133	372980	0	0	6096.63	169.544	0
Piperazine	9972.99	0*	28.3287	28.3286	39884.3	71036.0	0	0	761.938	21.1890	0
TEG	0	0*	0	0	0	0	0	0	0	0	0

Process Streams	Absorber OH 1	Absorber OH 2	Amine Flash	Amine Flow (Orifice Check)	AmineCoolerInlet	AmineCoolerInletRec	AmineCoolerOutlet	AmineLeavingAbs
Properties 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
Temperature (°F)	123.741	123.741	166.270	178.892	217.403	217.051	120*	166.125
Pressure (psia)	907.696	907.696	19.6959*	909.696	70.6959	70.6959	65.6959	914.696*

Process Streams	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)
Temperature (°F)	206.363	60*	214.494	120.000	158.181*	169.838	70	70	158.063	158.063	120*
Pressure (psia)	70.6959	914.696*	24.6959	24.6959	179.696*	74.6959	914.696	914.696	84.6959	84.6959	1114.70*

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
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
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
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
0	1.18307E-08	0	0	0.00108748	0.000473497	0.0235648	0.000522683	2.14370	2.14370	0*	0.00145931	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	4.67621E-06	0	0	0.111328	0.159340	10.5396	0.181450	72.4728	72.4728	0*	0.0821306	0	0.111327	72.5082	0.00862197	76.6776	0	76.6776	0.00796813	25.4454	76.7543	0.0821306	4.83949E-06
0.0719945	0.0907321	0.0719945	0.0719945	5.10698	92.8141	0.0517249	92.6165	5.64356	5.64356	0*	0.250042	0.254095	5.10698	5.64632	5.09046	0.00739204	0.107690	0.00739199	4.71280	3.88421	0.00714901	0.250042	0.106289
0	1.60231E-06	0	0	0.0203997	0.0432605	13.1435	0.0711648	10.8559	10.8559	0*	0.0104992	0	0.0203995	10.8612	0.00234085	11.4814	0	11.4814	0.00244757	13.7473	11.4928	0.0104992	1.46587E-06
0.0148028	0.00804485	0.0148028	0.0148028	0.000189962	0.00338288	0	0.00337567	0.000199066	0.000199066	0*	5.90722E-07	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
0	3.61410E-07	0	0	0.00732733	0.0132880	17.8852	0.0513560	5.59129	5.59129	0*	0.00326174	0	0.00732725	5.59403	0.000719019	5.91719	0	5.91719	0.000719088	16.8289	5.92311	0.00326174	3.45703E-07
0	1.09064E-08	0	0	0.000618062	0.000936728	2.55530	0.00637765	0.678089	0.678089	0*	0.000188103	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	7.47721E-08	0	0	0.00192416	0.00388099	10.5640	0.0263745	1.56644	1.56644	0*	0.000613089	0	0.00192414	1.56721	0.000210002	1.65789	0	1.65789	0.000156625	11.8188	1.65955	0.000613089	9.59161E-08
0	1.13515E-09	0	0	0.000147890	0.000140130	4.19768	0.00908110	0.329313	0.329313	0*	5.29728E-05	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
0	2.65638E-09	0	0	0.000195709	0.000245574	5.27162	0.0114739	0.323284	0.323284	0*	6.36870E-05	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
0	2.08212E-10	0	0	0.000120891	0.000124918	8.81557	0.0189023	0.293009	0.293009	0*	2.83298E-05	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
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	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
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	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
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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
--	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	--	--
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	--	--
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
0.000268462	2.27069	2.14370	0.631037	0	0	0	0	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*
0.0558686	76.6776	72.4728	61.0421	0	0	0	0	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*
42.1859	0.00739202	5.64356	14.9059	0.0717028	0	0.0721446	0.0717028	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*
0.0173849	11.4814	10.8559	10.7339	0	0	0	0	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*
1.45966	4.39512E-08	0.000199066	0.000602237	1.26822E-05	0	6.57371E-06	1.26822E-05	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*
0.00509842	5.91719	5.59129	3.92773	0	0	0	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*
0.000243539	0.717933	0.678089	0.337216	0	0	0	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*
0.00111692	1.65789	1.56644	1.01886	0	0	0	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*
3.33057E-05	0.348843	0.329313	0.0833858	0	0	0	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*
6.33584E-05	0.342397	0.323284	0.108418	0	0	0	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*
8.77210E-06	0.310399	0.293009	0.0678300	0	0	0	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*
1.46936E-07	0.00286283	0.00270174	0.000281037	0	0	0	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*
1.80118E-08	0.000795958	0.000751181	8.38928E-05	0	0	0	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*
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

N2		288.170	288.170	0.319540							554.420	0.00769693				288.333	288.333			319.797			0.00637104	576.667					0	10.8655
C1		9731.05	9731.04	30.9101							15380.7	2.59019				9747.80	9747.80			8881.85			1.46546	19495.6					0	301.302
CO2		0.938114	0.938107	7.54793							920.031	1510.57				759.074	759.074			932.467			2.83093	1518.15					33.1214	0.137019
C2		1457.08	1457.08	5.43535							3067.42	0.703234				1460.15	1460.15			1779.87			0.327262	2920.30					0	60.2277
H2S		5.57781E-06	5.57777E-06	0.000304957							43.3732	0.0551554				0.0267749	0.0267749			25.1706			6.80644E-05	0.0535498					5.44401	0.000254155
C3		750.943	750.943	1.98890							1628.38	0.216005				752.045	752.045			952.262			0.108158	1504.09					0	32.1181
iC4		91.1119	91.1118	0.170757							149.778	0.0152270				91.2048	91.2048			88.3795			0.00799330	182.410					0	2.96880
nC4		210.401	210.401	0.515921							356.747	0.0630880				210.691	210.691			211.505			0.0305905	421.381					0	7.08586
iC5		44.2712	44.2712	0.0422243							57.2558	0.00227787				44.2935	44.2935			34.3446			0.00163855	88.5870					0	1.14484
nC5		43.4532	43.4532	0.0548998							63.5476	0.00399191				43.4826	43.4826			38.2602			0.00253995	86.9652					0	1.27289
C6		39.3924	39.3924	0.0343473							19.5644	0.00203058				39.4106	39.4106			12.0054			0.00135714	78.8211					0	0.395860
C7		0.363318	0.363318	0.000142309							1.35240	4.37116E-06				0.363391	0.363391			0.836187			3.54395E-06	0.726783					0	0.0274661
C8		0.101014	0.101014	4.24811E-05							0.139432	1.70856E-06				0.101036	0.101036			0.0869560			1.26160E-06	0.202072					0	0.00284185
C9		0.0502977	0.0502977	4.31745E-06							0.0289453	4.17504E-08				0.0502999	0.0502999			0.0190233			3.88362E-08	0.100600					0	0.000619393
C10		0	0	0							0.00322436	0				0	0			0.00196750			0	0					0	6.39400E-05
Cyclopentane		2.47925	2.47925	0.0100533							2.02706	0.00258322				2.48557	2.48557			1.22649			0.000919424	4.97113					0	0.0406435
Benzene		1.29138	1.29138	0.0242688							0.943815	0.211191				1.40884	1.40884			0.535073			0.00340308	2.81768					0	0.0165634
Cyclohexane		1.35475	1.35475	0.00599613							0.774008	0.00224545				1.35887	1.35887			0.485043			0.000527524	2.71775					0	0.0159619
Methylcyclohexane		0.462856	0.462856	0.000928577							0.205255	0.000151653				0.463396	0.463396			0.127023			6.55049E-05	0.926793					0	0.00416805
2,2,4-Trimethylpentane		0.189462	0.189462	8.90102E-05							0.0851741	3.46989E-06				0.189508	0.189508			0.0527854			2.16714E-06	0.379016					0	0.00173206
Toluene		0.289505	0.289505	0.00456262							0.139786	0.0393598				0.311429	0.311429			0.0862412			0.000653384	0.622858					0	0.00269477
Ethylbenzene		0.0102902	0.0102902	0.000121758							0.00378279	0.000828911				0.0107649	0.0107649			0.00235439			2.04996E-05	0.0215297					0	7.46093E-05
p-Xylene		0.0472345	0.0472345	0.000606585							0.0175600	0.00542120				0.0502421	0.0502421			0.0109128			0.000111015	0.100484					0	0.000341874
H2O		27.3547	27.3545	3.56962							0.696388	1859.74				6.98078	6.98078			4.95197			0.922617	0.810540					29879.4	0.433806
MDEA		0.0113181	0.0113180	0.000519312							0	0.552405				0	0			0			0.000235302	0					2681.47	5.33661E-07
Piperazine		0.0487917	0.0487914	0.000104078							0	0.328884				0	0			0			5.18678E-05	0					472.541	4.05567E-06
TEG		0	0	0							0	0				0	0			0			0	0					0	0
Mass Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
N2		2.99607	2.99607	0.742156							3.05360	0.000215234				2.66673	2.66673			2.86277			0.0977092	2.66777					0	3.31510
C1		57.9387	57.9387	41.1126							48.5125	0.0414792				51.6292	51.6292			45.5324			12.8708	51.6494					0	52.6446
CO2		0.0153229	0.0153228	27.5409							7.96080	66.3613				11.0293	11.0293			13.1137			68.2080	11.0336					0.161933	0.0656762
C2		16.2608	16.2608	13.5504							18.1343	0.0211080				14.4956	14.4956			17.1022			5.38734	14.5013					0	19.7241
H2S		7.05525E-08	7.05519E-08	0.000861694							0.290630	0.00187640				0.000301271	0.000301271			0.274126			0.00126996	0.000301389					0.0206115	9.43388E-05
C3		12.2897	12.2897	7.27130							14.1176	0.00950794				10.9486	10.9486			13.4183			2.61105	10.9529					0	15.4250
iC4		1.96542	1.96542	0.822857							1.71159	0.000883453				1.75016	1.75016			1.64149			0.254348	1.75085					0	1.87933
nC4		4.53866	4.53866	2.48616							4.07671	0.00366029				4.04302	4.04302			3.92833			0.973393	4.04460					0	4.48555
iC5		1.18546	1.18546	0.252578							0.812187	0.000164053				1.05508	1.05508			0.791832			0.0647216	1.05550					0	0.899607
nC5		1.16356	1.16356	0.328401							0.901438	0.000287500				1.03577	1.03577			0.882109			0.100326	1.03617					0	1.00023
C6		1.25989	1.25989	0.245403							0.331480	0.000174675				1.12128	1.12128			0.330602			0.0640278	1.12172					0	0.371540
C7		0.0135114	0.0135114	0.00118226							0.0266433	4.37220E-07				0.0120218	0.0120218			0.0267747			0.000194412	0.0120265					0	0.0299746
C8		0.00428246	0.00428246	0.000402322							0.00313144	1.94819E-07				0.00381039	0.00381039			0.00317409			7.88961E-05	0.00381188					0	0.00353555
C9		0.00239420	0.00239420	4.59099E-05							0.000729896	5.34519E-09				0.00212990	0.00212990			0.000779663			2.72691E-06	0.00213074					0	0.000865211
C10		0	0	0							9.01988E-05	0				0	0			8.94561E-05			0	0					0	9.90838E-05
Cyclopentane		0.0645327	0.0645327	0.0584569							0.0279509	0.000180847				0.0575527	0.0575527			0.0274872			0.0353019	0.0575752					0	0.0310451
Benzene		0.0374377	0.0374376	0.157170							0.0144948	0.0164672				0.0363327	0.0363327			0.0133560			0.145529	0.0363469					0	0.0140911
Cyclohexane		0.0423156	0.0423156	0.0418387							0.0128073	0.000188640				0.0377572	0.0377572			0.0130446			0.0243055	0.0377720					0	0.0146308
Methylcyclohexane		0.0168668	0.0168668	0.00755914							0.00396234	1.48637E-05				0.0150218	0.0150218			0.00398546			0.00352114	0.0150276					0	0.00445721
2,2,4-Trimethylpentane		0.00803220	0.00803220	0.000842983							0.00191289	3.95656E-07				0.00714695	0.00714695			0.00192679			0.000135525	0.00714975					0	0.00215485
Toluene		0.00990000	0.00989998	0.0348545							0.00253228	0.00362011				0.00947367	0.00947367			0.00253923			0.0329586	0.00947737					0	0.00270422
Ethylbenzene		0.000405454	0.000405454	0.00107173							7.89590E-05	8.78449E-05				0.000377318	0.000377318			7.98742E-05			0.00119148	0.000377466					0	8.62690E-05
p-Xylene		0.00186114	0.00186114	0.00533922							0.000366534	0.000574519				0.00176103	0.00176103			0.000370223			0.00645242	0.00176172					0	0.000395301
H2O		0.182899	0.182897	5.33172							0.00246661	33.4442				0.0415206	0.0415206			0.0285079			9.09960	0.00241143					59.7988	0.0851172
MDEA		0.000500553	0.000500549	0.00513064							0	0.0657088				0	0			0			0.0153505	0					35.4969	6.92604E-07
Piperazine		0.00155979	0.00155978	0.000743272							0	0.0282783				0	0			0			0.00244591	0					4.52170	3.80475E-06
TEG		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
N2		8072.61	8072.61	8.95140							15531.2	0.215617				8077.20	8077.20			8958.61			0.178474	16154.4					0	304.380
C1		156110	156110	495.873							246744	41.5530				156379	156379			142487			23.5096	312757					0	4833.63
CO2		41.2859	41.2856	332.181							40490.1	66479.5				33406.5	33406.5			41037.4			124.588	66813.0					1457.66	6.03014
C2		43813.1	43813.1	163.436							92234.4	21.1456				43905.4	43905.4			53518.8			9.84045	87810.7					0	1810.99
H2S		0.000190097	0.000190095	0.0103932							1478.20	1.87974				0.912513	0.912513			857.837			0.00231969	1.82503					185.537	0.00866183
C3		33113.3	33113.3	87.7017							71804.6	9.52486				33161.9	33161.9			41990.6			4.76931	66323.8					0	1416.27
iC4		5295.62	5295.62	9.92476							8705.45	0.885026				5301.03	5301.03			5136.81			0.464588	10602.1					0	172.553
nC4		12229.0	12229.0	29.9865							20734.9	3.66681				12245.8	12245.8			12293.1			1.77799	24491.6					0	411.846
iC5		3194.12	3194.12	3.04643							4130.94	0.164345				3195.72	3195.72			2477.92			0.118220	6391.44					0	82.5985
nC5		3135.09	3135.09	3.96095							4584.88	0.288012				3137.22	3137.22			2760.43			0.183254	6274.44					0	91.8378
C6		3394.65	3394.65	2.95989							1685.97	0.174986				3396.22	3396.22			1034.57			0.116952	6792.44					0	34.1134
C7		36.4052	36.4052	0.0142597							135.513	0.000437999				36.4125	36.4125			83.7875			0.000355111	72.8250					0	2.75215
C8		11.5387	11.5387	0.00485255							15.9271	0.000195166				11.5412	11.5412			9.93285			0.000144110	23.0824					0	0.324621
C9		6.45094	6.45094	0.000553736							3.71238	5.35470E-06				6.45122	6.45122			2.43984			4.98094E-06	12.9024					0	0.0794404
C10		0	0	0							0.458768	0				0	0			0.279939			0	0					0	0.00909750
Cyclopentane		173.877	173.877	0.705068							142.164	0.181169				174.320	174.320			86.0170			0.0644819	348.640					0	2.85044
Benzene		100.872	100.872	1.89568							73.7231	16.4965				110.047	110.047			41.7955			0.265821	220.095					0	1.29379
Cyclohexane		114.015	114.015	0.504632							65.1401	0.188976				114.362	114.362			40.8210			0.0443962	228.724					0	1.34335
Methylcyclohexane		45.4460	45.4460	0.0911733							20.1532	0.0148902				45.4991	45.4991			12.4719			0.00643166	90.9981					0	0.409244
2,2,4-Trimethylpentane		21.6420	21.6420	0.0101675							9.72931	0.000396361				21.6472	21.6472			6.02960			0.000247549	43.2945					0	0.197850
Toluene		26.6745	26.6745	0.420392							12.8797	3.62655				28.6946	28.6946			7.94613			0.0602017	57.3891					0	0.248292
Ethylbenzene		1.09246	1.09245	0.0129265							0.401600	0.0880013				1.14285	1.14285			0.249954			0.00217634	2.28570					0	0.00792089
p-Xylene		5.01465	5.01465	0.0643981							1.86426	0.575542				5.33396	5.33396			1.15856			0.0117859	10.6679					0	0.0362950
H2O		492.802	492.799	64.3078							12.5456	33503.7				125.761	125.761			89.2112			16.6212	14.6021					538286	7.81514
MDEA		1.34869	1.34868	0.0618824							0	65.8258				0	0			0			0.0280391	0					319530	6.35923E-05
Piperazine		4.20270	4.20268	0.00896486							0	28.3287				0	0			0			0.00446766	0					40702.6	0.000349338
TEG		0	0	0							0	0				0	0			0			0	0					0	0

Process Streams		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
Properties	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	Approximate Solution	Solved
Phase: **Vapor**	From Block:	Absorber	Absorber 2	PCV-1101	--	Booster	RCYL-1	AmineCooler	--	--	--	DTWR-100	Reflux Condenser	--	Flash	SPLT-101	SPLT-101	--	--	--	--	MKUP-1	L/R	--	K-100	MSP	L/R	--	--	--
	To Block:	Gas/Gas EX 1	Gas/Gas EX 2	--	Abs LCV	RCYL-1	AmineCooler	MSP	VLVE-100	BoosterRecycleCV	--	Reflux Condenser	Reflux Pumps	--	L/R	Gas/Gas EX 2	Gas/Gas EX 1	XCHG-101	XCHG-100	LCV 2001/2	--	L/R	VLVE-101	VSSL-101	MKUP-1	SPLT-102	Booster	MSPrecycleCV	--	--
Property	**Units**																													
Temperature	°F	123.741	123.741	166.270							60	214.494				70	70			120			205	70					458.292	48.8679
Pressure	psia	907.696	907.696	19.6959							914.696	24.6959				914.696	914.696			1114.70			69.6959	914.696					75.1959	164.696
Mole Fraction Vapor	%	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
Mole Fraction Heavy Liquid	%	0	0	0							0	0				0	0			0			0	0					0	0
Molecular Weight	lb/lbmol	21.2310	21.2310	23.8191							22.8617	29.6814				22.5191	22.5191			23.5567			31.9838	22.5213					27.2183	21.9621
Mass Density	lb/ft^3	3.63169	3.63169	0.0700507							5.12376	0.102169				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Molar Flow	lbmol/h	12690.9	12690.9	50.6373							22247.6	3375.11				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Mass Flow	lb/h	269440	269440	1206.13							508619	100178				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Vapor Volumetric Flow	ft^3/h	74191.4	74191.3	17218.0							99266.6	980514				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Liquid Volumetric Flow	gpm	9249.84	9249.83	2146.66							12376.1	122246				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Std Vapor Volumetric Flow	MMSCFD	115.583	115.583	0.461185							202.623	30.7392				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Std Liquid Volumetric Flow	sgpm	1530.60	1530.60	5.71003							2722.72	230.317				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Compressibility		0.847549	0.847549	0.996997							0.731823	0.991659				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Specific Gravity		0.733052	0.733052	0.822412							0.789356	1.02482				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
API Gravity																														
Enthalpy	Btu/h	-4.29751E+08	-4.29751E+08	-2.92735E+06							-8.97155E+08	-4.45199E+08				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Mass Enthalpy	Btu/lb	-1594.98	-1594.98	-2427.05							-1763.91	-4444.07				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Mass Cp	Btu/(lb*°F)	0.615219	0.615220	0.434196							0.666939	0.301469				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Ideal Gas CpCv Ratio		1.23369	1.23369	1.23865							1.24672	1.28838				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Dynamic Viscosity	cP	0.0132311	0.0132311	0.0133197							0.0132443	0.0167069				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Kinematic Viscosity	cSt	0.227440	0.227440	11.8703							0.161369	10.2083				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Thermal Conductivity	Btu/(h*ft*°F)	0.0227095	0.0227095	0.0196337							0.0206507	0.0141000				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Surface Tension	lbf/ft																													
Net Ideal Gas Heating Value	Btu/ft^3	1133.01	1133.01	874.245							1116.05	2.45712				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Net Liquid Heating Value	Btu/lb	20188.5	20188.5	13811.8							18455.8	-373.048				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Gross Ideal Gas Heating Value	Btu/ft^3	1248.75	1248.75	967.695							1228.94	30.3982				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]
Gross Liquid Heating Value	Btu/lb	22257.6	22257.6	15300.9							20330.1	-15.8139				[illegible]	[illegible]			[illegible]			[illegible]	[illegible]					[illegible]	[illegible]

Process Streams		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
Composition	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	Approximate Solution	Solved
Phase: **Light Liquid**	From Block:	Absorber	Absorber 2	PCV-1101	--	Booster	RCYL-1	AmineCooler	--	--	--	DTWR-100	Reflux Condenser	--	Flash	SPLT-101	SPLT-101	--	--	--	--	MKUP-1	L/R	--	K-100	MSP	L/R	--	--	--
	To Block:	Gas/Gas EX 1	Gas/Gas EX 2	--	Abs LCV	RCYL-1	AmineCooler	MSP	VLVE-100	BoosterRecycleCV	--	Reflux Condenser	Reflux Pumps	--	L/R	Gas/Gas EX 2	Gas/Gas EX 1	XCHG-101	XCHG-100	LCV 2001/2	--	L/R	VLVE-101	VSSL-101	MKUP-1	SPLT-102	Booster	MSPrecycleCV	--	--
Mole Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
N2					0.00118799	0	0	0	0.00124342	0	0.431942		7.44150E-09	3.89530E-05	2.56212E-05			3.89530E-05	3.89530E-05		3.89530E-05	0	4.41405E-06	0.309367	0	0	0	0		
C1					0.108900	0	0	0	0.110713	0	27.3867		4.83949E-06	0.00796813	0.00862197			0.00796813	0.00796813		0.00796813	0	0.00374444	25.4454	0	0	0	0		
CO2					6.47195	0.0717475	0.0717028	0.0717028	4.56049	0.0719833	3.05300		0.106289	4.71280	5.09046			4.71280	4.71280		4.71280	0.0717475	5.08200	3.88421	0.0721446	0.0717028	0.0717475	0.0719945		
C2					0.0282975	0	0	0	0.0288445	0	18.2691		1.46587E-06	0.00244757	0.00234085			0.00244757	0.00244757		0.00244757	0	0.00125169	13.7473	0	0	0	0		
H2S					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
iC4					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
iC5					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
C6					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
C8					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
C10					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
Benzene					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
Methylcyclohexane					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
Toluene					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
p-Xylene					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
MDEA					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
TEG					[illegible]	[illegible]	[illegible]	[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
N2					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
CO2					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
H2S					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
iC4					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
iC5					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
C6					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
C8					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
C10					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
Benzene					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
Methylcyclohexane					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
Toluene					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
p-Xylene					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
MDEA					[illegible]	[illegible]	[illegible]	[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]	[illegible]	[illegible]	[illegible]		
TEG					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
Mass Fraction		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%

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	--	--
				169.838	120.000	120.353	118.708	95	95	533.942	98.7079	249.246	167.854	70	194.206	96.7894		96.7891			96.7567			214.697	96.7892	70	169.838							180.726	167.859	66.7484	32.2381	180.246	120				478.388		167.854	169.838	169.838		55.4
				74.6959	24.6959	14.2000	14.2000	909.696	909.696	914.696	84.6959	25.6959	809.696	914.696	24.6959	902.696		902.696			902.196			24.6959	902.696	914.696	74.6959							114.696	74.6959	410.031	64.6959	84.6959	19.6959				179.696		809.696	74.6959	74.6959		141.196
				100	100	100	100	100	100	100	100	100	100	100	100	100		100			100			100	100	100	100							100	100	100	100	100	100				100		100	100	100		100
				0	0	0	0	0	0	0	0	0	0	0	0	0		0			0			0	0	0	0							0	0	0	0	0	0				0		0	0	0		0
				0	0	0	0	0	0	0	0	0	0	0	0	0		0			0			0	0	0	0							0	0	0	0	0	0				0		0	0	0		0
				23.8191	42.1600	50.1731	42.1771	22.5191	22.5191	18.0153	19.1245	18.2500	21.2625	22.5213	34.4273	21.2338		21.2338			21.2338			29.2399	21.2338	22.5191	23.8191							28.6794	28.3762	23.5567	23.5567	30.8203	41.4134				29.7664		21.2624	23.8191	23.8191		17.2196
				0.266322	0.168681	0.116332	0.0969278	4.25104	4.25104	1.95452	0.274439	0.0624650	2.84233	4.70739	0.122038	3.93025		3.93025			3.92809			0.100636	3.93025	4.70694	0.266322							0.487693	0.318909	1.93885	0.295498	0.385808	0.131955				0.563585		2.84233	0.266322	0.266322		0.451202
				50.6373	1625.52	3.46850	1628.99	13450.3	13450.3	9.76702	0.0222764	6898.96	1.76205	26887.4	331.630	12678.2		12678.2			25356.3			3169.52	25356.3	26900.6	50.6373							28.0735	31.6120	13284.3	13284.3	36.3254	1516.19				550.372		1.76255	25.3190	25.3183		25427.7
				1206.13	68532.0	174.026	68706.0	302888	302888	175.956	0.426025	125906	37.4655	605538	11417.1	269206		269206			538412			92676.6	538412	605775	1206.13							805.130	897.028	312935	312935	1119.56	62790.8				16382.6		37.4761	603.074	603.060		437855
				4528.86	406282	1495.94	708837	71250.3	71250.3	90.0250	1.55235	2.01562E+06	13.1813	128636	93553.5	68496.0		68495.9			137067			920913	136992	128698	4528.86							1650.89	2812.81	161403	1.05901E+06	2901.85	475850				29068.5		13.1850	2264.46	2264.40		970419
				564.637	50653.3	186.507	88374.5	8883.16	8883.16	11.2239	0.193539	251299	1.64338	16037.7	11663.8	8539.76		8539.75			17088.9			114815	17079.5	16045.5	564.637							205.826	350.688	20122.9	132032	361.790	59326.8				3624.13		1.64385	282.322	282.315		120987
				0.461185	14.8046	0.0315898	14.8362	122.5	122.5	0.0889542	0.000202885	62.8331	0.0160481	244.880	3.02036	115.468		115.468			230.936			28.8668	230.936	245	0.461185							0.255682	0.287910	120.989	120.989	0.330838	13.8089				5.01257		0.0160526	0.230595	0.230590		231.586
				5.71003	167.001	0.586873	167.588	1614.11	1614.11	0.351748	0.00256655	252.746	0.210433	3227.75	27.2234	1530.13		1530.13			3060.25			212.601	3060.25	3228.22	5.71003							3.18977	3.57717	1621.49	1621.49	4.01118	152.819				33.3700		0.210493	2.85505	2.85498		2770.11
				0.988897	0.992239	0.983903	0.995501	0.809569	0.809569	0.790675	0.984950	0.986808	0.899430	0.769875	0.992827	0.816682		0.816681			0.816725			0.991496	0.816682	0.769873	0.988897							0.981429	0.986933	0.881847	0.976989	0.985238	0.993684				0.942783		0.899430	0.988897	0.988897		0.974864
				0.822412	1.45568	1.73235	1.45626	0.777525	0.777525	0.622021	0.660319	0.630125	0.734138	0.777601	1.18869	0.733149		0.733149			0.733149			1.00958	0.733149	0.777525	0.822412							0.990224	0.979756	0.813352	0.813352	1.06414	1.42990				1.02776		0.734137	0.822411	0.822412		0.594548
				-2.92735E+06	-2.66514E+08	-159307	-2.66674E+08	-5.62074E+08	-5.62074E+08	-990973	-743.282	-7.07872E+08	-62888.6	-1.13215E+09	-4.74549E+07	-4.32888E+08		-4.32888E+08			-8.65775E+08			-4.08474E+08	-8.65777E+08	-1.13352E+09	-2.92735E+06							-2.26701E+06	-2.52561E+06	-5.79573E+08	-5.79573E+08	-3.45109E+06	-2.39618E+08				-5.73428E+07		-62906.5	-1.46369E+06	-1.46366E+06		-8.35643E+08
				-2427.05	-3888.90	-915.422	-3881.37	-1855.72	-1855.72	-5631.95	-1744.69	-5622.23	-1678.57	-1869.65	-4156.47	-1608.02		-1608.02			-1608.02			-4407.52	-1608.02	-1871.19	-2427.05							-2815.71	-2815.53	-1852.06	-1852.06	-3082.55	-3816.14				-3500.23		-1678.57	-2427.05	-2427.05		-1908.49
				0.439597	0.216720	0.401634	0.216250	0.596369	0.596369	0.649754	0.507022	0.464565	0.586039	0.626363	0.266026	0.628997		0.628997			0.628914			0.304743	0.628997	0.626356	0.439597							0.372412	0.370100	0.491262	0.424413	0.337756	0.219142				0.707725		0.586039	0.439597	0.439596		0.513084
				1.23778	1.28068	1.11013	1.28004	1.24321	1.24321	1.30392	1.26326	1.31064	1.22625	1.24977	1.27961	1.24070		1.24070			1.24071			1.28997	1.24070	1.24979	1.23778							1.23444	1.23738	1.24550	1.25469	1.24066	1.28254				1.10744		1.22625	1.23778	1.23778		1.30220
				0.0134499	0.0161329	0.00898785	0.0160612	0.0133833	0.0133833	0.0201087	0.0113455	0.0133647	0.0136056	0.0132484	0.0171140	0.0129697		0.0129697			0.0129677			0.0165913	0.0129697	0.0132500	0.0134499							0.0146217	0.0142655	0.0115330	0.0102262	0.0151781	0.0160337				0.0175866		0.0136056	0.0134499	0.0134499		0.0110124
				3.15278	5.97070	4.82321	10.3445	0.196538	0.196538	0.642277	2.58080	13.3568	0.298829	0.175697	8.75457	0.206011		0.206011			0.206092			10.2922	0.206011	0.175734	3.15278							1.87168	2.79253	0.371347	2.16043	2.45598	7.58557				1.94806		0.298829	3.15278	3.15278		1.52367
				0.0199473	0.0106838	0.0113308	0.0106196	0.0214172	0.0214172	0.0297484	0.0190729	0.0167302	0.0237886	0.0208787	0.0132147	0.0218839		0.0218839			0.0218802			0.0141206	0.0218839	0.0208790	0.0199473							0.0184709	0.0179287	0.0175407	0.0148448	0.0173100	0.0106753				0.0210506		0.0237886	0.0199473	0.0199473		0.0183883
				874.245	3.24098	2441.42	8.43247	1070.86	1070.86	0	1028.26	7.20921	1097.09	1071.39	15.1847	1134.13		1134.13			1134.13			10.3516	1134.13	1070.86	874.245							720.935	725.995	1085.21	1085.21	587.632	20.0056				384.960		1097.09	874.245	874.244		913.186
				13811.8	-74.8949	18268.9	-28.4318	17982.8	17982.8	-1059.76	20350.1	-894.955	19514.8	17990.3	-93.3498	20206.6		20206.6			20206.6			-284.181	20206.6	17982.8	13811.8							9430.55	9594.11	17411.4	17411.4	7117.11	68.1054				4222.97		19514.8	13811.8	13811.8		20110.7
				967.695	7.02878	2636.74	12.6281	1180.18	1180.18	50.31	1136.83	57.8763	1209.86	1180.73	34.7312	1249.93		1249.93			1249.93			39.5519	1249.93	1180.18	967.695							796.943	802.953	1194.91	1194.91	650.989	26.1154				461.830		1209.86	967.695	967.694		1012.87
				15300.9	-40.8001	19746.6	9.31989	19825.3	19825.3	0	22504.8	158.598	21528.0	19833.1	122.112	22276.6		22276.6			22276.7			94.7931	22276.6	19825.3	15300.9							10436.6	10623.6	19179.1	19179.1	7897.42	124.097				5202.97		21528.0	15300.9	15300.9		22307.8

N2					0.000970142	0	0	0	0.00109472	0	0.301139		1.15251E-08	3.66590E-05	2.26071E-05			3.66590E-05	3.66590E-05		3.66590E-05	0	3.89478E-06	0.187950	0	0	0	0		
C1					0.0509277	0	0	0	0.0558200	0	10.9342		4.29228E-06	0.00429439	0.00435669			0.00429439	0.00429439		0.00429439	0	0.00189207	8.85265	0	0	0	0		
CO2					8.30306	0.101593	0.101529	0.101529	6.30777	0.109062	3.34387		0.258614	6.96787	7.05639			6.96787	6.96787		6.96787	0.101593	7.04467	3.70725	0.101919	0.101529	0.101593	0.109079		
C2					0.0248041	0	0	0	0.0272584	0	13.6714		2.43688E-06	0.00247246	0.00221703			0.00247246	0.00247246		0.00247246	0	0.00118549	8.96480	0	0	0	0		
H2S					0.178622	7.16858E-06	1.39064E-05	1.39064E-05	0.139527	0.0173821	0.240958		1.78756E-05	0.199722	0.000203173			0.199722	0.199722		0.199722	7.16858E-06	0.000202968	0.000210611	7.19160E-06	1.39064E-05	7.16858E-06	0.0173680		
C3					0.0136886	0	0	0	0.0147842	0	24.7181		8.42783E-07	0.00106525	0.000998653			0.00106525	0.00106525		0.00106525	0	0.000498687	16.0936	0	0	0	0		
iC4					0.00116990	0	0	0	0.00122811	0	5.51553		4.93726E-08	6.72131E-05	9.27932E-05			6.72131E-05	6.72131E-05		6.72131E-05	0	4.40896E-05	4.84516	0	0	0	0		
nC4					0.00377477	0	0	0	0.00407763	0	17.0038		3.08213E-07	0.000305828	0.000384455			0.000305828	0.000305828		0.000305828	0	0.000198071	14.8977	0	0	0	0		
iC5					0.000283686	0	0	0	0.000322664	0	6.10852		6.96641E-09	1.14292E-05	1.72314E-05			1.14292E-05	1.14292E-05		1.14292E-05	0	4.83698E-06	6.89237	0	0	0	0		
nC5					0.000424614	0	0	0	0.000473333	0	8.02111		1.50715E-08	2.16656E-05	3.01975E-05			2.16656E-05	2.16656E-05		2.16656E-05	0	1.09854E-05	8.20250	0	0	0	0		
C6					0.000115761	0	0	0	0.000125719	0	7.22255		5.18133E-09	3.58502E-06	1.83471E-05			3.58501E-06	3.58501E-06		3.58502E-06	0	6.08586E-06	22.3159	0	0	0	0		
C7					4.05048E-06	0	0	0	4.45989E-06	0	1.13095		7.48654E-12	6.99625E-08	4.59239E-08			6.99625E-08	6.99625E-08		6.99625E-08	0	8.69221E-09	0.494333	0	0	0	0		
C8					5.37102E-07	0	0	0	5.58852E-07	0	0.281016		2.86516E-12	9.73543E-09	2.04631E-08			9.73542E-09	9.73542E-09		9.73542E-09	0	5.35412E-09	0.343798	0	0	0	0		
C9					2.69576E-08	0	0	0	2.95089E-08	0	0.173979		2.35376E-14	1.21685E-10	5.61439E-10			1.21685E-10	1.21685E-10		1.21685E-10	0	3.91954E-11	0.492530	0	0	0	0		
C10					1.28180E-09	0	0	0	1.42746E-09	0	0.0374735		0	2.74471E-12	0			2.74471E-12	2.74471E-12		2.74471E-12	0	0	0	0	0	0	0		
Cyclopentane					4.86801E-05	0	0	0	5.57933E-05	0	0.309314		4.92449E-08	8.49200E-06	1.89939E-05			8.49200E-06	8.49200E-06		8.49200E-06	0	1.22353E-05	0.596774	0	0	0	0		
Benzene					0.000783995	0	0	0	0.000917312	0	0.269398		0.000130923	0.000511018	0.00172531			0.000511021	0.000511018		0.000511018	0	0.00169777	0.664584	0	0	0	0		
Cyclohexane					2.89034E-05	0	0	0	3.13630E-05	0	0.308896		4.48297E-08	5.07675E-06	1.98126E-05			5.07675E-06	5.07675E-06		5.07675E-06	0	1.51606E-05	0.874691	0	0	0	0		
Methylcyclohexane					3.34676E-06	0	0	0	3.67370E-06	0	0.176127		1.67409E-09	3.06551E-07	1.56118E-06			3.06551E-07	3.06551E-07		3.06551E-07	0	8.86991E-07	0.666804	0	0	0	0		
2,2,4-Trimethylpentane					3.47810E-07	0	0	0	3.29802E-07	0	0.0783145		3.82671E-12	5.03957E-09	4.15583E-08			5.03957E-09	5.03957E-09		5.03957E-09	0	1.56058E-08	0.280300	0	0	0	0		
Toluene					0.000132427	0	0	0	0.000155997	0	0.109681		2.16590E-05	7.39785E-05	0.000379525			7.39789E-05	7.39789E-05		7.39785E-05	0	0.000373284	0.412340	0	0	0	0		
Ethylbenzene					2.64639E-06	0	0	0	3.22831E-06	0	0.00739143		4.28065E-07	1.49032E-06	9.21273E-06			1.49032E-06	1.49032E-06		1.49032E-06	0	8.98626E-06	0.0364915	0	0	0	0		
p-Xylene					1.59752E-05	0	0	0	2.02931E-05	0	0.0353696		4.19131E-06	9.49767E-06	6.02065E-05			9.49771E-06	9.49771E-06		9.49767E-06	0	5.89820E-05	0.176304	0	0	0	0		
H2O					41.0019	49.8984	49.8985	49.8985	46.6671	54.8736	0.000877089		99.4437	50.9585	46.3780			50.9585	50.9585		50.9585	49.8984	46.3851	0.000723274	49.7388	49.8985	49.8984	54.8736		
MDEA					44.9202	42	42	42	44.4406	40	0		0.208006	37.2141	39.1070			37.2141	37.2141		37.2141	42	39.1144	0	42.1346	42	42	40		
Piperazine					5.49905	8	8	8	2.33865	5	0		0.0895171	4.65091	7.44812			4.65091	4.65091		4.65091	8	7.44954	0	8.02474	8	8	5		
TEG					0	0	0	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
N2					4.22033	0	0	0	4.72868	0	230.872		3.64723E-06	0.314373	0.215613			0.00600568	0.000167014		0.00422936	0	0.0371391	22.9641	0	0	0	0		
C1					221.547	0	0	0	241.116	0	8382.84		0.00135834	36.8269	41.5517			0.703531	0.0195648		0.495445	0	18.0421	1081.66	0	0	0	0		
CO2					36120.2	902.197	901.636	901.636	27246.6	217.534	2563.62		81.8411	59753.6	67299.9			1141.52	31.7449		803.884	902.197	67175.3	452.960	902.197	901.636	902.197	224.150		
C2					107.904	0	0	0	117.744	0	10481.4		0.000771175	21.2028	21.1448			0.405052	0.0112643		0.285248	0	11.3044	1095.34	0	0	0	0		
H2S					777.047	0.0636609	0.123496	0.123496	602.690	34.6703	184.734		0.00565692	1712.73	1.93775			32.7198	0.909912		23.0420	0.0636609	1.93543	0.0257328	0.0636609	0.123496	0.0636609	35.6901		
C3					59.5487	0	0	0	63.8610	0	18950.4		0.000266707	9.13515	9.52460			0.174515	0.00485317		0.122898	0	4.75529	1966.35	0	0	0	0		
iC4					5.08933	0	0	0	5.30485	0	4228.54		1.56245E-05	0.576392	0.885010			0.0110112	0.000306216		0.00775439	0	0.420422	591.992	0	0	0	0		
nC4					16.4211	0	0	0	17.6134	0	13036.2		9.75372E-05	2.62266	3.66671			0.0501025	0.00139332		0.0352835	0	1.88873	1820.23	0	0	0	0		
iC5					1.23410	0	0	0	1.39376	0	4683.17		2.20459E-06	0.0980123	0.164343			0.00187240	5.20703E-05		0.00131859	0	0.0461235	842.124	0	0	0	0		
nC5					1.84717	0	0	0	2.04458	0	6149.48		4.76952E-06	0.185795	0.288007			0.00354937	9.87059E-05		0.00249956	0	0.104753	1002.20	0	0	0	0		
C6					0.503588	0	0	0	0.543048	0	5537.26		1.63968E-06	0.0307436	0.174985			0.000587317	1.63329E-05		0.000413604	0	0.0580324	2726.60	0	0	0	0		
C7					0.0176205	0	0	0	0.0192646	0	867.055		2.36919E-09	0.000599870	0.000437996			1.14616E-05	3.18742E-07		8.07109E-06	0	9.28650E-05	60.3986	0	0	0	0		
C8					0.00233652	0	0	0	0.00241396	0	215.444		9.06711E-10	9.34970E-05	0.000199165			1.78616E-06	4.45036E-08		1.12318E-06	0	5.10546E-05	42.0059	0	0	0	0		
C9					0.000117271	0	0	0	0.000127465	0	133.383		7.44871E-12	1.04352E-06	5.30469E-06			1.99351E-08	5.54363E-10		1.40386E-08	0	3.73752E-07	60.1783	0	0	0	0		
C10					5.57612E-06	0	0	0	6.16595E-06	0	28.7295		0	2.35375E-08	0			4.49658E-10	1.25046E-11		3.16658E-10	0	0	0	0	0	0	0		
Cyclopentane					0.211769	0	0	0	0.241001	0	237.139		1.55841E-05	0.0726239	0.181153			0.00139121	3.86897E-05		0.000979724	0	0.116671	72.9151	0	0	0	0		
Benzene					3.41096	0	0	0	3.96236	0	206.537		0.0414319	4.36226	16.4551			0.0835704	0.00232816		0.0589583	0	16.1692	81.2003	0	0	0	0		
Cyclohexane					0.125736	0	0	0	0.135473	0	236.819		1.41868E-05	0.0433361	0.188961			0.000831702	2.31292E-05		0.000585706	0	0.144585	106.871	0	0	0	0		
Methylcyclohexane					0.0145592	0	0	0	0.0158687	0	135.030		5.29784E-07	0.00262885	0.0148897			5.02206E-05	1.39661E-06		3.53666E-05	0	0.00845801	81.4714	0	0	0	0		
2,2,4-Trimethylpentane					0.00151305	0	0	0	0.00142459	0	60.0407		1.21100E-09	4.32173E-05	0.000396360			8.25614E-07	2.29590E-08		5.81418E-07	0	0.000148811	34.2476	0	0	0	0		
Toluene					0.576088	0	0	0	0.673834	0	84.0883		0.00685421	0.634409	3.61970			0.0121197	0.000337040		0.00853492	0	3.55950	50.3898	0	0	0	0		
Ethylbenzene					0.0115124	0	0	0	0.0139448	0	5.66673		0.000135466	0.0127803	0.0878659			0.000244153	6.78978E-06		0.000171938	0	0.0856880	4.45861	0	0	0	0		
p-Xylene					0.0694956	0	0	0	0.0876567	0	27.1165		0.00132638	0.0814481	0.574216			0.00155597	4.32708E-05		0.00109575	0	0.562430	21.5412	0	0	0	0		
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		**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**
Properties	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	Approximate Solution	Solved
Phase: Light Liquid	From Block:	Absorber	Absorber 2	PCV-1101	--	Booster	RCYL-1	AmineCooler	--	--	--	DTWR-100	Reflux Condenser	--	Flash	SPLT-101	SPLT-101	--	--	--	--	MKUP-1	L/R	--	K-100	MSP	L/R	--	--	--
	To Block:	Gas/Gas EX 1	Gas/Gas EX 2	--	Abs LCV	RCYL-1	AmineCooler	MSP	VLVE-100	BoosterRecycleCV	--	Reflux Condenser	Reflux Pumps	--	L/R	Gas/Gas EX 2	Gas/Gas EX 1	XCHG-101	XCHG-100	LCV 2001/2	--	L/R	VLVE-101	VSSL-101	MKUP-1	SPLT-102	Booster	MSPrecycleCV	--	--
Property	**Units**																													
Temperature	°F				178.892	217.403	217.051	120	166.125	206.363	60		120.000	158.181	169.838			158.063	158.063		210	248.736	205	70	249.246	122.443	217.254	126.369		
Pressure	psia				909.696	70.6959	70.6959	65.6959	914.696	70.6959	914.696		24.6959	179.696	74.6959			84.6959	84.6959		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	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	100	100	100		
Mole Fraction Heavy Liquid	%				0	0	0	0	0	0	0		0	0	0			0	0		0	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		18.0877	29.7664	31.7483			29.7664	29.7664		29.7664	31.0807	31.7483	46.1102	31.1527	31.0807	31.0807	29.0473		
Mass Density	lb/ft^3				70.8599	61.5832	61.5938	64.0759	68.0657	61.8796	30.4083		61.7235	68.5486	69.7755			68.5438	68.5438		67.6533	60.5786	69.2378	33.1233	60.5640	64.1167	61.5815	63.9562		
Molar Flow	lbmol/h				12681.4	28572.5	28572.5	28572.5	13575.5	6866.72	1908.01		1749.59	28809.7	30040.7			550.372	15.3055		387.586	28572.5	30035.0	264.978	28415.2	28572.5	28572.5	7074.44		
Mass Flow	lb/h				435022	888055	888055	888055	431953	199460	76666.2		31646.0	857559	953744			16382.6	455.590		11537.0	888055	953561	12218.2	885212	888055	888055	205494		
Vapor Volumetric Flow	ft^3/h				6139.19	14420.4	14417.9	13859.4	6346.12	3223.35	2521.22		512.706	12510.2	13668.7			239.009	6.64669		170.531	14659.6	13772.3	368.870	14616.1	13850.6	14420.8	3213.03		
Liquid Volumetric Flow	gpm				765.405	1797.87	1797.56	1727.93	791.204	401.873	314.335		63.9218	1559.72	1704.16			29.7985	0.828678		21.2611	1827.68	1717.06	45.9890	1822.27	1726.83	1797.92	400.586		
Std Vapor Volumetric Flow	MMSCFD				115.498	260.228	260.228	260.228	123.640	62.5395	17.3774		15.9346	262.387	273.600			5.01257	0.139397		3.52998	260.228	273.548	2.41332	258.795	260.228	260.228	64.4313		
Std Liquid Volumetric Flow	sgpm				890.193	1800	1800	1800	869.710	400	313.527		63.3159	1746.78	1961.31			33.3700	0.928000		23.5000	1800	1960.73	46.2767	1794.31	1800	1800	412.1		
Compressibility					0.0642647	0.00491049	0.00491219	0.00512260	0.0636700	0.00464295	0.216729		0.00116336	0.0117684	0.00503096			0.00554825	0.00554825		0.0110015	0.00173417	0.00448038	0.224012	0.00173735	0.0787382	0.00143788	0.0732773		
Specific Gravity					1.13614	0.987404	0.987574	1.02737	1.09134	0.992157	0.487557		0.989655	1.09909	1.11876			1.09901	1.09901		1.08473	0.971297	1.11014	0.531089	0.971064	1.02803	0.987378	1.02545		
API Gravity					-8.75267	4.01705	4.01719	4.01807	-4.33115	4.26078	158.722		9.87263	-4.67024	-6.78049			-4.66016	-4.66016		-4.67024	4.02494	-6.77408	130.797	4.01200	3.85273	4.02582	4.10396		
Enthalpy	Btu/h				-1.67116E+09	-3.54379E+09	-3.54408E+09	-3.61838E+09	-1.78428E+09	-8.57727E+08	-1.02452E+08		-2.13605E+08	-3.72552E+09	-3.87635E+09			-7.11764E+07	-1.97937E+06		-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				-3841.55	-3990.51	-3990.83	-4074.50	-4130.72	-4300.25	-1336.33		-6749.83	-4344.33	-4064.35			-4344.64	-4344.64		-4304.63	-3962.01	-4037.71	-1273.46	-3953.00	-4070.28	-3990.74	-4367.98		
Mass Cp	Btu/(lb*°F)				0.718521	0.899627	0.899348	0.825958	0.745097	0.902684	0.687482		0.993900	0.740867	0.742158			0.740914	0.740915		0.796470	0.925085	0.776479	0.633510	0.925215	0.824535	0.899737	0.843479		
Ideal Gas CpCv Ratio					1.12827	1.12893	1.12899	1.15033	1.14386	1.14516	1.14175		1.32209	1.15889	1.14188			1.15892	1.15892		1.14748	1.12328	1.13454	1.12186	1.12278	1.14971	1.12895	1.16365		
Dynamic Viscosity	cP				5.61206	1.03343	1.03701	3.56996	2.71884	0.953935	0.0939603		0.573158	2.85983	4.48440			2.85865	2.85865		1.50844	0.776054	2.75201	0.117687	0.776616	3.49652	1.03367	2.55707		
Kinematic Viscosity	cSt				4.94425	1.04761	1.05105	3.47815	2.49364	0.962388	0.192900		0.579699	2.60448	4.01218			2.60358	2.60358		1.39193	0.799746	2.48134	0.221806	0.800517	3.40443	1.04788	2.49597		
Thermal Conductivity	Btu/(h*ft*°F)				0.168124?	0.193968	0.193992	0.197573	0.186868?	0.211800	0.0595430		0.364821	0.195299?	0.181118?			0.195181?	0.195181?		0.194187?	0.191538	0.179837?	0.0609366	0.191015	0.197659	0.193971	0.213359		
Surface Tension	lbf/ft				0.00307750?	0.00311470	0.00311676	0.00364246	0.00337349?	0.00332825?	0.000227841?		0.00465178	0.00344566?	0.00321179?			0.00344651?	0.00344651?		0.00315251?	0.00292723	0.00302567?	0.000325052?	0.00292100	0.00363208	0.00311544	0.00378329		
Net Ideal Gas Heating Value	Btu/ft^3				535.299	483.819	483.819	483.819	454.781	402.656	2034.46		1.72884	384.960	460.335			384.960	384.960		384.960	483.819	460.347	2311.99	486.484	483.819	483.819	402.655		
Net Liquid Heating Value	Btu/lb				5312.90	5214.38	5214.38	5214.38	4766.31	4529.24	19075.5		-1018.72	4222.97	4852.85			4222.97	4222.97		4222.97	5214.38	4852.90	18886.2	5234.35	5214.38	5214.38	4529.24		
Gross Ideal Gas Heating Value	Btu/ft^3				622.600	570.172	570.171	570.171	537.437	483.267	2213.95		52.1105	461.830	542.408			461.830	461.830		461.830	570.172	542.426	2510.39	573.035	570.171	570.172	483.267		
Gross Liquid Heating Value	Btu/lb				6278.66	6268.71	6268.71	6268.71	5752.11	5582.37	20771.2		38.2955	5202.97	5833.85			5202.97	5202.97		5202.97	6268.71	5833.98	20519.5	6288.66	6268.71	6268.71	5582.37		

Name	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	--	--
	90	90	120	123	169.838		120.353				533.942	98.7079		167.854		194.206	96.7894	247.682	96.7891	187.1	70		96.7567	120.085		96.7892			122.443	100		122.443	167.535	167.535	180.726	167.859			180.246	120	206.474	128.968	120		120	167.854	169.838	169.838	165.079	
	179.696	69.6959	179.696	1554.70	74.6959		14.2000				914.696	84.6959		809.696		24.6959	902.696	25.6959	902.696	179.696	914.696		902.196	59.6959		902.696			1014.70	50		1014.70	909.696	909.696	114.696	74.6959			84.6959	19.6959	20.6959	65.6959	179.696		69.6959	809.696	74.6959	74.6959	909.696	
	0	0	0	0	0		0				0	0		0		0	0	0	0	0	0		0	0		0			0	0		0	0	0	0	0			0	0	0	0	0		0	0	0	0	0	
	100	100	100	100	100		100				100	100		100		100	100	100	100	100	100		100	100		100			100	100		100	100	100	100	100			100	100	100	100	100		100	100	100	100	100	
	0	0	0	0	0		0				0	0		0		0	0	0	0	0	0		0	0		0			0	0		0	0	0	0	0			0	0	0	0	0		0	0	0	0	0	
	29.0473	18.0759	29.0473	29.0473	31.7483		19.3212				18.0153	18.4301		31.7362		31.7184	18.4309	28.6321	18.4309	29.7664	46.1102		18.4307	18.0877		18.4309			31.0807	18.0722		31.0807	31.7350	31.7350	34.3164	31.8267			34.3139	18.0761	29.0473	29.0473	29.0473		18.0759	31.7362	31.7483	31.7483	29.7595	
	64.5608	62.1182	64.0087	64.0739	69.7755		62.1566				46.9435	62.1877		69.7886		68.7273	62.1927	60.5964	62.1927	68.0765	33.1233		62.1930	61.7244		62.1927			64.1167	61.9709		64.1167	69.7915	69.7915	70.8185	68.0099			70.7875	61.7130	61.8707	63.8141	64.0087		61.7176	69.7886	69.7755	69.7755	68.4375	
	505.906	219.890	8837.47	6866.72	30040.7		0.00132750				3.38400	25.3715		15043.9		29709.1	12.6892	35314.2	12.6891	15.3055	264.978		25.3938	1749.59		25.3783			14286.3	157.296		14286.3	15045.7	15045.7	12653.4	13543.9			12645.1	1653.33	6866.72	7074.44	505.906		219.890	15043.9	15020.4	15020.4	14425.8	
	14695.2	3974.72	256705	199460	953744		0.0256490				60.9638	467.599		477438		942327	233.873	1.01112E+06	233.872	455.590	12218.2		468.025	31646.0		467.745			444027	2842.67		444027	477475	477475	434217	431056			433903	29885.8	199460	205494	14695.2		3974.72	477438	476872	476872	429305	
	227.618	63.9863	4010.47	3112.96	13668.7		0.000412650				1.29866	7.51915		6841.20		13711.1	3.76045	16686.1	3.76044	6.69232	368.870		7.52536	512.699		7.52089			6925.30	45.8710		6925.30	6841.45	6841.45	6131.41	6338.14			6129.65	484.272	3223.82	3220.19	229.582		64.4017	6841.20	6834.37	6834.37	6272.95	
	28.3784	7.97752	500.007	388.110	1704.16		5.14473E-05				0.161911	0.937453		852.928		1709.44	0.468836	2080.34	0.468834	0.834367	45.9890		0.938227	63.9209		0.937670			863.415	5.71899		863.415	852.960	852.960	764.436	790.210			764.216	60.3767	401.931	401.478	28.6232		8.02930	852.928	852.078	852.078	782.082	
[illegible]																																																		

[illegible]

QStream Report

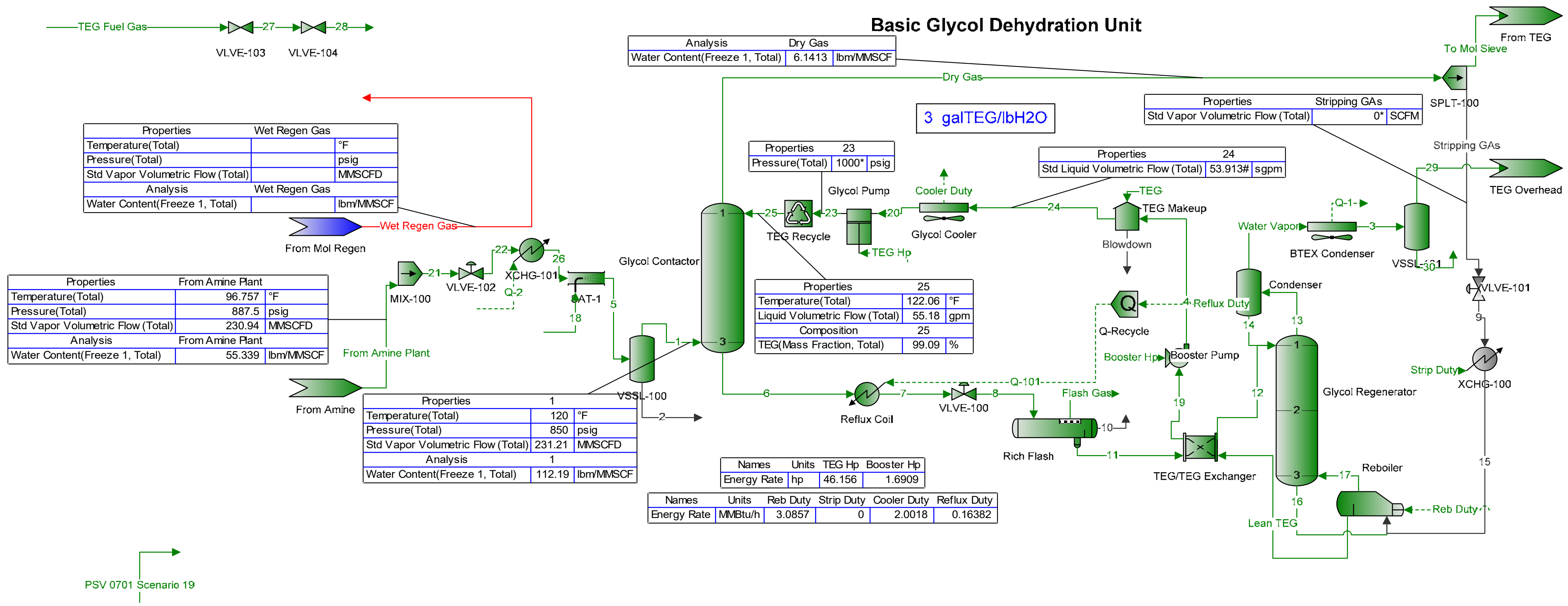
Client Name:		**Job:**	
Location:			
Flowsheet:	AMINE		

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



Analysis	Dry Gas	
Water Content(Freeze 1, Total)	6.1413	lbm/MMSCF

Properties	Wet Regen Gas	
Temperature(Total)		°F
Pressure(Total)		psig
Std Vapor Volumetric Flow (Total)		MMSCFD
Analysis	Wet Regen Gas	
Water Content(Freeze 1, Total)		lbm/MMSCF

Properties	From Amine Plant	
Temperature(Total)	96.757	°F
Pressure(Total)	887.5	psig
Std Vapor Volumetric Flow (Total)	230.94	MMSCFD
Analysis	From Amine Plant	
Water Content(Freeze 1, Total)	55.339	lbm/MMSCF

Properties	1	
Temperature(Total)	120	°F
Pressure(Total)	850	psig
Std Vapor Volumetric Flow (Total)	231.21	MMSCFD
Analysis	1	
Water Content(Freeze 1, Total)	112.19	lbm/MMSCF

Properties	23	
Pressure(Total)	1000*	psig

Properties	25	
Temperature(Total)	122.06	°F
Liquid Volumetric Flow (Total)	55.18	gpm
Composition	25	
TEG(Mass Fraction, Total)	99.09	%

Properties	24	
Std Liquid Volumetric Flow (Total)	53.913#	sgpm

Properties	Stripping GAs	
Std Vapor Volumetric Flow (Total)	0*	SCFM

Names	Units	TEG Hp	Booster Hp
Energy Rate	hp	46.156	1.6909

Names	Units	Reb Duty	Strip Duty	Cooler Duty	Reflux Duty
Energy Rate	MMBtu/h	3.0857	0	2.0018	0.16382

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	1	2	3	4	5
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Benzene	0.000142161	0.00909233	0.0511874	0.0101855	0.000142161	0.00363716	0.00909233	0*	0.00323896	0.00909233	0.463204		0.0101734		0.463204	0.000142161	0.0101734
Cyclohexane (C6)	6.73592E-07	0.0105289	0.0417971	0.0106857	6.73592E-07	0.00377564	0.0105289	0*	0.00360890	0.0105289	0.0670910		0.0106729		0.0670910	6.73592E-07	0.0106729
Methylcyclohexane (C7)	4.42123E-07	0.00358887	0.0128428	0.00365081	4.42123E-07	0.000984577	0.00358887	0*	0.000936643	0.00358887	0.0266955		0.00364645		0.0266955	4.42123E-07	0.00364645
2,2,4-Trimethylpentane(C8)	4.96504E-09	0.00148497	0.00442082	0.00149440	4.96504E-09	0.000412461	0.00148497	0*	0.000392267	0.00148497	0.00428837		0.00149261		0.00428837	4.96504E-09	0.00149261
Toluene	0.000184812	0.00190927	0.00971517	0.00228345	0.000184812	0.000564797	0.00190927	0*	0.000493041	0.00190927	0.158996		0.00228072		0.158996	0.000184812	0.00228072
Ethylbenzene	1.83344E-05	6.57912E-05	0.000273044	8.11635E-05	1.83344E-05	1.52615E-05	6.57912E-05	0*	1.35440E-05	6.57912E-05	0.00654500		8.10665E-05		0.00654500	1.83344E-05	8.10665E-05
p-Xylene	8.49380E-05	0.000303367	0.00126707	0.000372559	8.49380E-05	7.06232E-05	0.000303367	0*	6.07003E-05	0.000303367	0.0294589		0.000372114		0.0294589	8.49380E-05	0.000372114
H2O	7.08962	0.0129348	0.659201	0.116433	7.08962	0.0135705	0.0129348	0.9*	0.0135781	0.0129348	94.8522		0.235763		94.8522	7.08962	0.235763
MDEA	0.00326260	4.79644E-08	2.29215E-07	0	0.00326260	9.44525E-08	4.79644E-08	0*	9.64658E-08	4.79644E-08	0.000104107		0		0.000104107	0.00326260	0
Piperazine	1.24441E-07	1.56139E-10	6.10948E-10	0	1.24441E-07	5.21762E-09	1.56139E-10	0*	8.48651E-09	1.56139E-10	3.56156E-08		0		3.56156E-08	1.24441E-07	0
TEG	92.9067	0.000111298	0.000423489	0	92.9067	0.000117198	0.000111298	99.1*	0.000116703	0.000111298	0.00333412		0		0.00333412	92.9067	0
CHEMTHERM 550	0	0	0	0	0	0	0	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	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h	lbmol/h
N2	0	576.293	0.0449959	576.339	7.97383E-16	10.8789	0	0*	0.343943	576.293	0.000817781		576.339		0.000817781	7.97383E-16	576.339
C1	0	19456.6	5.08699	19462.1	1.32904E-11	301.624	0	0*	9.52346	19456.6	0.365817		19462.1		0.365817	1.32904E-11	19462.1
CO2	0	1.80822	0.00270011	1.81273	1.48956E-11	0.137246	0	0*	0.00682086	1.80822	0.00180375		1.81273		0.00180375	1.48956E-11	1.81273
C2	0	2911.89	1.81824	2914.16	4.80029E-10	60.2683	0	0*	1.89478	2911.89	0.456232		2914.16		0.456232	4.80029E-10	2914.16
H2S	0	0	0	0	0	0.000255501	0	0*	9.80571E-06	0	0		0		0	0	0
C3	0	1499.99	1.27683	1501.88	3.83129E-09	32.1278	0	0*	1.00436	1499.99	0.620748		1501.88		0.620748	3.83129E-09	1501.88
iC4	0	181.986	0.149158	182.224	1.11249E-09	2.96964	0	0*	0.0922217	181.986	0.0886774		182.224		0.0886774	1.11249E-09	182.224
nC4	0	420.015	0.420523	420.802	1.18497E-08	7.08481	0	0*	0.219167	420.015	0.366641		420.802		0.366641	1.18497E-08	420.802
iC5	0	88.3032	0.0935820	88.5425	2.31969E-08	1.14395	0	0*	0.0350990	88.3032	0.145674		88.5425		0.145674	2.31969E-08	88.5425
nC5	0	86.6245	0.0989530	86.9063	4.53619E-08	1.27140	0	0*	0.0389003	86.6245	0.182931		86.9063		0.182931	4.53619E-08	86.9063
C6	0	78.3890	0.0898675	78.7847	3.06136E-07	0.394876	0	0*	0.0119198	78.3890	0.305901		78.7847		0.305901	3.06136E-07	78.7847
C7	0	0.720629	0.000779822	0.726636	2.67634E-08	0.0273345	0	0*	0.000820560	0.720629	0.00522740		0.726636		0.00522740	2.67634E-08	0.726636
C8	0	0.199768	0.000188699	0.202028	3.96648E-08	0.00282208	0	0*	8.40917E-05	0.199768	0.00207140		0.202028		0.00207140	3.96648E-08	0.202028
C9	0	0.0989652	7.93761E-05	0.100595	1.06010E-07	0.000612907	0	0*	1.81629E-05	0.0989652	0.00155084		0.100595		0.00155084	1.06010E-07	0.100595
C10	0	0	0	0	0	6.30096E-05	0	0*	1.86203E-06	0	0		0		0	0	0
Cyclopentane	0	4.87943	0.00845501	4.95849	1.18130E-06	0.0402026	0	0*	0.00122403	4.87943	0.0706042		4.95849		0.0706042	1.18130E-06	4.95849
Benzene	0	2.30199	0.00469026	2.58267	0.000307210	0.0152058	0	0*	0.000426758	2.30199	0.276009		2.58267		0.276009	0.000307210	2.58267
Cyclohexane	0	2.66570	0.00382984	2.70950	1.45563E-06	0.0157848	0	0*	0.000475502	2.66570	0.0399774		2.70950		0.0399774	1.45563E-06	2.70950
Methylcyclohexane	0	0.908629	0.00117678	0.925712	9.55428E-07	0.00411621	0	0*	0.000123410	0.908629	0.0159070		0.925712		0.0159070	9.55428E-07	0.925712
2,2,4-Trimethylpentane	0	0.375964	0.000405076	0.378924	1.07294E-08	0.00172437	0	0*	5.16843E-05	0.375964	0.00255530		0.378924		0.00255530	1.07294E-08	0.378924
Toluene	0	0.483387	0.000890194	0.578998	0.000399379	0.00236124	0	0*	6.49621E-05	0.483387	0.0947406		0.578998		0.0947406	0.000399379	0.578998
Ethylbenzene	0	0.0166570	2.50188E-05	0.0205801	3.96206E-05	6.38035E-05	0	0*	1.78452E-06	0.0166570	0.00389995		0.0205801		0.00389995	3.96206E-05	0.0205801
p-Xylene	0	0.0768062	0.000116101	0.0944672	0.000183551	0.000295253	0	0*	7.99774E-06	0.0768062	0.0175536		0.0944672		0.0175536	0.000183551	0.0944672
H2O	0	3.27483	0.0604020	29.5231	15.3207	0.0567341	0	4.68461E-05*	0.00178902	3.27483	56.5194		59.8524		56.5194	15.3207	59.8524
MDEA	0	1.21436E-05	2.10028E-08	0	0.00705047	3.94877E-07	0	0*	1.27101E-08	1.21436E-05	6.20338E-05		0		6.20338E-05	0.00705047	0
Piperazine	0	3.95312E-08	5.59807E-11	0	2.68917E-07	2.18132E-08	0	0*	1.11816E-09	3.95312E-08	2.12222E-08		0		2.12222E-08	2.68917E-07	0
TEG	0	0.0281783	3.88039E-05	0	200.771	0.000489968	0	0.00515828*	1.53766E-05	0.0281783	0.00198670		0		0.00198670	200.771	0
CHEMTHERM 550	0	0	0	0	0	0	0	0*	0	0	0		0		0	0	0

Process Streams	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
From Block:	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:	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	0.0160835	0.0160835	0.0160835			0.000296634	0.000296634	0.00124766	3.62537E-08		2.46008E-13	1.16001E-12	0*	3.68988E-16	0	2.27296	2.27296	0	0	0	2.27296	2.61042	2.61042	0.0235648	2.18847E-07
C1	1.91428	1.91428	1.91428			0.132693	0.132693	0.558115	3.70281E-05		1.90447E-09	8.96797E-09	0*	6.15010E-12	0	76.7543	76.7543	0	0	0	76.7543	72.2800	72.2800	10.5396	0.000198096
CO2	0.00158113	0.00158113	0.00158113			0.000654275	0.000654275	0.00275205	1.63142E-06		7.10865E-10	3.33028E-09	0*	6.89293E-12	0	0.00714901	0.00714901	0	0	0	0.00714901	0.0517681	0.0517681	0.0517249	1.60058E-05
C2	0.798481	0.798481	0.798481			0.165489	0.165489	0.696060	7.36040E-05		3.30506E-08	1.55203E-07	0*	2.22133E-10	0	11.4928	11.4928	0	0	0	11.4928	14.3808	14.3808	13.1435	0.000308122
H2S	0	0	0			0	0	0	0		0	0	0*	0	0	0	0	0	0	0	0	7.44222E-05	7.44222E-05	0	0
C3	0.666169	0.666169	0.666169			0.225164	0.225164	0.947059	0.000112854		1.80638E-07	8.46180E-07	0*	1.77292E-09	0	5.92311	5.92311	0	0	0	5.92311	7.62278	7.62278	17.8852	0.000289399
iC4	0.0834949	0.0834949	0.0834949			0.0321660	0.0321660	0.135292	1.15045E-05		4.37159E-08	2.04463E-07	0*	5.14804E-10	0	0.718652	0.718652	0	0	0	0.718652	0.699933	0.699933	2.55530	2.29332E-05
nC4	0.276344	0.276344	0.276344			0.132992	0.132992	0.559377	8.91330E-05		3.89994E-07	1.82072E-06	0*	5.48344E-09	5.48331E-09	1.65955	1.65955	5.48331E-09	5.48331E-09	5.85912E-09	1.65955	1.66341	1.66341	10.5640	0.000158782
iC5	0.0839937	0.0839937	0.0839937			0.0528403	0.0528403	0.222251	3.06170E-05		5.31383E-07	2.46867E-06	0*	1.07344E-08	1.07341E-08	0.349193	0.349193	1.07341E-08	1.07341E-08	1.14731E-08	0.349193	0.266390	0.266390	4.19768	3.78005E-05
nC5	0.0989590	0.0989590	0.0989590			0.0663548	0.0663548	0.279094	3.98494E-05		9.57255E-07	4.44101E-06	0*	2.09912E-08	2.09907E-08	0.342740	0.342740	2.09907E-08	2.09907E-08	2.24346E-08	0.342740	0.295241	0.295241	5.27162	2.69609E-05
C6	0.138940	0.138940	0.138940			0.110960	0.110960	0.466706	6.46058E-05		4.86999E-06	2.24637E-05	0*	1.41664E-07	1.41661E-07	0.310710	0.310710	1.41661E-07	1.41661E-07	1.51223E-07	0.310710	0.0904672	0.0904672	8.81557	2.79997E-05
C7	0.00210892	0.00210892	0.00210892			0.00189615	0.00189615	0.00797531	1.04403E-06		3.04266E-07	1.39033E-06	0*	1.23847E-08	1.23844E-08	0.00286570	0.00286570	1.23844E-08	1.23844E-08	1.32047E-08	0.00286570	0.00622779	0.00622779	0.150648	3.03163E-07
C8	0.000793451	0.000793451	0.000793451			0.000751375	0.000751375	0.00316029	4.31705E-07		3.45667E-07	1.56357E-06	0*	1.83548E-08	1.83544E-08	0.000796755	0.000796755	1.83544E-08	1.83544E-08	1.95455E-08	0.000796755	0.000638229	0.000638229	0.0596965	5.97275E-08
C9	0.000572345	0.000572345	0.000572345			0.000562575	0.000562575	0.00236607	2.08289E-07		7.01409E-07	3.12876E-06	0*	4.90561E-08	4.90549E-08	0.000396727	0.000396727	4.90549E-08	4.90549E-08	5.22419E-08	0.000396727	0.000137851	0.000137851	0.0446945	2.68169E-08
C10	0	0	0			0	0	0	0		0	0	0*	0	0	0	0	0	0	0	0	1.41322E-05	1.41322E-05	0	0
Cyclopentane (C5)	0.0277551	0.0277551	0.0277551			0.0256107	0.0256107	0.107723	5.24076E-05		9.90318E-06	4.47181E-05	0*	5.46645E-07	5.46632E-07	0.0195552	0.0195552	5.46632E-07	5.46632E-07	5.82111E-07	0.0195552	0.00928999	0.00928999	2.03330	9.26844E-05
Benzene	0.0986507	0.0986507	0.0986507			0.100228	0.100228	0.421331	0.00259698		0.00122845	0.00527044	0*	0.000142161	0.000142158	0.0101855	0.0101855	0.000142158	0.000142158	0.000149673	0.0101855	0.00323896	0.00323896	7.77818	0.0109040
Cyclohexane (C6)	0.0153796	0.0153796	0.0153796			0.0145015	0.0145015	0.0609951	3.57993E-05		1.03101E-05	4.61669E-05	0*	6.73592E-07	6.73576E-07	0.0106857	0.0106857	6.73576E-07	6.73576E-07	7.16484E-07	0.0106857	0.00360890	0.00360890	1.15134	4.96813E-05
Methylcyclohexane (C7)	0.00599780	0.00599780	0.00599780			0.00577029	0.00577029	0.0242696	1.10698E-05		6.16092E-06	2.74401E-05	0*	4.42123E-07	4.42113E-07	0.00365081	0.00365081	4.42113E-07	4.42113E-07	4.70154E-07	0.00365081	0.000936643	0.000936643	0.458298	8.55416E-06
2,2,4-Trimethylpentane(C8)	0.00103928	0.00103928	0.00103928			0.000926890	0.000926890	0.00389857	5.87667E-07		1.32514E-07	6.07111E-07	0*	4.96504E-09	4.96492E-09	0.00149440	0.00149440	4.96492E-09	4.96492E-09	5.28449E-09	0.00149440	0.000392267	0.000392267	0.0736412	1.38435E-07
Toluene	0.0337126	0.0337126	0.0337126			0.0345102	0.0345102	0.144642	0.00109840		0.00125427	0.00523365	0*	0.000184812	0.000184808	0.00228345	0.00228345	0.000184808	0.000184808	0.000193989	0.00228345	0.000493041	0.000493041	2.68335	0.00290986
Ethylbenzene	0.00139182	0.00139182	0.00139182			0.00142900	0.00142900	0.00595406	4.46710E-05		0.000104895	0.000426981	0*	1.83344E-05	1.83339E-05	8.11635E-05	8.11635E-05	1.83339E-05	1.83339E-05	1.91970E-05	8.11635E-05	1.35440E-05	1.35440E-05	0.110893	9.29630E-05
p-Xylene	0.00626762	0.00626762	0.00626762			0.00643382	0.00643382	0.0267994	0.000204010		0.000484230	0.00196996	0*	8.49380E-05	8.49359E-05	0.000372559	0.000372559	8.49359E-05	8.49359E-05	8.89532E-05	0.000372559	6.07003E-05	6.07003E-05	0.500344	0.000343129
H2O	25.2416	25.2416	25.2416			26.0586	26.0586	94.7490	93.7163		25.0860	92.0492	100*	7.08962	7.08947	0.116433	0.116433	7.08947	7.08947	7.08957	0.116433	0.0135781	0.0135781	11.9073	99.9809
MDEA	0.00249694	0.00249694	0.00249694			0.00257992	0.00257992	0.000118503	0.000262470		0.00279992	0.00107833	0*	0.00326260	0.00326252	0	0	0.00326252	0.00326252	0.00329644	0	9.64658E-08	9.64658E-08	0.000589351	7.41030E-05
Piperazine	1.01877E-07	1.01877E-07	1.01877E-07			1.05242E-07	1.05242E-07	1.21220E-07	9.77269E-07		2.02431E-07	4.92623E-07	0*	1.24441E-07	1.24438E-07	0	0	1.24438E-07	1.24438E-07	1.52558E-07	0	8.48651E-09	8.48651E-09	7.98567E-12	3.78173E-08
TEG	70.4840	70.4840	70.4840			72.8266	72.8266	0.573839	6.27889		74.9081	7.93671	0*	92.9067	92.9068	0	0	92.9068	92.9068	92.9067	0	0.000116703	0.000116703	4.50394E-08	0.00354027
CHEMTHERM 550	0	0	0			0	0	0	0		0	0	0*	0	0	0	0	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	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	0.0458137	0.0458137	0.0458137			0.000817781	0.000817781	0.000817784	2.16025E-09		6.74497E-13	6.73700E-13	0*	7.97383E-16	0	576.339	576.339	0	0	0	576.339	0.343943	0.343943	0.000817659	1.22810E-07
C1	5.45281	5.45281	5.45281			0.365817	0.365817	0.365819	2.20638E-06		5.22163E-09	5.20834E-09	0*	1.32904E-11	0	19462.1	19462.1	0	0	0	19462.1	9.52346	9.52346	0.365706	0.000111165
CO2	0.00450386	0.00450386	0.00450386			0.00180375	0.00180375	0.00180385	9.72109E-08		1.94903E-09	1.93413E-09	0*	1.48956E-11	0	1.81273	1.81273	0	0	0	1.81273	0.00682086	0.00682086	0.00179477	8.98196E-06
C2	2.27447	2.27447	2.27447			0.456232	0.456232	0.456236	4.38583E-06		9.06173E-08	9.01372E-08	0*	4.80029E-10	0	2914.16	2914.16	0	0	0	2914.16	1.89478	1.89478	0.456059	0.000172909
H2S	0	0	0			0	0	0	0		0	0	0*	0	0	0	0	0	0	0	0	9.80571E-06	9.80571E-06	0	0
C3	1.89758	1.89758	1.89758			0.620748	0.620748	0.620755	6.72464E-06		4.95268E-07	4.91437E-07	0*	3.83129E-09	0	1501.88	1501.88	0	0	0	1501.88	1.00436	1.00436	0.620586	0.000162402
iC4	0.237835	0.237835	0.237835			0.0886774	0.0886774	0.0886781	6.85518E-07		1.19859E-07	1.18746E-07	0*	1.11249E-09	0	182.224	182.224	0	0	0	182.224	0.0922217	0.0922217	0.0886645	1.28694E-05
nC4	0.787164	0.787164	0.787164			0.366641	0.366641	0.366646	5.31115E-06		1.06927E-06	1.05742E-06	0*	1.18497E-08	1.18497E-08	420.802	420.802	1.18497E-08	1.18497E-08	1.26635E-08	420.802	0.219167	0.219167	0.366552	8.91036E-05
iC5	0.239256	0.239256	0.239256			0.145674	0.145674	0.145675	1.82437E-06		1.45693E-06	1.43373E-06	0*	2.31969E-08	2.31969E-08	88.5425	88.5425	2.31969E-08	2.31969E-08	2.47971E-08	88.5425	0.0350990	0.0350990	0.145652	2.12125E-05
nC5	0.281884	0.281884	0.281884			0.182931	0.182931	0.182934	2.37450E-06		2.62457E-06	2.57921E-06	0*	4.53619E-08	4.53619E-08	86.9063	86.9063	4.53619E-08	4.53619E-08	4.84885E-08	86.9063	0.0389003	0.0389003	0.182916	1.51296E-05
C6	0.395769	0.395769	0.395769			0.305901	0.305901	0.305905	3.84965E-06		1.33524E-05	1.30463E-05	0*	3.06136E-07	3.06136E-07	78.7847	78.7847	3.06136E-07	3.06136E-07	3.26842E-07	78.7847	0.0119198	0.0119198	0.305885	1.57126E-05
C7	0.00600724	0.00600724	0.00600724			0.00522742	0.00522742	0.00522746	6.22103E-08		8.34226E-07	8.07463E-07	0*	2.67634E-08	2.67634E-08	0.726636	0.726636	2.67634E-08	2.67634E-08	2.85396E-08	0.726636	0.000820560	0.000820560	0.00522723	1.70126E-07
C8	0.00226014	0.00226014	0.00226014			0.00207144	0.00207144	0.00207143	2.57239E-08		9.47739E-07	9.08074E-07	0*	3.96648E-08	3.96648E-08	0.202028	0.202028	3.96648E-08	3.96648E-08	4.22442E-08	0.202028	8.40917E-05	8.40917E-05	0.00207137	3.35173E-08
C9	0.00163032	0.00163032	0.00163032			0.00155095	0.00155095	0.00155085	1.24113E-08		1.92310E-06	1.81709E-06	0*	1.06010E-07	1.06010E-07	0.100595	0.100595	1.06010E-07	1.06010E-07	1.12912E-07	0.100595	1.81629E-05	1.81629E-05	0.00155082	1.50488E-08
C10	0	0	0			0	0	0	0		0	0	0*	0	0	0	0	0	0	0	0	1.86203E-06	1.86203E-06	0	0
Cyclopentane	0.0790604	0.0790604	0.0790604			0.0706054	0.0706054	0.0706073	3.12280E-06		2.71523E-05	2.59710E-05	0*	1.18130E-06	1.18130E-06	4.95849	4.95849	1.18130E-06	1.18130E-06	1.25813E-06	4.95849	0.00122403	0.00122403	0.0705522	5.20117E-05
Benzene	0.281006	0.281006	0.281006			0.276316	0.276316	0.276163	0.000154746		0.00336813	0.00306092	0*	0.000307210	0.000307210	2.58267	2.58267	0.000307210	0.000307210	0.000323491	2.58267	0.000426758	0.000426758	0.269890	0.00611897
Cyclohexane	0.0438087	0.0438087	0.0438087			0.0399788	0.0399788	0.0399795	2.13317E-06		2.82681E-05	2.68124E-05	0*	1.45563E-06	1.45563E-06	2.70950	2.70950	1.45563E-06	1.45563E-06	1.54856E-06	2.70950	0.000475502	0.000475502	0.0399495	2.78796E-05
Methylcyclohexane	0.0170847	0.0170847	0.0170847			0.0159079	0.0159079	0.0159076	6.59613E-07		1.68918E-05	1.59364E-05	0*	9.55428E-07	9.55428E-07	0.925712	0.925712	9.55428E-07	9.55428E-07	1.01616E-06	0.925712	0.000123410	0.000123410	0.0159022	4.80034E-06
2,2,4-Trimethylpentane	0.00296039	0.00296039	0.00296039			0.00255531	0.00255531	0.00255534	3.50172E-08		3.63322E-07	3.52592E-07	0*	1.07294E-08	1.07294E-08	0.378924	0.378924	1.07294E-08	1.07294E-08	1.14215E-08	0.378924	5.16843E-05	5.16843E-05	0.00255523	7.76856E-08
Toluene	0.0960302	0.0960302	0.0960302			0.0951400	0.0951400	0.0948060	6.54502E-05		0.00343893	0.00303955	0*	0.000399379	0.000399379	0.578998	0.578998	0.000399379	0.000399379	0.000419273	0.578998	6.49621E-05	6.49621E-05	0.0931077	0.00163293
Ethylbenzene	0.00396459	0.00396459	0.00396459			0.00393957	0.00393957	0.00390262	2.66180E-06		0.000287599	0.000247978	0*	3.96206E-05	3.96206E-05	0.0205801	0.0205801	3.96206E-05	3.96206E-05	4.14909E-05	0.0205801	1.78452E-06	1.78452E-06	0.00384779	5.21680E-05
p-Xylene	0.0178533	0.0178533	0.0178533			0.0177372	0.0177372	0.0175658	1.21563E-05		0.00132765	0.00114410	0*	0.000183551	0.000183551	0.0944672	0.0944672	0.000183551	0.000183551	0.000192257	0.0944672	7.99774E-06	7.99774E-06	0.0173611	0.000192554
H2O	71.9005	71.9005	71.9005			71.8401	71.8401	62.1037	5.58426		68.7801	53.4595	30.3293*	15.3207	15.3207	29.5231	29.5231	15.3207	15.3207	15.3229	29.5231	0.00178902	0.00178902	0.413163	56.1063
MDEA	0.00711252	0.00711252	0.00711252			0.00711250	0.00711250	7.76736E-05	1.56398E-05		0.00767673	0.000626263	0*	0.00705047	0.00705047	0	0	0.00705047	0.00705047	0.00712467	0	1.27101E-08	1.27101E-08	2.04495E-05	4.15843E-05
Piperazine	2.90195E-07	2.90195E-07	2.90195E-07			2.90139E-07	2.90139E-07	7.94545E-08	5.82323E-08		5.55019E-07	2.86101E-07	0*	2.68917E-07	2.68917E-07	0	0	2.68917E-07	2.68917E-07	3.29727E-07	0	1.11816E-09	1.11816E-09	2.77089E-13	2.12219E-08
TEG	200.773	200.773	200.773			200.773	200.773	0.376126	0.374139		205.381	4.60941	0*	200.771	200.776	0	0	200.776	200.776	200.801	0	1.53766E-05	1.53766E-05	1.56279E-09	0.00198669
CHEMTHERM 550	0	0	0			0	0	0	0		0	0	0*	0	0	0	0	0	0	0	0	0	0	0	0

Composition / Phase: Vapor											
Status:	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
To Block:	--	SPLT-100	--	MIX-100	TEG/TEG Exchanger	--	VLVE-101	TEG Makeup	VLVE-103	From TEG	BTEX Condenser
Mole Fraction	%	%	%	%	%	%	%	%	%	%	%
N2		2.27622	0.491065	2.27296		2.60218			2.61042	2.27622	0.00137242
C1		76.8491	55.5172	76.7543		72.1469			72.2800	76.8491	0.613923
CO2		0.00714206	0.0294677	0.00714901		0.0328285			0.0517681	0.00714206	0.00302710
C2		11.5013	19.8434	11.4928		14.4159			14.3808	11.5013	0.765659
H2S		0	0	0		6.11146E-05			7.44222E-05	0	0
C3		5.92460	13.9348	5.92311		7.68482			7.62278	5.92460	1.04175
iC4		0.718802	1.62784	0.718652		0.710323			0.699933	0.718802	0.148821
nC4		1.65896	4.58940	1.65955		1.69465			1.66341	1.65896	0.615306
iC5		0.348777	1.02131	0.349193		0.273626			0.266390	0.348777	0.244473
nC5		0.342147	1.07993	0.342740		0.304112			0.295241	0.342147	0.307000
C6		0.309618	0.980773	0.310710		0.0944523			0.0904672	0.309618	0.513370
C7		0.00284632	0.00851063	0.00286570		0.00653828			0.00622779	0.00284632	0.00877274
C8		0.000789036	0.00205938	0.000796755		0.000675027			0.000638229	0.000789036	0.00347628
C9		0.000390890	0.000866275	0.000396727		0.000146604			0.000137851	0.000390890	0.00260266
C10		0	0	0		1.50716E-05			1.41322E-05	0	0
Cyclopentane		0.0192726	0.0922742	0.0195552		0.00961627			0.00928999	0.0192726	0.118490
Benzene		0.00909233	0.0511874	0.0101855		0.00363716			0.00323896	0.00909233	0.463204
Cyclohexane		0.0105289	0.0417971	0.0106857		0.00377564			0.00360890	0.0105289	0.0670910
Methylcyclohexane		0.00358887	0.0128428	0.00365081		0.000984577			0.000936643	0.00358887	0.0266955
2,2,4-Trimethylpentane		0.00148497	0.00442082	0.00149440		0.000412461			0.000392267	0.00148497	0.00428837
Toluene		0.00190927	0.00971517	0.00228345		0.000564797			0.000493041	0.00190927	0.158996
Ethylbenzene		6.57912E-05	0.000273044	8.11635E-05		1.52615E-05			1.35440E-05	6.57912E-05	0.00654500
p-Xylene		0.000303367	0.00126707	0.000372559		7.06232E-05			6.07003E-05	0.000303367	0.0294589
H2O		0.0129348	0.659201	0.116433		0.0135705			0.0135781	0.0129348	94.8522
MDEA		4.79644E-08	2.29215E-07	0		9.44525E-08			9.64658E-08	4.79644E-08	0.000104107
Piperazine		1.56139E-10	6.10948E-10	0		5.21762E-09			8.48651E-09	1.56139E-10	3.56156E-08
TEG		0.000111298	0.000423489	0		0.000117198			0.000116703	0.000111298	0.00333412
CHEMTHERM 550		0	0	0		0			0	0	0

	Lean TEG	TEG	3	4	6	7	8	11	12	14	16	18	19	20	22	23	24	25	30
Ethylbenzene	0.00420632	0	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	0.0194867	0	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	276.006	0.000843946	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	0.840150	0	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	2.31633E-05	0	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	30150.4	0.774634	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	0	0

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
Properties	Status:	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Solved	Unsolved
Phase: Light Liquid	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	--
Property	Units												
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				

Process Streams	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			120	232.718		122.860	131.706	134.689			134.689	300		211.097	
Pressure			14.2000	44.6959		864.696	859.696	74.6959			74.6959	69.6959		14.7000	
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			18.0295	140.802		111.865	111.872	114.671			114.671	114.936		26.3164	
Mass Density			61.5891	65.4282		67.1374	66.9266	67.8907			67.8907	63.5021		64.0488	
Molar Flow			56.1170	216.100		284.850	284.825	275.687			275.687	274.784		5.95868	
Mass Flow			1011.76	30427.4		31864.6	31864.1	31613.2			31613.2	31582.5		156.811	
Vapor Volumetric Flow			16.4276	465.049		474.618	476.105	465.648			465.648	497.346		2.44831	
Liquid Volumetric Flow			2.04811	57.9802		59.1731	59.3586	58.0548			58.0548	62.0068		0.305243	
Std Vapor Volumetric Flow			0.511092	1.96816		2.59430	2.59408	2.51085			2.51085	2.50262		0.0542694	
Std Liquid Volumetric Flow			2.02275	53.9115		57.7857	57.7828	56.5212			56.5212	56.3991		0.300599	
Compressibility			0.000668225	0.0129449		0.230468	0.226434	0.0197800			0.0197800	0.0154735		0.000839069	
Specific Gravity			0.987500	1.04905		1.07646	1.07308	1.08854			1.08854	1.01817		1.02694	
API Gravity			10.2795	-6.10351		-2.73968	-2.74425	-4.64850			-4.64850	-4.80540		2.77937	
Enthalpy			-6.85263E+06	-6.85978E+07		-7.79523E+07	-7.77877E+07	-7.74505E+07			-7.74505E+07	-7.41383E+07		-800010	
Mass Enthalpy			-6772.99	-2254.48		-2446.36	-2441.23	-2449.95			-2449.95	-2347.45		-5101.74	
Mass Cp			0.981286	0.608880		0.580505	0.584983	0.586436			0.586436	0.658309		0.930006	
Ideal Gas CpCv Ratio			1.32325	1.02930		1.04214	1.04164	1.04044			1.04044	1.03433		1.19310	
Dynamic Viscosity			0.570804	2.80525		9.32769	8.00439	9.43877			9.43877	1.39418		0.588145	
Kinematic Viscosity			0.578578	2.67661		8.67339	7.46636	8.67928			8.67928	1.37060		0.573261	
Thermal Conductivity			0.367104	0.113184?		0.115524?	0.115591?	0.117344?			0.117344?	0.115194?		0.262773?	
Surface Tension			0.00466078	0.00260916?		0.00289166	0.00286943	0.00296301			0.00296301	0.00249167?		0.00402734	
Net Ideal Gas Heating Value			0.701878	3503.66		2735.05	2735.19	2777.24			2777.24	2781.21		236.957	
Net Liquid Heating Value			-1044.15	9171.73		8983.72	8983.54	8894.85			8894.85	8886.69		2642.43	
Gross Ideal Gas Heating Value			51.0408	3834.11		3002.54	3002.69	3048.97			3048.97	3053.34		306.205	
Gross Liquid Heating Value			15.3791	10062.3		9891.15	9890.95	9794.08			9794.08	9785.16		3640.99	

Process Streams	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	302.430		527.040	232.616	120		94.2651	122.061	232.715	122.061					120
Pressure	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
Mole Fraction Light Liquid	100		100	100	100		100	100	100	100					100
Mole Fraction Heavy Liquid	0		0	0	0		0	0	0	0					0
Molecular Weight	117.017		18.0153	140.802	140.802		18.0168	140.802	140.802	140.802					18.0295
Mass Density	63.6694		47.2327	65.4283	68.7326		61.9115	68.7583	65.4283	68.7583					61.5891
Molar Flow	274.177		6.30672	216.100	216.105		0.819060	216.105	216.105	216.132					56.1170
Mass Flow	32083.4		113.617	30427.4	30428.1		14.7568	30428.1	30428.1	30431.9					1011.76
Vapor Volumetric Flow	503.906		2.40548	465.049	442.703		0.238354	442.538	465.061	442.593					16.4276
Liquid Volumetric Flow	62.8246		0.299904	57.9801	55.1942		0.0297168	55.1735	57.9816	55.1804					2.04811
Std Vapor Volumetric Flow	2.49710		0.0574392	1.96816	1.96820		0.00745968	1.96820	1.96820	1.96845					0.511092
Std Liquid Volumetric Flow	57.0635		0.227129	53.9115	53.9129		0.0295657	53.9129	53.9129	53.9197					2.02275
Compressibility	0.00341575		0.0311465	0.00425807	0.0130722		0.0423299	0.332840	0.0129450	0.332840					0.000668225
Specific Gravity	1.02085		0.757313	1.04906	1.10204		0.992669	1.10245	1.04906	1.10245					0.987500
API Gravity	-5.31489		10.1778	-6.09925	-6.10281		10.3647	-6.24071	-6.10352	-6.24069					10.2795
Enthalpy	-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	-2342.88		-6330.88	-2254.62	-2320.27		-6796.44	-2316.41	-2254.48	-2316.41					-6772.99
Mass Cp	0.657493		1.43930	0.608888	0.556207		0.980229	0.556378	0.608878	0.556378					0.981286
Ideal Gas CpCv Ratio	1.03362		1.30432	1.02930	1.03336		1.32460	1.03326	1.02930	1.03326					1.32325
Dynamic Viscosity	1.41828		0.164021	2.80443	13.8988		0.748604	13.7543	2.80534	13.7543					0.570804
Kinematic Viscosity	1.39062		0.216788	2.67583	12.6240		0.754849	12.4880	2.67670	12.4880					0.578578
Thermal Conductivity	0.115612?		0.338427	0.113186?	0.113516		0.356175	0.113540?	0.113184?	0.113540?					0.367104
Surface Tension	0.00250149?		0.00139572	0.00260945?	0.00296381		0.00484603	0.00295876	0.00260917	0.00295876					0.00466078
Net Ideal Gas Heating Value	2825.03		0	3503.66	3503.67		1.08437	3503.67	3503.67	3503.67					0.701878
Net Liquid Heating Value	8866.80		-1059.76	9171.73	9171.73		-1035.79	9171.73	9171.73	9171.73					-1044.15
Gross Ideal Gas Heating Value	3101.20		50.31	3834.11	3834.11		51.4556	3834.11	3834.11	3834.11					51.0408
Gross Liquid Heating Value	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 i
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 i
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

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PROCESS DESIGN CONDITIONS

	Units				
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-

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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	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 Firec

Pilot Design:

Type / Model		Self-Inspirating	/	by O.E.M.
Ignition	- - -	Electric		requires elec.ign.systen
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 Diametel
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

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)

Crossovers:		RADIANT	SHIELD	CONVECTION	
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

Tube Supports:		RADIANT	SHIELD	CONVECTION	
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 ... Pipinc	ASTM	tube/ smls pipe/ fitting spec's noted hereir
ASME	Sections I, II, VIII, IX; ASME B&PV Code	ASTM	refractories per C27, C155, C401 & C612
ASME	Section V; Non Destructive Examinatior	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
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

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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

COMBUSTION DESIGN CONDITIONS

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Overall Performance:

Operating Case	---	Over-Design Case	Design Case		
Service	---	Regen Gas Heater	Regen Gas Heater		
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

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PRESSURE PARTS DESIGN

		RADIANT	SHIELD	CONVECTION
Coil Design:		RADIANT	SHIELD	CONVECTION
Service		Regen Gas Heater	Regen Gas Heater	Regen Gas 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	1,095 /	1,095 /	1,095 /
Design Fluid Temperature	°F	550	550	550
Design Temperature Allowance	°F	29	29	29
Design Corrosion Allowance (tubes/fittings)	in	0.0625 / 0.0625	0.0625 / 0.0625	0.0625 / 0.0625
Maximum Tube Temperature (clean)	°F	702		
Maximum Tube Temperature (fouled)	°F	734	372	475
Design Tube Temperature	°F	763	650	650
Inside Film Coefficient	BTU/ hr ft2 °F	271	233	233
Weld Inspection	RT or Other	100 of 100%	100 of 100%	100 of 100%
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	4.500	4.500	4.500
Tube Wall Thickness (aw / mw)	in	0.337 / 0.295	0.337 / 0.295	0.337 / 0.295
Number of Cells (radiant or convection)	---	1	1	1
Number of Flow Passes (total / cell)	---	1 / 1	1 / 1	1 / 1
Number of Tubes per Row (total / cell)	---		4 / 4	4 / 4
Overall Tube (1 turn in radiant) Length	ft	20.42	9.04	9.04
Effective Tube Length / Helix Diameter	ft	20.42 / 6.50	7.46	7.46
Number of Turns or Tubes (total / pass)		11.8 / 11.8	4.0 / 4.0	0.0 / 0.0
Total Exposed Surface	ft2	283	35	0
Number of Ext.Surf. Tubes (total / cell)	---	0 / 0.0	0 / 0.0	12 / 12.0
Total Exposed Surface	ft2	0	0	1,309
Tube Spacing (horiz. / tube centers)	in	--- / 8.00	8.00 / 8.00	8.00 / 8.00
Tube Spacing (horiz. to refractory)	in	6.00	4.00	4.00
Coil Fittings:		Regen Gas Heater	Regen Gas Heater	Regen Gas 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	4.500	4.500	4.500
Fitting Wall Thickness (aw / mw)	in	0.337 / 0.295	0.337 / 0.295	0.337 / 0.295
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	4" NPS / 900#		4" NPS / 900#
Flange Type	RFWN or RTJ	RFWN		RFWN
Location	---	Burner Endwall		Terminal End
Extended Surface:			CONVECTION	CONVECTION
Service	---		Regen Gas Heater	Regen Gas Heater
Fin or Stud Row Number	starting @ bottom		No.1 / No.2-3	
Ext. Surface Type	seg.fins, solid fins, studs		HF Seg. Fins	
Fin/Stud Material	---		C.S. / C.S.	
Fin/Stud Height	in		1.00 / 1.00	
Fin/Stud Thickness	in		0.06 / 0.06	
Fin/Stud Density	fin/ in		4.00 / 5.00	

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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 Heater	Regen Gas Heater	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)			

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CASING / REFRACTORY SYSTEMS DESIGN

		BURNER ENDWALL		SHIELDED SIDEWALLS	ARCH ENDWALL
Radiant Section Design:					
Total Refractory Thickness	in	5.0		3.0	5.0
Hot Face Temperature (design)	°F	2,000		2,000	2,000
Hot Face Temperaure (calculated)	°F	1,649		1,130	1,649
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		2/ 6# CF Blanket	1/ 8# CF Blanket
Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 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		0.1345 / 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	1,048	1,048	1,048	766
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	0.1345 / A36	0.1345 / 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:			15° TRANSITION	DISCH. DUCT	
Quantity			One	One	
Type / Location	- - -		Full L / Conv	Self.Spt / Grade	
Length / Metal Outside Diameter (top)	ft/ ft		1.08 / n/ a	7 / 1.333	
Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 20	
Total Refractory Thickness	in		0.0	0.0	
Hot Face Temperature (design)	°F				
Hot Face Temperaure (calculated)	°F		447	447	
Hot Face Layer	in/ - - -		None	None	
Back-Up Layer No.1	in/ - - -				
Castable Reinforcement (SS Needles)					
Anchors / Tie Backs:	- - -				
Material	- - -				
Attachment	- - -				
Casing:					
Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36	
Corrosion Allowance	in		None	None	
Internal Coating	- - -		None	None	
External Temperature, Typical	°F		447	447	
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.	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 & 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 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

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:

	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

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
Purchaser:	UOPR	Purch. Ref.:	J463
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265
Burner OEM:	**Callidus Technologies, LLC**	OEM Ref.:	9020143
SHO Model:	SHO500	Service:	Regen Gas Heater
CMS Model:	CMS1500	Location:	Unknown @ 750 ft elevation

Ftnt & Rev

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)	**Flame Dimensions:**		ft / (in)
Casing Width / Height, Casing	face - face	8.00 / (96)	Burner CL elev., approx.	AG	4.50 / (54)
Casing Length, Casing to Casing	face - face	10.00 / (120)	Flame Length, calc.	@ design HR	10.9 / (131)
Helical Coil CenterLine Diameter	CL - CL	6.50 / (78)	Flame Dia., calc.	@ design HR	2.50 / (30)
Helical Coil Inside Diameter	face - face	6.13 / (74)			
Serpentine Coil CtrLine Dimensions	W / H		**Actual Clearances**		ft / (in)
Serpentine Coil Inside Dimensions	face - face		Burner - tube (tangential)	CL / Net	3.25 / (39)
Firebox Length, Refractory Faces	face - face	9.17 / (110)			

Combustion Air (CA) Basis - All Fuel(s):

CA Temperature, min.	-20	°F	FG Draft, at Bridgewall	0.50	inH2O	(positive)
CA Temperature, design	60	°F	CA Pressure, at Burner	7.64	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

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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:			**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
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

				Ftnt & Rev
Owner:	Unknown	Heater Ref.:	H-741	
Purchaser:	UOPR	Purch. Ref.:	J463	
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-265	
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	

Process Design Conditions:		**AES Units**					
		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	

THM TULSA HEATERS MIDSTREAM

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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 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

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PRESSURE PARTS DESIGN

Coil Design:		RADIANT	SHIELD	CONVECTION
Service		Heat Medium Hea	Heat Medium Hea	Heat Medium 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	305	305	305
Design Temperature Allowance	°F	29	29	29
Design Corrosion Allowance (tubes/fittings)	in	0.063 / 0.063	0.063 / 0.063	0.063 / 0.063
Maximum Tube Temperature (clean)	°F	440		
Maximum Tube Temperature (fouled)	°F	486	389	582
Design Tube Temperature	°F	515	611	611
Inside Film Coefficient	BTU/ hr ft2 °F	195	141	141
Weld Inspection	RT or Other	100 of 100%	100 of 100%	100 of 100%
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	4.500	4.500	4.500
Tube Wall Thickness (aw / mw)	in	0.237 / 0.207	0.237 / 0.207	0.237 / 0.207
Number of Cells (radiant or convection)	---	1	1	1
Number of Flow Passes (total / cell)	---	2 / 2	2 / 2	2 / 2
Number of Tubes per Row (total / cell)	---		4 / 4	4 / 4
Overall Tube (1 turn in radiant) Length	ft	28.27	11.54	11.54
Effective Tube Length / Helix Diameter	ft	28.27 / 9.00	9.96	9.96
Number of Turns or Tubes (total / pass)		30.7 / 15.3	4.0 / 4.0	0.0 / 0.0
Total Exposed Surface	ft2	1,023	47	0
Number of Ext.Surf. Tubes (total / cell)	---	0 / 0.0	0 / 0.0	20 / 20.0
Total Exposed Surface	ft2	0	0	2,940
Tube Spacing (horiz. / tube centers)	in	--- / 8.00	8.00 / 8.00	8.00 / 8.00
Tube Spacing (horiz. to refractory)	in	6.00	4.00	4.00
Coil Fittings:		Heat Medium Hea	Heat Medium Hea	Heat Medium 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	4.500	4.500	4.500
Fitting Wall Thickness (aw / mw)	in	0.237 / 0.207	0.237 / 0.207	0.237 / 0.207
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	4" NPS / 300#		4" NPS / 300#
Flange Type	RFWN or RTJ	RFWN		RFWN
Location	---	Burner Endwall		Terminal End
Extended Surface:			CONVECTION	CONVECTION
Service	---		Heat Medium Hea	Heat Medium Heater
Fin or Stud Row Number	starting @ bottom		No.1 / No.2-3	No.4-5 /
Ext. Surface Type	seg.fins, solid fins, studs		HF Seg. Fins	HF Seg. Fins
Fin/Stud Material	---		C.S. / C.S.	C.S. /
Fin/Stud Height	in		0.75 / 1.00	1.00 /
Fin/Stud Thickness	in		0.06 / 0.06	0.06 /
Fin/Stud Density	fin/ in		5.00 / 5.00	5.00 /

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#	Item	Units	Radiant	Shield	Convection	
1	PRESSURE PARTS DESIGN (continued)					
2						
3	Crossovers:		RADIANT	SHIELD	CONVECTION	
4	Type, location / connections	---	External	/ Flanged	None	
5	Tube / Fittings Material	ASTM	SA106GrB	/ SA234 WPB		
6	Tube & Fitting OD / Thickness (aw)	in	4.500	/ 0.237		
7						
8	Inlet Manifold(s):	type			Simple LOG	
9	Location	---			Top - Term. End	
10	Design Basis for Manifold Thickness	---			ASME B31.3	
11	Design Conditions (temp./press.)	°F/ psig			611 / 150	
12	Pipe Material	ASTM			SA106GrB	
13	Fittings Material	ASTM			SA234 WPB	
14	Flange Material / Style	ASTM			SA105 / RFWN	
15	Outside Diameters, each Branch	in			8" NPS	
16	Wall Thickness(es); aw ~~or mw~~	in			SCH40 (0.322)	
17	End Types (terminal/ dead)	beveled or flanged			Flanged / W.Cap	
18	Manifold Terminal Type	NPS/ ASME			8" NPS / 300# Flg	
19	Coil Connection Type	extrusion, olet, etc.			Weld-O-Let	
20	Coil Terminal Type	NPS/ ASME			4" NPS / 300# Flg	
21						
22	Outlet Manifold(s):	type	Simple LOG			
23	Location	---	Burner Endwall			
24	Design Basis for Manifold Thickness	---	ASME B31.3			
25	Design Conditions (temp./press.)	°F/ psig	515 / 150			
26	Pipe Material	ASTM	SA106GrB			
27	Fittings Material	ASTM	SA234 WPB			
28	Flange Material / Style	ASTM	SA105 / RFWN			
29	Outside Diameters, each Branch	in	8" NPS			
30	Wall Thickness(es); aw ~~or mw~~	in	SCH40 (0.322)			
31	End Types (terminal/ dead)	beveled or flanged	Flanged / W.Cap			
32	Manifold Terminal Type	NPS/ ASME	8" NPS / 300# Flg			
33	Coil Connection Type	extrusion, olet, etc.	Weld-O-Let			
34	Coil Terminal Type	NPS/ ASME	4" NPS / 300# Flg			
35						

#	Item	Units	Radiant	Shield	Convection	
36						
37	COIL & MANIFOLD SUPPORTS DESIGN					
38						
39	Tube Supports:		RADIANT	SHIELD	CONVECTION	
40	Service		Heat Medium Hea	Heat Medium Hea	Heat Medium Heater	
41	Location	Top, Bottom, Ends	Bottom	Ends	Ends	
42	Support Type	casting, tubesht, spring, etc.	SS Pipe Rail	Welded Tbsheets	Welded Tbsheets	
43	Support Thicknesses	in	SCH40	0.375	0.375	
44	Support Materials	ASTM	A240 T304	A36 CS	A36 CS	
45	Support Temperatures (calc./ design)	°F / °F	840 / 1,030	536 / 690	536 / 690	
46	TbSht Ferrules Thickness/Materials	in/ ASTM	--- / ---	14 ga. / 304 SS	14 ga. / 304 SS	
47	Refractory & Anchor Materials & Types		none	per refrac. section	per refrac. section	
48						
49	Intermediate Guides & Supports:		None	None	None	
50	Location	---				
51	Guide/ Support Type	casting, spring, etc.				
52	Material	ASTM				
53	Spacing, average	ft				
54						
55	Tube Guides:	Top, Bottom, Ends	None	None	None	
56	Material	ASTM				
57						
58	Manifold Supports:		Outlet Manifold		Intlet Manifold	
59	Material	ASTM	A36		N/A	
60	Materials Design & Supply	---	by THM			
61	Location	Top, Bottom, Ends	Burner Endwall			
62	Support Type	roller, shoe, spring, etc.	Simple Shelf			
63	Number of Supports	---	One (1)			
64						

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CASING / REFRACTORY SYSTEMS DESIGN

Radiant Section Design:		BURNER ENDWALL		SHIELDED SIDEWALLS	ARCH ENDWALL
Total Refractory Thickness	in	5.0		3.0	5.0
Hot Face Temperature (design)	°F	2,000		2,000	2,000
Hot Face Temperaure (calculated)	°F	1,452		840	1,452
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		2/ 6# CF Blanket	1/ 8# CF Blanket
Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 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		0.1345 / 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	960	960	960	650
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	0.1345 / A36	0.1345 / 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:			15° TRANSITION	DISCH. DUCT	
Quantity			One	One	
Type / Location	- - -		Full L / Conv	Self.Spt / Grade	
Length / Metal Outside Diameter (top)	ft/ ft		1.41 / n/ a	7 / 2.333	
Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 24	
Total Refractory Thickness	in		0.0	0.0	
Hot Face Temperature (design)	°F				
Hot Face Temperaure (calculated)	°F		468	468	
Hot Face Layer	in/ - - -		None	None	
Back-Up Layer No.1	in/ - - -				
Castable Reinforcement (SS Needles)					
Anchors / Tie Backs:	- - -				
Material	- - -				
Attachment	- - -				
Casing:					
Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36	
Corrosion Allowance	in		None	None	
Internal Coating	- - -		None	None	
External Temperature, Typical	°F		468	468	
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						

				Ftnt & Rev
Owner:	Unknown	Owner Ref.:	H-781	
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

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TULSA HEATERS MIDSTREAM LLC

project reference: American Engineering Standard (AES) Units

COIL UNDER INTERNAL PRESSURE — **FLUXED HEATER COIL**

ASME SECTION VIII - DIVISION 1 CALCS — **MJ17-266-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:

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	**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

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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

www.tulsaheatersmidstream.com u TULSA HEATERS MIDSTREAM LLC u 1215 S. Boulder Ste 1040 u Tulsa, OK 74119 u www.tulsaheatersmidstream.com u (918) 392 -8000(vce) u info@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 @	

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

THM TULSA HEATERS MIDSTREAM

BURNER DATA SHEET
AES SYSTEMS of UNITS

SHO = Superior Quality, Flexibility, Dependability & Modularity

MJ17-266-BRNRds-Rev. 1

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

	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

				Ftnt & Rev
Owner:	Unknown	Heater Ref.:	H-781	
Purchaser:	UOPR	Purch. Ref.:	J463	
Heater Mfgr:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	
Location:	Unknown	FDF OEM Ref.:	340829	
FD Fan OEM:	**Chicago Blower**	FDF Item No.:	BL-781	

General Application:

			Ftnt
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.**	Ftnt
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**	Ftnt
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

FD FAN DATA SHEET

AES & cgs or SI SYSTEMS of UNITS

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

MJ17-266-FDFANds-Rev. 1

Datasheet 111-9
12/23/2014

Eclipse Winnox

Burners

Model WX0850

Version 2

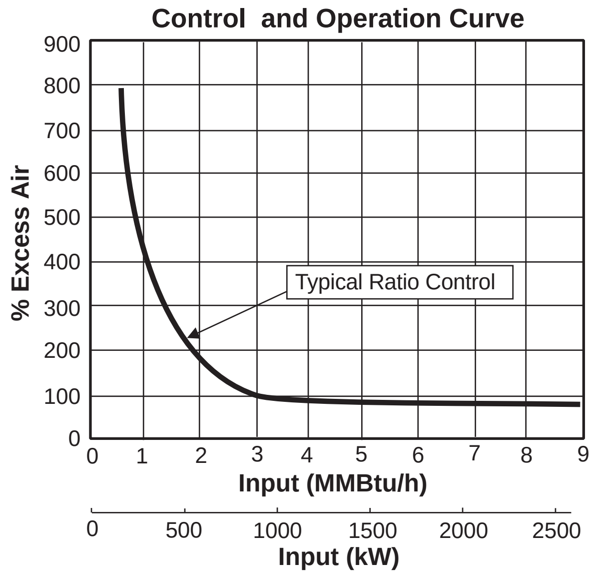
Parameter		Specifications	
Blower Type		**Packaged Blower**	**Remote Blower**
Maximum Input, Btu/h (kW)[1]	Chamber Pressure "w.c. (mbar)	Nominal (60Hz)	Pressure at Air Inlet 1.5 psig (100 mbar)
For chamber pressures outside the given range or for varying chamber pressure conditions, contact Eclipse, 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)	Natural Gas	500,000 (146)	500,000 (146)
For lower inputs, contact Eclipse, Inc.	Propane, Butane	600,000 (175)	600,000 (175)
Main Gas Inlet Pressure, "w.c. (mbar)[2]	Maximum	82 (207)	110 (273)
Fuel pressure at ratio regulator inlet	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		РСТ АИ30	

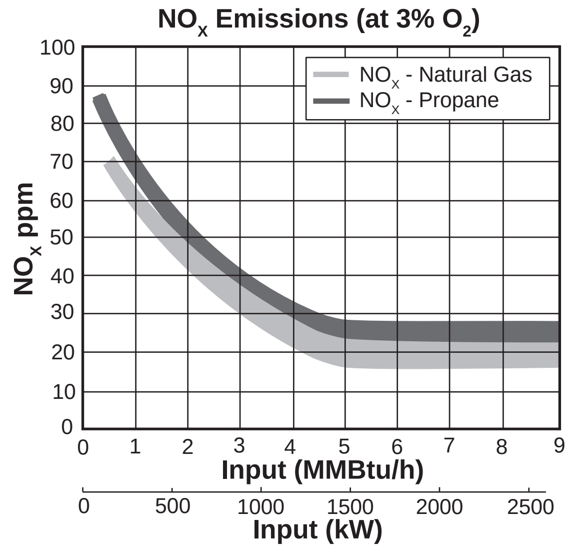
[1] Maximum inputs for packaged blower versions are given for the standard combustion air blower without an inlet air filter.
[2] For proper performance, this pressure must be kept constant across the burner operating range.
[3] See page 3 of this datasheet and the "Refractory Plug" section of Installation 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.

ECLIPSE®
Innovative Thermal Solutions

Performance Graphs





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.

Fuel/Input Measurement

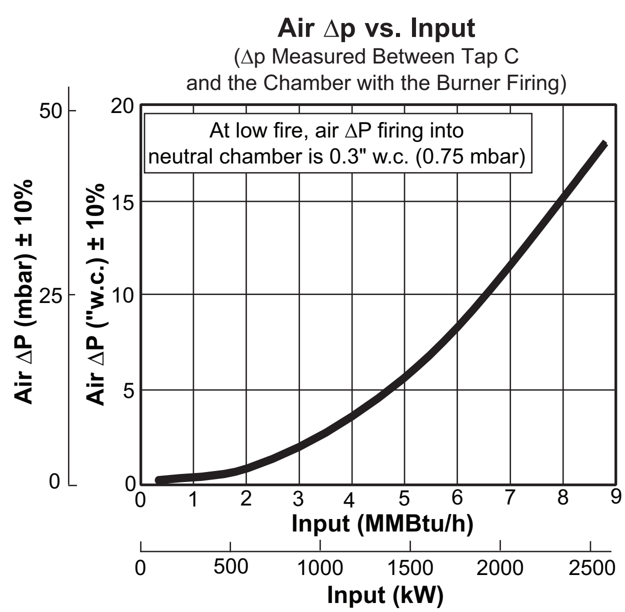
System design must include fuel flow measurement upstream of the burner. Eclipse recommends its 12-5 FOM (Fuel Orifice Meter) assembly number 302050-5 for natural gas. See Bulletin 930 for details.

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.



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. **<u>TORQUE REQUIREMENTS</u>**

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. **<u>PAINTING SPECIFICATION:</u>**

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. **<u>SPECIFICATION FOR PIPING AND FITTINGS:</u>**

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		

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

TULSA HEATERS MIDSTREAM

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 Heater	Regen Gas Heater		
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

Owner Ref.: H-741 THM Ref.: MJ17-265

Ftnt & Rev

PRESSURE PARTS DESIGN

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)

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 Heater	Regen Gas Heater	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

#		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**

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:

	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

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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)	**Flame Dimensions:**		ft / (in)
Casing Width / Height, Casing	face - face	8.00 / (96)	Burner CL elev., approx.	AG	4.50 / (54)
Casing Length, Casing to Casing	face - face	10.00 / (120)	Flame Length, calc.	@ design HR	10.9 / (131)
Helical Coil CenterLine Diameter	CL - CL	6.50 / (78)	Flame Dia., calc.	@ design HR	2.50 / (30)
Helical Coil Inside Diameter	face - face	6.13 / (74)			
Serpentine Coil CtrLine Dimensions	W / H		**Actual Clearances**		ft / (in)
Serpentine Coil Inside Dimensions	face - face		Burner - tube (tangential)	CL / Net	3.25 / (39)
Firebox Length, Refractory Faces	face - face	9.17 / (110)			

Combustion Air (CA) Basis - All Fuel(s):

CA Temperature, min.	-20	°F	FG Draft, at Bridgewall	0.50	inH2O	(positive)
CA Temperature, design	60	°F	CA Pressure, at Burner	7.64	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 @	

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THM TULSA HEATERS MIDSTREAM

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BURNER DATA SHEET

AES SYSTEMS of UNITS

MJ17-265-BRNRds-Rev. 1

GASEOUS FUEL(S) & PRODUCTS OF COMBUSTION

Ftnt & Rev

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:			**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

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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

	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

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	
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			

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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
Purchaser:	UOPR	Purchaser Ref.:	J463	&
Manufacturer:	Tulsa Heaters Midstream, LLC	THM Ref.:	MJ17-266	Rev
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 Heat	Heat Medium Heat		
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		

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

FIRED HEATER DATA SHEET

AMERICAN ENGINEERING SYSTEM of UNITS

MJ17-266-HTRds- Rev. 1

Owner Ref.: H-781 THM Ref.: MJ17-266

Ftnt & Rev

COMBUSTION DESIGN CONDITIONS

#	Overall Performance:	Units				
3	Overall Performance:					
4	Operating Case	- - -	Over-Design Case	Design Case		
5	Service	- - -	Heat Medium Heat	Heat Medium Heat		
6	Excess Air	mol%	15.0%	15.0%		
7	Calculated Heat Release (LHV)	MMBTU/ hr	20.28	18.22		
8	Guaranteed Efficiency	HR%	84.5%	85.6%		
9	Calculated Efficiency	HR%	86.5%	87.6%		
10	Radiation Loss	HR%	3.00%	3.00%		
11	Flow Rate, Combustion Gen./ Imp.	Lb/ hr	19,739	17,736		
12	Flue Gas Temp. Leaving (R/C)	°F	1,452 / 468	1,402 / 429		
13	Flue Gas Mass Velocity	Lb/ sec ft2	0.472	0.424		

#	Fuel(s) Data:	Units	Gas 1			
16			Mol.Wt.			
17	LHV	BTU/ scf	976			
18	LHV	BTU/ Lb	20,426			
19	P @ Burner	psig	75			
20	T @ Burner	°F	100			
21	MW	Lb/ Lbmole	18.13			
22	m @ ??? °F	cp	- - -			
23	m @ ??? °F	cp	- - -			
24	Atomizing Media		- - -			
25	Atom. Media P & T		- - -			
27	Components:					
28	N	wt%	- - -			
29	S	wt%	- - -			
30	Ash	wt%	- - -			
31	Ni	ppm	- - -			
32	Va	ppm	- - -			
33	Na	ppm	- - -			
34	Fe	ppm	- - -			
36	H2	mol%	0.0%			
37	O2	mol%	0.0%			
38	N2 + Ar	mol%	1.0%			
39	CO	mol%	0.0%			
40	CO2	mol%	1.0%			
41	CH4	mol%	88.0%			
42	C2H6	mol%	8.0%			
43	C2H4	mol%	0.0%			
44	C3H8	mol%	2.0%			
45	C3H6	mol%	0.0%			
46	C4H10	mol%	0.0%			
47	C4H8	mol%	0.0%			
48	C5H12	mol%	0.0%			
49	C5H10	mol%	0.0%			
50	C6+	mol%	0.0%			
51	H2S	ppmv	0.0%			
52	SO2	mol%	0.0%			
53	NH3	mol%	0.0%			
54	H2O	mol%	0.0%			
55	spare	mol%	0.0%			

#	Blower/Fan Peformance:	Units	
59	Volumetric Flow	acfm	4,300
60	Rated Power	HP	15
61	Fan Speed	RPM	3,600
62	Sound Pressure	dBA	< 85
63	Area Classification	NEC	Unclassified

#	Burner Design:			
16	OEM	- - -	Callidus Technologies, LLC	
17	Type	- - -	Enhanced IFGR	ULTRA Low NOx
18	Quantities	- - -	1	Burner
19	Model No.	- - -	CUBL-5W	Cylindrical
20	Windbox	- - -	yes ...	
21	Location	- - -	EndWall Center ...	Horizontally Fired
22	Pilot Design:			
23	Type / Model		Self-Inspirating /	by O.E.M.
24	Ignition	- - -	Electric	requires elec.ign.system
25	Heat Release	- - -	> 90000 BTU/ hr on ...	Gas 1

#	Burner Performance:	Units	
28	Minimum Heat Release	MMBTU/ hr	4.46
29	Design Heat Release	MMBTU/ hr	20.28
30	Maximum Heat Release	MMBTU/ hr	22.30
31	Burner Turndown	Max:Min	5.00
32	Volumetric Ht. Release	BTU/ hr ft3	10,034
33	Pressure @ Arch	inH2O	0.60
34	Pressure @ Burner	inH2O	7.75
35	Combustion Air T @ Burner	°F	60
36	Flue Gas T @ Burner	°F	1,260

#	Guaranteed Emissions:	Units		
39	Basis of Guarantee	- - -	3.0% O2,	dry (LHV)
40	NOx Emissions	Lb/MMBTU	0.053	40 ppm
41	SOx Emissions	Lb/MMBTU	no quote	
42	CO Emissions	Lb/MMBTU	0.041	50 ppm
43	VOC Emissions	Lb/MMBTU	0.019	15 ppm
44	UHC Emissions	Lb/MMBTU	0.007	15 ppm
45	SPM10 Emissions	Lb/MMBTU	0.014	16 ppm
46	Noise Emissions	dBA @ 3ft	85	

#	Net Flame Clearances:	
49	Est. Flame Size	approx. 19.7 ft L x 3.5 ft Diameter
50	Hor Clearance	1 ft NET Tube Clearance
51	Vert. Clearance	1 ft NET Tube Clearance
52	Axial Clearance	1.45 ft NET Refractory Clearance (to Arch hot face)

#	Nominal Flame Clearances: from burner CL ...		Vertical	Horizontal
56	to Tube CL, API	ft	10.61	7.08
57	to Tube CL, calc.	ft	4.50	4.50
58	to Refrac., calc.	ft	n / a	21.17

Line	Item	Unit	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 /	
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 /	0.237		
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 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)			

CASING / REFRACTORY SYSTEMS DESIGN

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		BURNER		SHIELDED	ARCH	
Radiant Section Design:		ENDWALL		SIDEWALLS	ENDWALL	
Total Refractory Thickness	in	5.0		3.0	5.0	
Hot Face Temperature (design)	°F	2,000		2,000	2,000	
Hot Face Temperaure (calculated)	°F	1,452		840	1,452	
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		2/ 6# CF Blanket	1/ 8# CF Blanket	
Back-Up Layer No.2	in/ - - -	3/ 6# CF Blanket		None	3/ 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		0.1345 / 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	960	960	960	650	
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	0.1345 / A36	0.1345 / 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:			15° TRANSITION	DISCH. DUCT		
Quantity			One	One		
Type / Location	- - -		Full L / Conv	Self.Spt / Grade		
Length / Metal Outside Diameter (top)	ft/ ft		1.41 / n/ a	7 / 2.333		
Discharge Elev., minimum/ calculated	ft/ ft		n/ a / n/ a	20 / 24		
Total Refractory Thickness	in		0.0	0.0		
Hot Face Temperature (design)	°F					
Hot Face Temperaure (calculated)	°F		468	468		
Hot Face Layer	in/ - - -		None	None		
Back-Up Layer No.1	in/ - - -					
Castable Reinforcement (SS Needles)						
Anchors / Tie Backs:	- - -					
Material	- - -					
Attachment	- - -					
Casing:						
Minimum Thickness/ Material	in/ ASTM		0.1345 / A36	0.1345 / A36		
Corrosion Allowance	in		None	None		
Internal Coating	- - -		None	None		
External Temperature, Typical	°F		468	468		
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:

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

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:

t.s =

UG-27(c) (1)	or	UG-27(c) (2)	or	Appendix 1, 1-1(1)
$\frac{(P \times Ri)}{(S \times JE - 0.6 \times P)}$		$\frac{(P \times Ri)}{(2 \times S \times JE + 0.4 \times P)}$		$\frac{(P \times Ro)}{(S \times JE + 0.4 \times P)}$
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 @		

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

TULSA HEATERS MIDSTREAM

SHO = Superior Quality, Flexibility, Dependability & Modularity

BURNER DATA SHEET

AES SYSTEMS of UNITS

MJ17-266-BRNRds-Rev. 1

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:			**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-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**

	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	

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			

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

THM TULSA HEATERS MIDSTREAM

USA Applications

SHO = Superior Quality, Flexibility, Dependability & Modularity

FD FAN DATA SHEET

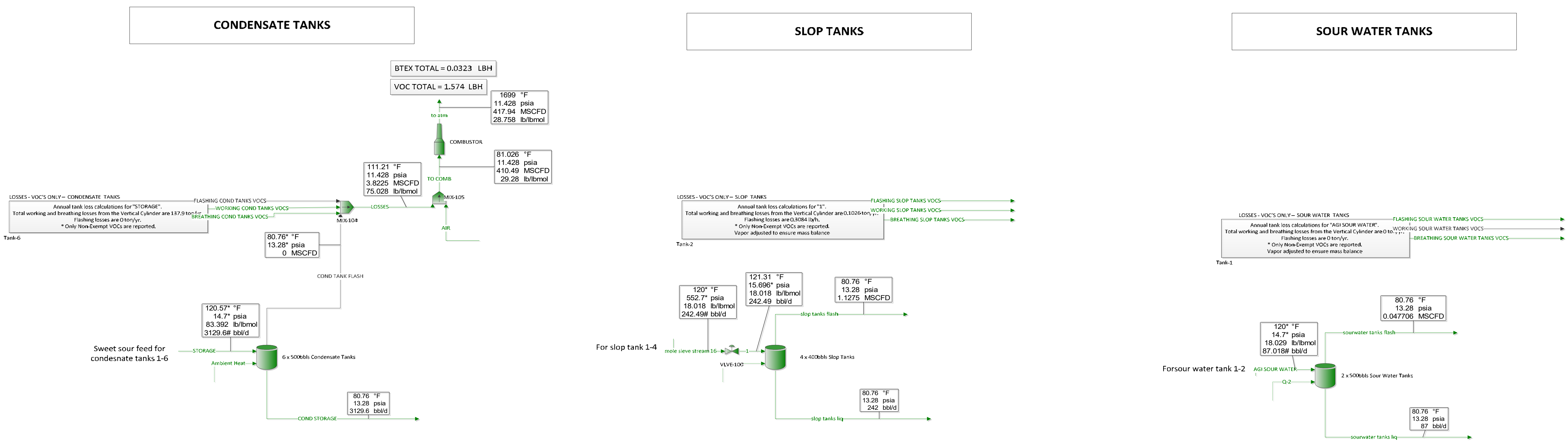
AES & cgs or SI SYSTEMS of UNITS

MJ17-266-FDFANds-Rev. 1

ProMax Flowsheet

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



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% Al2O3 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^{o}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

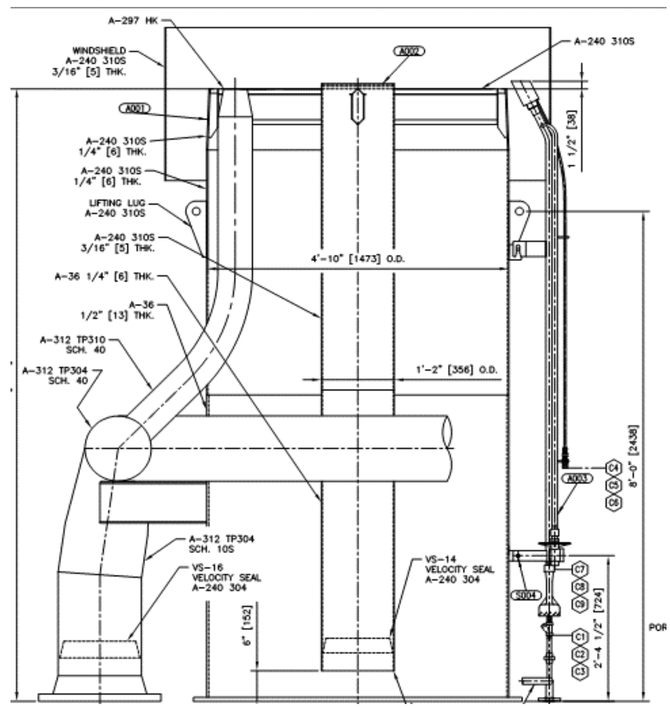
Client:	Lucid Midstream	Zeeco Ref.:	2019-03373FL-01	Date:	21-May-19
Location:	Jal, NM	Client Ref.:	"Red Hills V"	Rev.	0

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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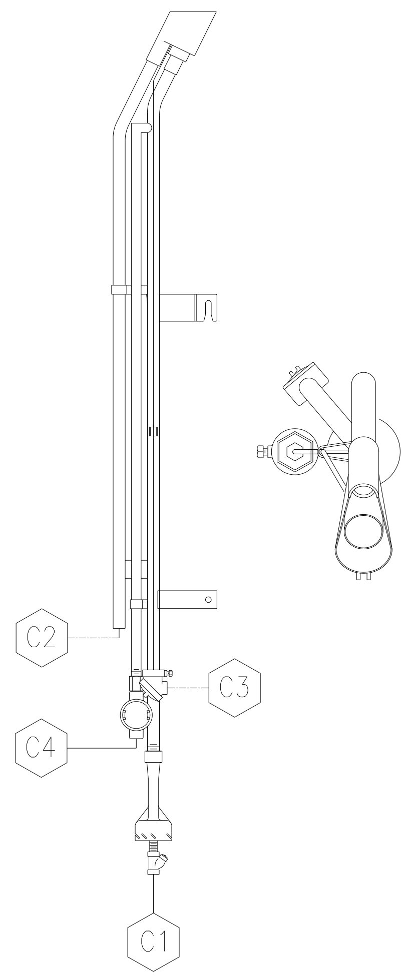
Pre-Mix Flare Pilot Assembly Specification Sheet

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

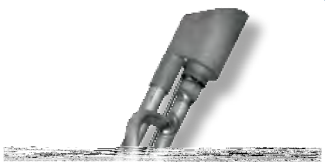
Construction:	
Pilot Firing Tip:	HK
Windshield Assembly:	HK
Integral Thermowell:	HK
Mounting Brackets:	HK
Premix Fuel Line:	310 SS
Thermocouple Sheath:	310 SS
Thermocouple Head:	316 SS
Fuel Mixer / Spud Assembly:	CF-3M / 18-8
Fuel Strainer Assembly:	CF-8M
HEI Probe and Support:	310 SS
HEI Junction Head:	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).

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.

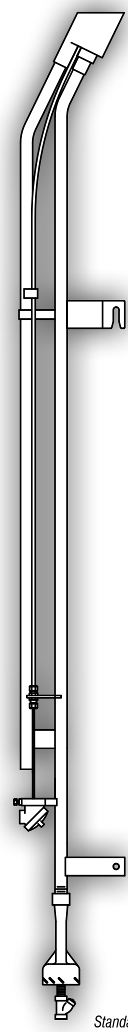
HSLF Flare Pilot



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.

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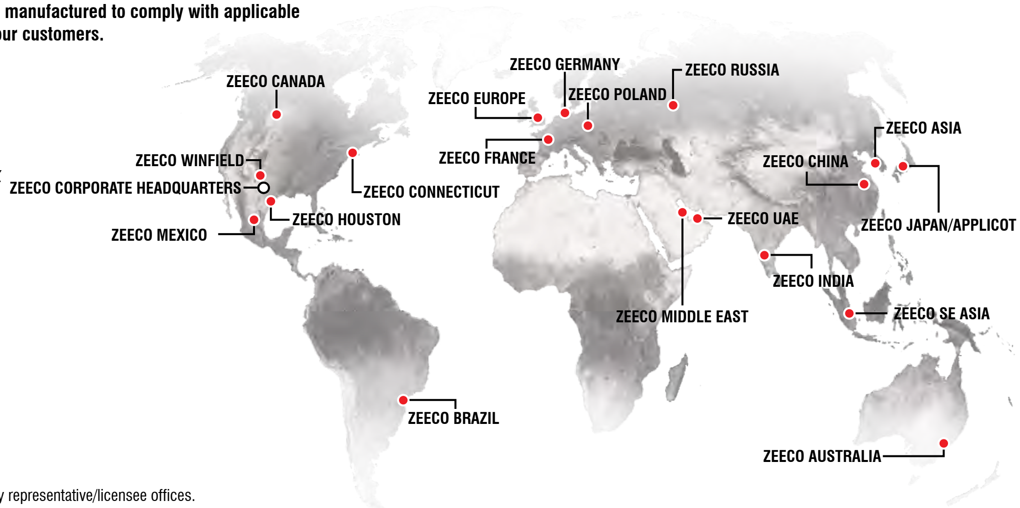
CERTIFICATION APPLIES TO ZEECO HEADQUARTERS ONLY.



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Zeeco.com

Self-supported Flare Stack Specification Sheet

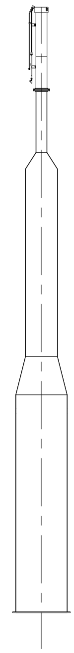
Client:	Lucid Midstream	Zeeco Ref.:	2019-03373FL-01	Date:	21-May-19
Location:	Jal, NM	Client Ref.:	"Red Hills V"	Rev.:	0

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.

OPD –F-1001- Lucid Energy PLA-30

JOHN ZINK HAMWORTHY COMBUSTION
www.johnzinkhamworthy.com

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.)

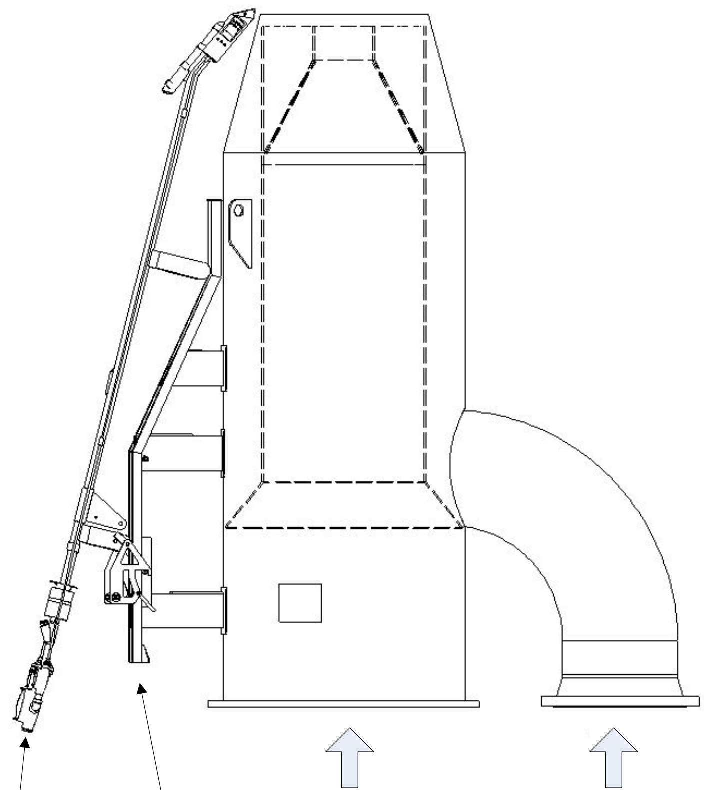
HEIGHT	*10' - 0"*
WEIGHT	*2,800 LBS*

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

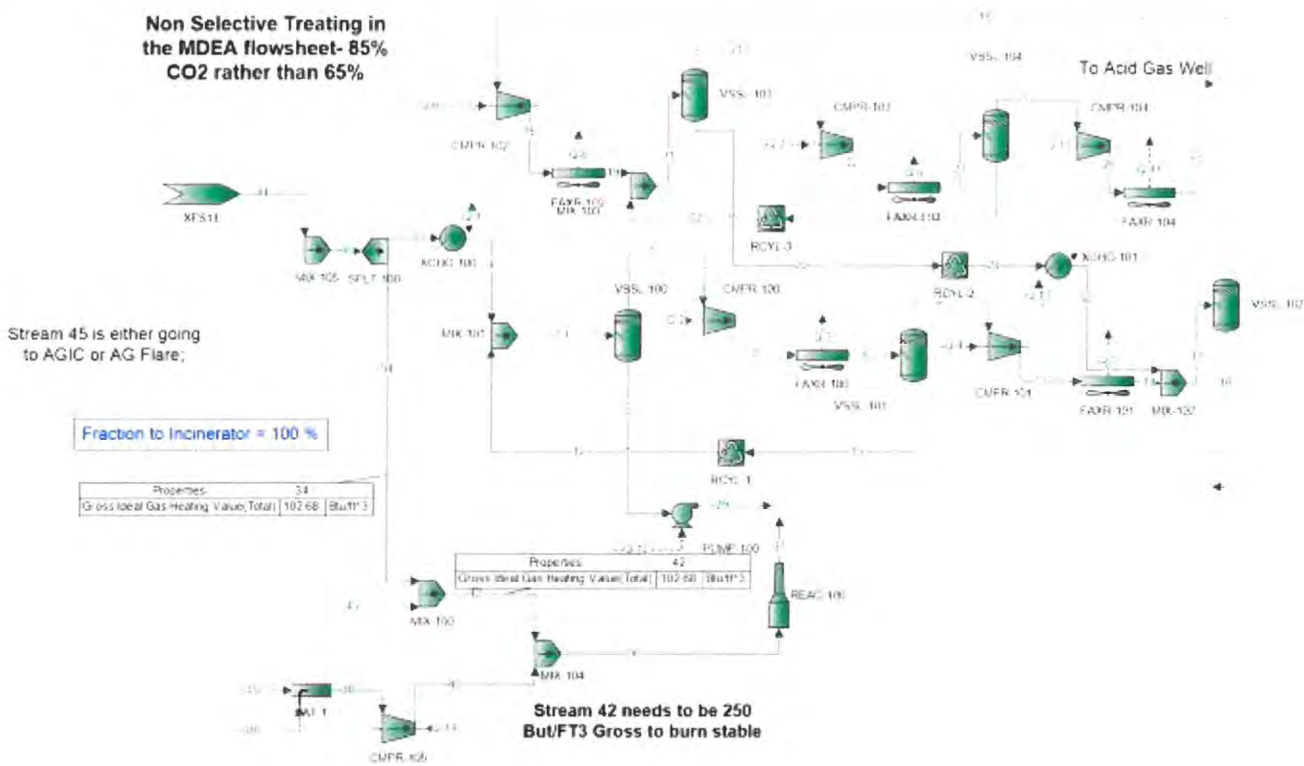
- Our senior staff individually have over 45 years of experience in flare design.

We look forward with enthusiasm to developing this project. Please let us know how we can assist you in moving to the next step.

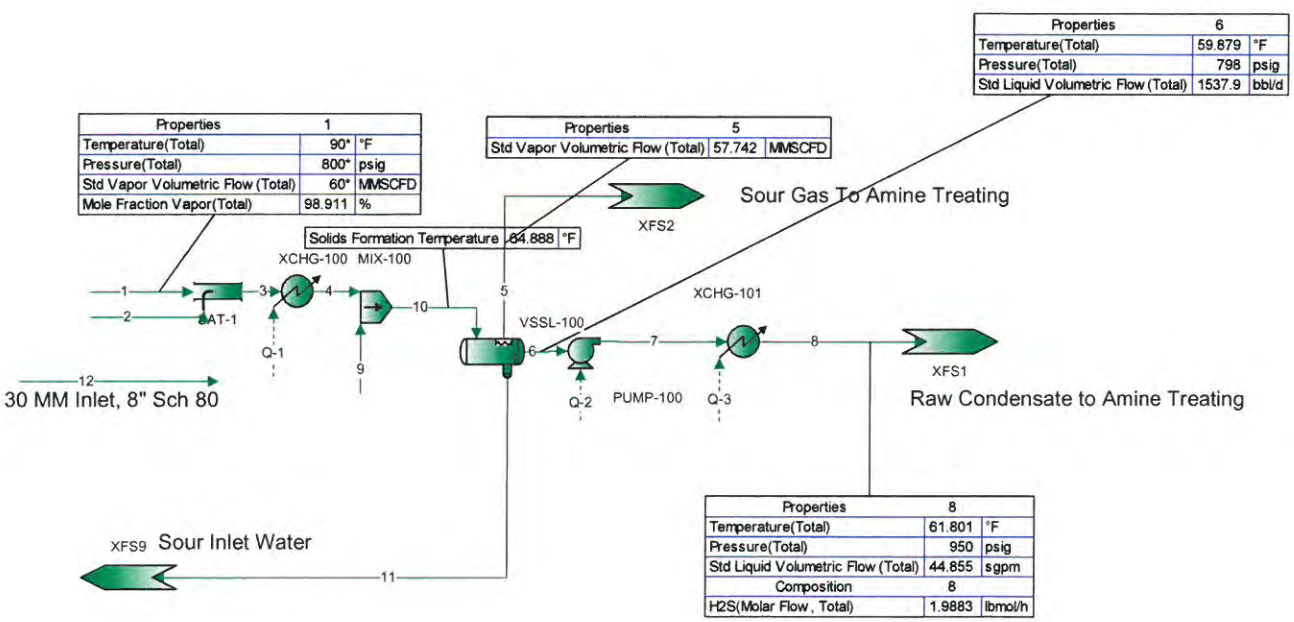
Best regards,

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

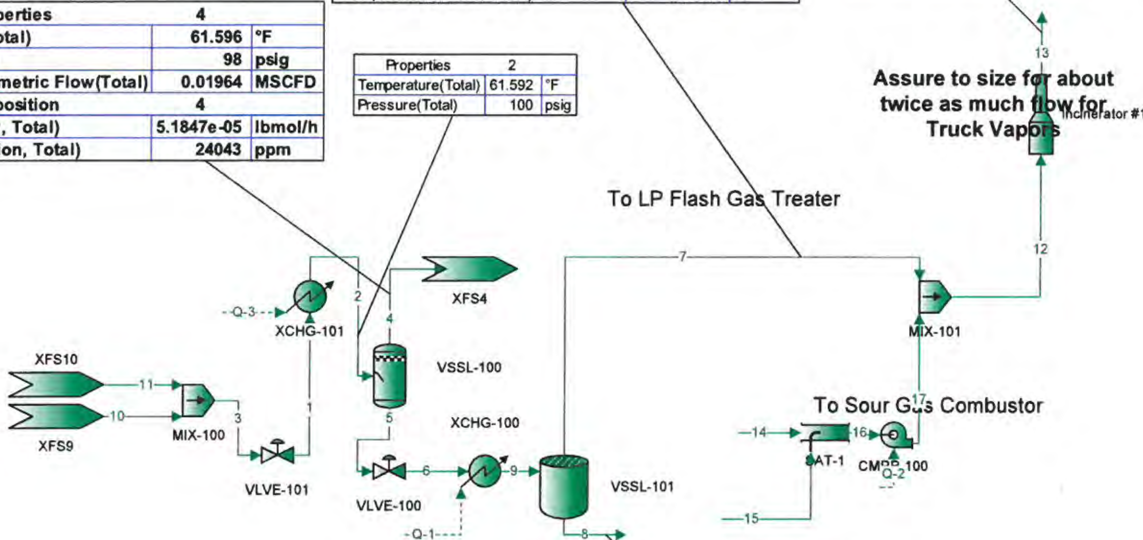
Properties	7	
Std Vapor Volumetric Flow(Total)	0.010215	MSCFD
Gross Ideal Gas Heating Value(Total)	444.37	Btu/ft^3
Composition	7	
H2S(Molar Flow, Total)	0.00017746	lbmol/h
H2S(Mole Fraction, Total)	1.5822e+05	ppm
H2S(Mole Fraction, Total)	15.822	%

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

Assure to size for about twice as much flow for Truck Vapors



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 SECTOR	ROUGHNESS LENGTH	1-HR CONC (ug/m3)	DIST (m)	TEMPORAL 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

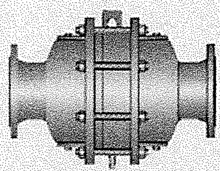
Minimum Invoice:

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.

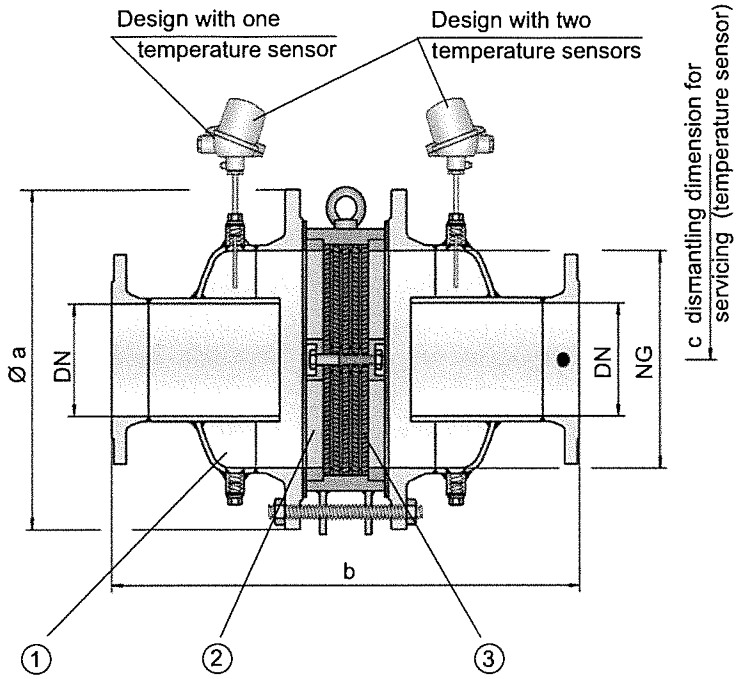
Protego



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

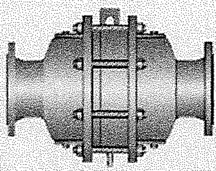
Table 2: Selection of the explosion group			
MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	
< 0,50 mm	IIC	B	

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	
Housing Heating jacket (DA-SB-(T)-H-...)	Steel Steel	Stainless Steel Stainless Steel	Hastelloy Stainless Steel	The housing is also available in Steel with ECTFE coating.
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

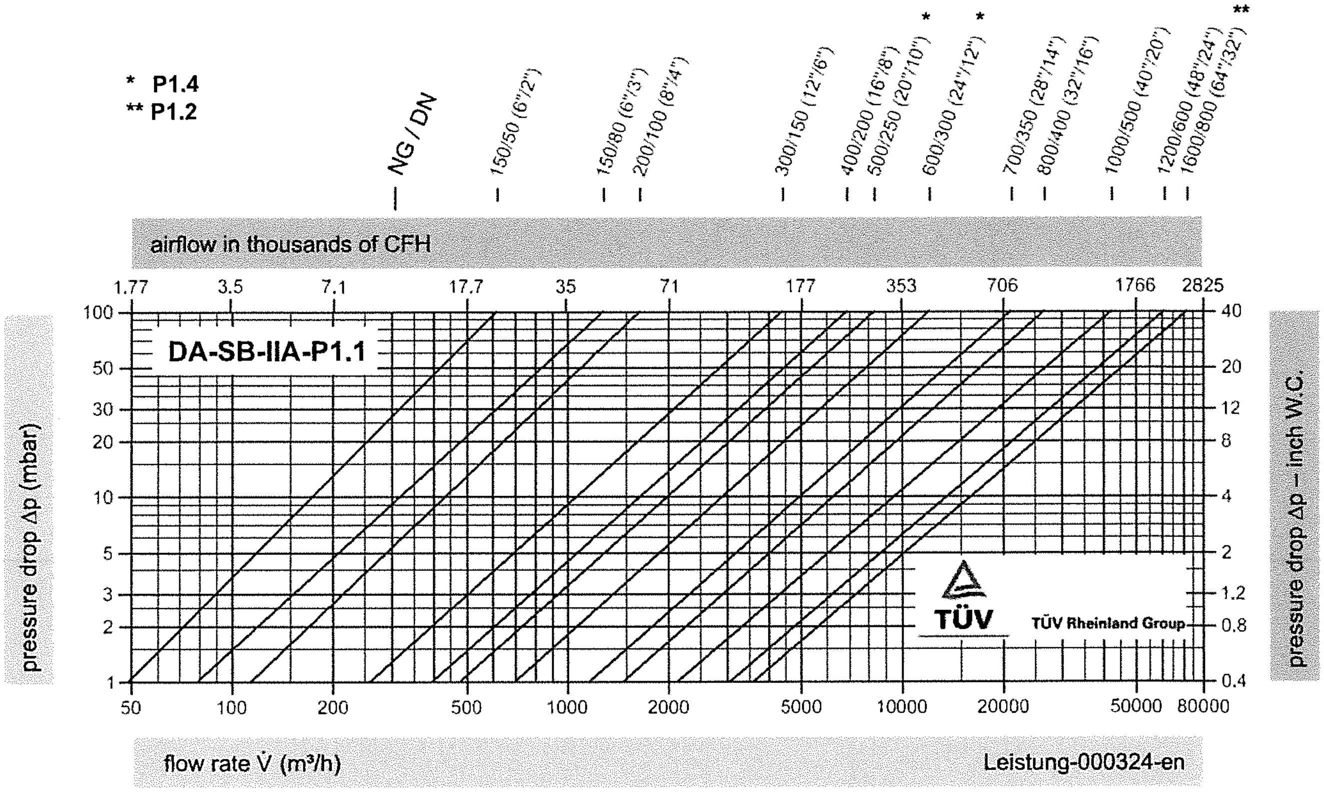
Design	A	B	C	D	
FLAMEFILTER® cage	Steel	Stainless Steel	Stainless Steel	Hastelloy	*the FLAMEFILTER® are also available in the materials Tantalum, Inconel, Copper, etc. when the listed housing and cage materials are used.
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	

Special materials upon request

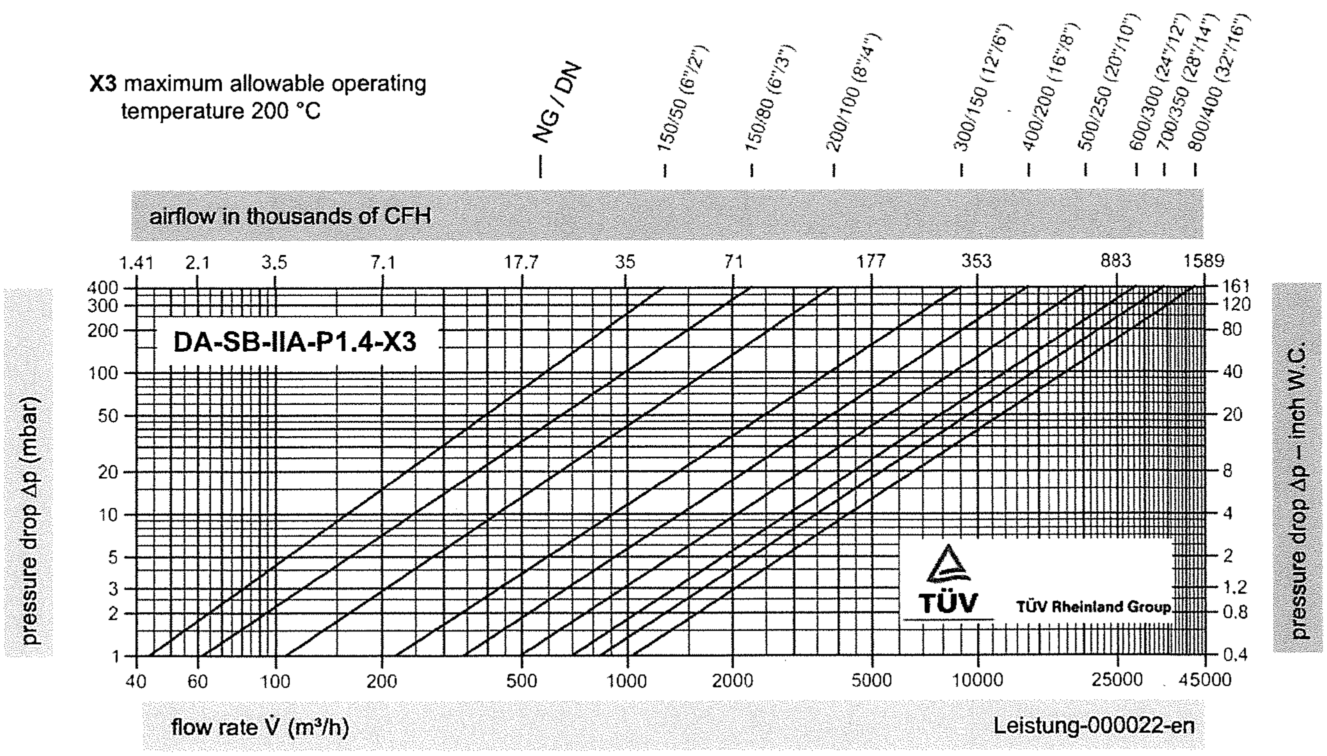
Table 7: Flange connection type

EN 1092-1; Form B1	other types upon request
ASME B16.5; 150 lbs RFSF	

* **P1.4**
** **P1.2**

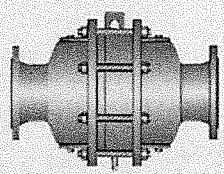


X3 maximum allowable operating temperature 200 °C



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".

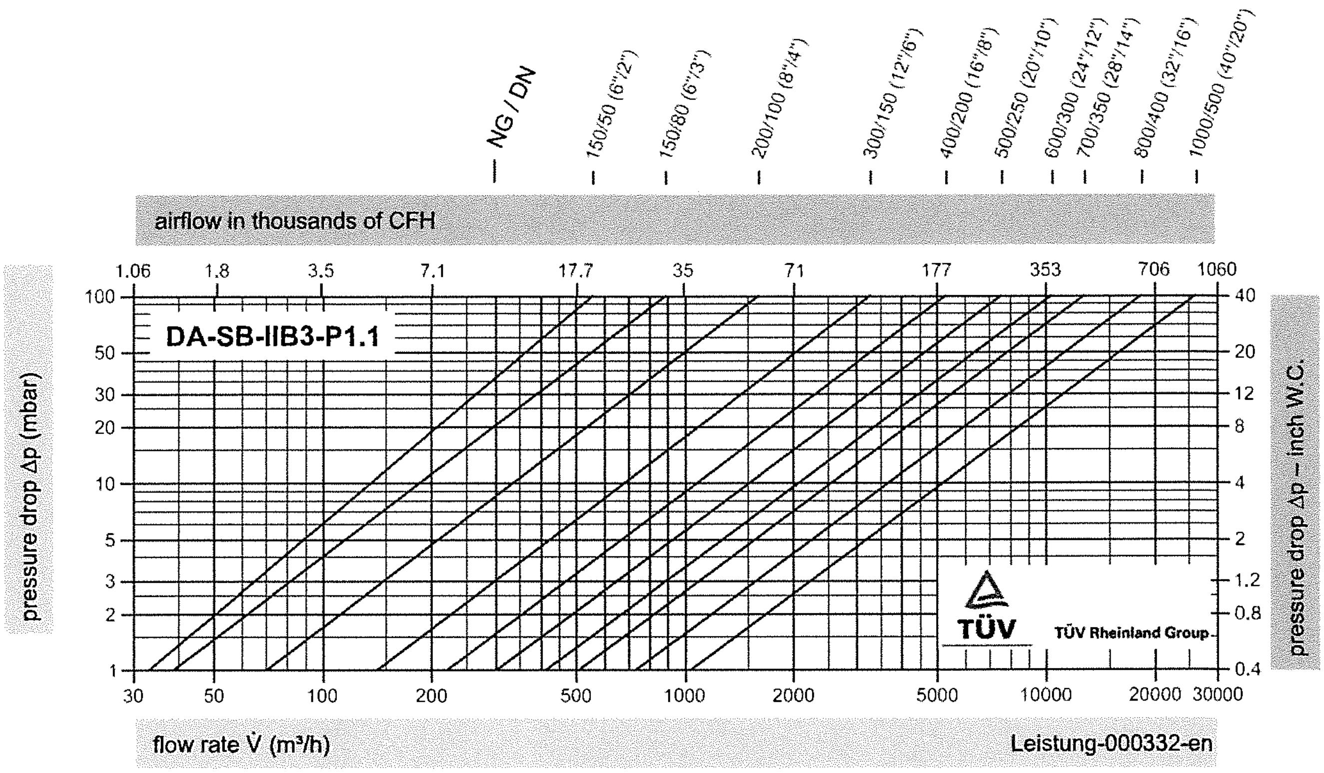
PROTEGO

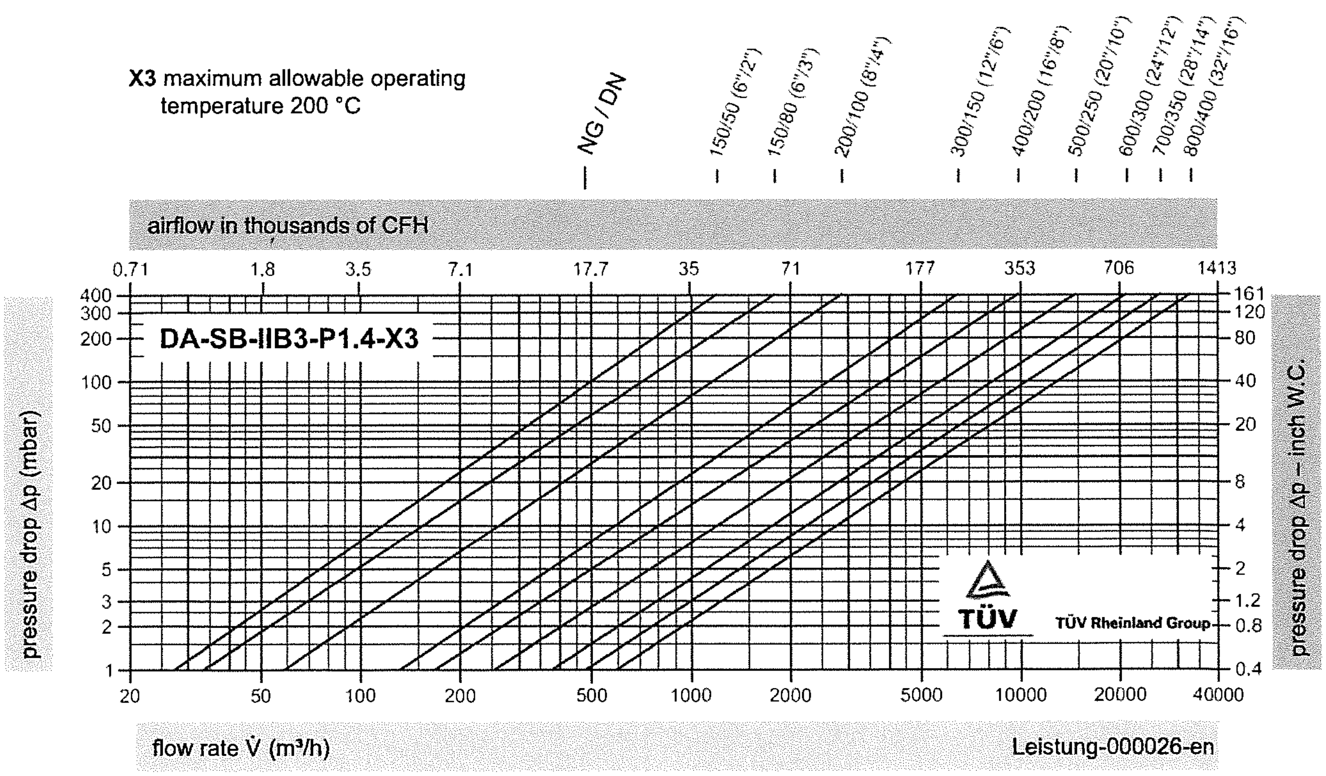


In-Line Detonation Flame Arrester

Flow Capacity Charts

PROTEGO® DA-SB





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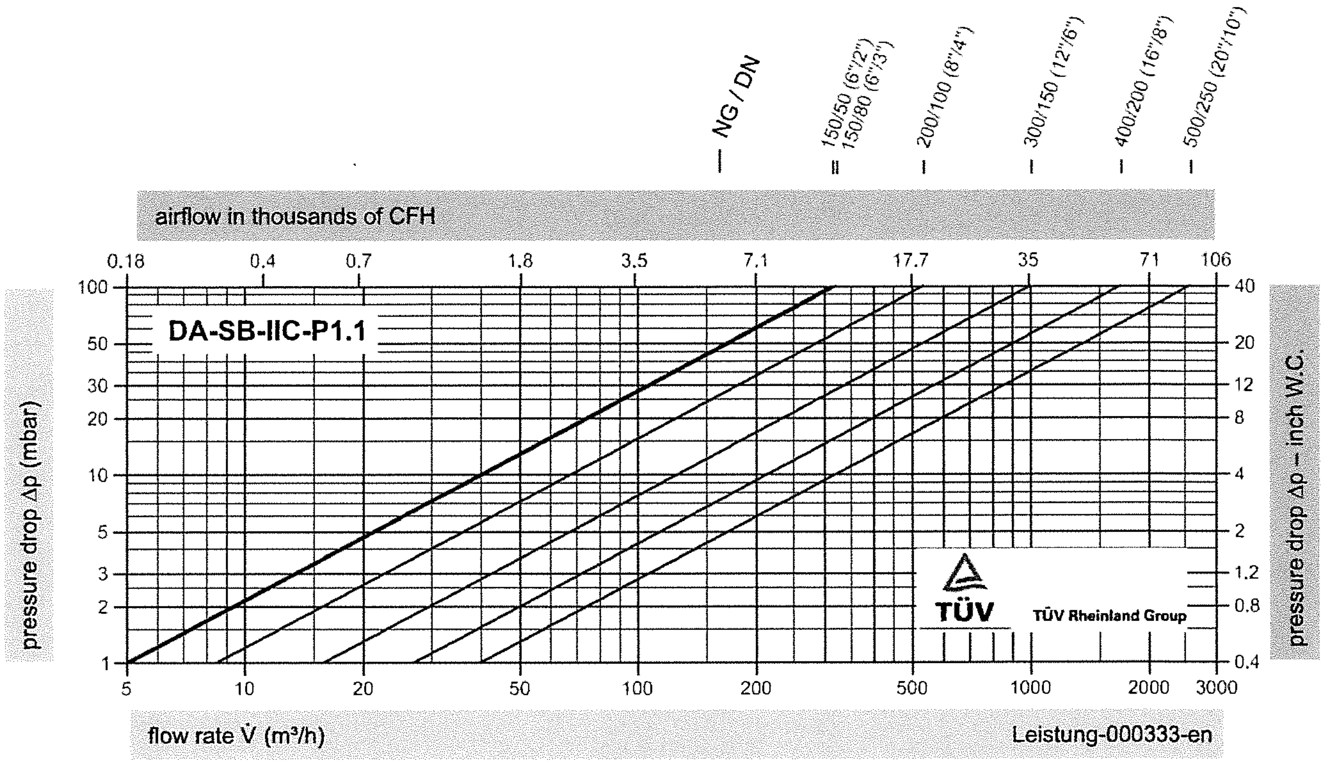
Conversion to other densities and temperatures refer to Vol. 1: "Technical Fundamentals".


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

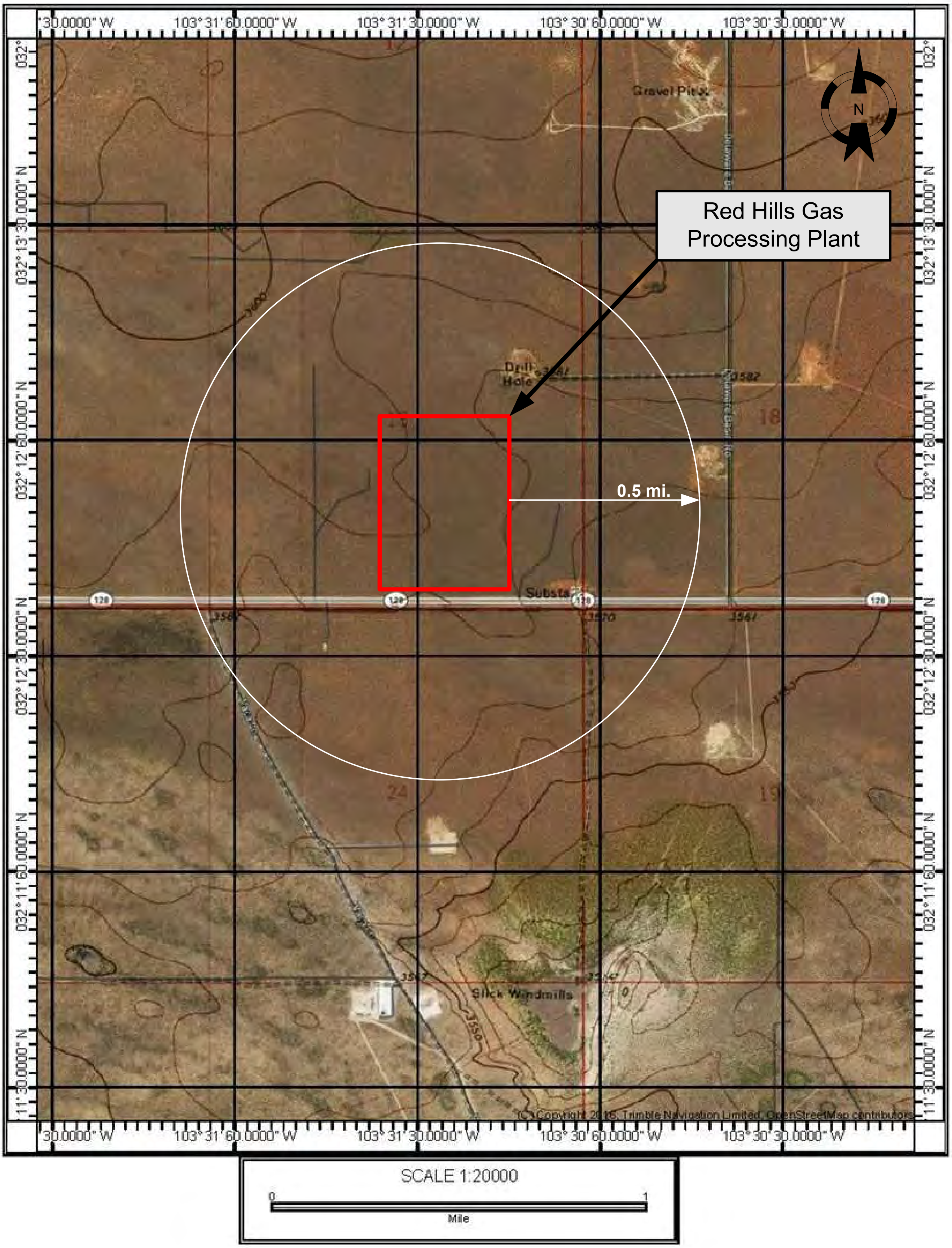
Section 8

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	

An area map is attached.



ALLIANT ENVIRONMENTAL, LLC		Area Map	Lucid Energy Delaware, LLC		
Scale: 1:20,000	Drawn by: MDF Chk'd by:	Date: 10/29/2021 Date:	**Red Hills Gas Processing Plant** N 32° 12' 38" Latitude W 103° 31' 26" Longitude	Project No.: 097-013	File Name: **Red Hills Area Map**	Figure: Section 8

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 it is a being submitted under 20.2.70 NMAC, for Title V permits. Public notice was last completed for the NSR permit revision application in July 2019.

Section 10

Written Description of the Routine Operations of the Facility

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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 operation of the Red Hills Gas Processing Plant is intended to process 75 MMSCFD of gas in Train 1, 40 MMSCFD in Train 1.5, 200 MMSCFD in Train 2, 200 MMSCFD in Train 3, 200 MMSCFD in Train 4 and 247.5 MMSCFD in Train 5 and 6 each. The facility total will be 1210 MMSCFD. Plant 2.5 will not increase total capacity of the site. The gas will be treated to remove acid gases (H_2S and SO_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)**:**
See the Section 2 Tables for a list of all equipment included in this application.

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 permit application be submitted under 20.2.70 NMAC. A PSD applicability determination was completed in the July 2019 NSR application.

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 REGU-LATIONS 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.
20.2.61.109 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 P-278.

STATE REGU-LATIONS 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.)
20.2.71 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 I 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.
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.

Table for FEDERAL REGULATIONS:

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
40 CFR 50	NAAQS	Yes	Facility	This regulation defines national ambient air quality standards. The facility meets all applicable national ambient air quality standards for NOx, CO, SO2, PM10, and PM2.5 under this regulation.
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.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
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.
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	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 capacity greater than or equal to 75 cubic meters (m3) 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 less than or equal to 1,589.874 m3 used for petroleum or condensate stored, processed, or treated prior to custody transfer. The tanks are not subject.
NSPS 40 CFR 60.330 Subpart GG	**Stationary Gas Turbines**	No	N/A	There are no turbines onsite; therefore, this regulation does not apply.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
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.
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-T-1, 1-T-2, 1-T-3, 1-T-4, 1-T-5, 1-T-6, 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. Lucid 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]. As the control device for some of the tanks is included in the site's monitoring plan, the tanks listed here must to comply with OOOO requirements, per NSR permit 4310-M5. 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, 2-T-1, 2-T-2, 3-T-1, 3-T-2, 3-T-3, 3-T-4, 3-T-5, 3-T-6, 4-T-1, 4-T-2, 5-T-1, 5-T-2, 5-T-3, 5-T-4	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]. As the control device for some of the tanks is included in the site's monitoring plan, the tanks listed here must to comply with OOOOa requirements, per NSR permit 4310-M5.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
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.
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 a 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.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
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 vent less than 0.90 megagrams of benzene per year to the atmosphere are exempt from the emissions control requirements of MACT HH per 63.764(e)(1)(ii). The dehydrators that comply with the 1 tpy control option under 63.765(b)(1)(ii) are considered large dehydrators under MACT HH. 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. Lucid 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 Boilers & Process Heaters	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, 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	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. Lucid will comply with all applicable MACT DDDDD requirements.
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) EPA Guidance Page: https://www.epa.gov/boilers
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.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
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	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. Lucid 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.
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.

Lucid has developed the above-mentioned plans and they will be made available to the Department upon request.

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: https://www.env.nm.gov/aqb/permit/aqb_pol.html. 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

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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 revision submitted under 20.2.70 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." Lucid 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 18

Addendum for Streamline Applications

Do not print this section unless this is a streamline application.

This Section is not applicable as this application is for a Title V permit under 20.2.70 NMAC.

Section 19

Requirements for Title V Program

Do not print this section unless this is a Title V application.

<u>Who Must Use this Attachment</u>:

* 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 http://www.env.nm.gov/aqb/index.html. 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, 2-EP-4, 2a-EP-3, 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, 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). 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 Unit 2.5-EP-4 has 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 (Units4-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.

Based on the information and belief formed after reasonable inquiry, Lucid believes that the Red Hills Gas Plant is in compliance with each requirement applicable to the facility.

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 and based on information and belief formed after reasonable inquiry, Lucid states that Red Hills Gas Plant will continue to be operated in compliance with applicable requirements for which it is in compliance as of the submittal date of this application.

In addition, Lucid 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 Lucid should discover new information affecting the compliance status of Red Hills Gas Plant, Lucid 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, 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.)

Lucid 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 http://www.env.nm.gov/aqb/index.html. Sources that are subject to both the Title V and Acid Rain regulations are **encouraged** to submit both applications **simultaneously**.

Based on information and belief formed after reasonable inquiry as described in Section 19.2, and with this filing, Lucid states that Red Hills is in compliance with applicable requirements. No compliance plan, compliance schedule, or compliance reports are required at this time.

In addition, based on information and belief formed after reasonable inquiry Lucid 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.

Based on information and belief formed after reasonable inquiry, Lucid 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:

Responsible Official: Matt Eales – Vice President of ESH&R

Address: P.O. Box 158, Artesia, NM 88211-0158

Email: MEales@lucid-energy.com

Lucid Energy Delaware, LLC / Red Hills Gas Processing Plant
CAM Plan for Amine Vent Controlled by Acid Gas Injection and Flare

I. Background

A. Emissions Unit

Description: Amine Vent
Identification: 2.5-EP-4
Facility: Red Hills Gas Plant

B. Applicable Regulation, Emission Limit, and Pre-CAM Monitoring Requirements

Regulation: Operation and reporting requirements created in NSR Permit 4310-M5 et seq. to establish federally enforceable recognition of the Amine Vent.
Emission limits: In accordance with Table 106.A, a zero emissions limit is established for the Amine Vent.

Uncontrolled Emissions:

VOC pph	VOC tpy	H2S pph	H2S tpy
10.65	46.66	612.94	2,684.68

Pre-CAM Monitoring Requirements: There are no pre-CAM monitoring requirements.

C. Control Technology, Capture System, Bypass, PER

Controls: Acid Gas Injection System (Compressor, Injection Well) and Acid Gas Flare (unit 2.5-EP-5)
Capture System: N/A
Bypass: The AGI well is the primary control mechanism for the Amine Unit. Alternate scenario emissions are routed to the flare. No other bypass on still vent stream.

Potential pre-control device emissions: Under 40 CFR 64.2 this is a CAM affected unit.

Potential post-control device emissions: 100% controlled, emission rate = 0 tpy for all pollutants from acid gas injection; 98% controlled for acid gas flare.

II. Monitoring Approach

The key elements of the monitoring approach are presented in the attached table.

III. Response to Excursion

Excursions of the AGI compressor injection pressure or flare system will trigger an inspection, corrective action, and reporting. Maintenance personnel will inspect the compressor, injection well, or acid gas flare within 24 hours and make needed repairs as soon as practicable.

Monitoring Approach: Red Hills Gas Plant AGI

	Indicator No. 1	Indicator No. 2.
I. AGI Performance Indicator	Injection pressure (psig)	Monitoring flow of acid gas to flare and AGI.
II. Indicator Range	900 – 2250 psig	Lucid will investigate any excursion outside the specified range of 0 to 11.7 MMscfd and perform corrective action as required. All information will be recorded and included in the required semi-annual Monitoring Report.
III. Performance Criteria	N/A	N/A
a. Data Representativeness	Pressure will be monitored by a pressure transducer	Flow rate will be monitored with a flow rate monitor.
b. QA/QC Practices/Criteria	Pressure transducer will be verified at least annually.	Acid gas flow meters will be calibrated as specified by the manufacturer or equivalent and as necessary to ensure correct and accurate readings.
c. Monitoring Frequency	Injection pressure will be monitored continuously.	Acid gas flow rates will be monitored continuously.
d. Data Collection Procedures	Injection pressure monitoring data will be reduced to daily averages.	Flow monitor data will be reduced to daily totals. Records of AGI system outages for maintenance or upset will be maintained. Lucid Energy Delaware will report acid gas compressor downtime, as required.
e. Averaging Time	24 hour average.	24 hour total.

Monitoring Approach: Red Hills Gas Plant Acid Gas Flare (unit 2.5-EP-5)

	Indicator No. 1	**Indicator No. 2**	**Indicator No. 3**
I. Indicator	Presence of combustion in the flare.	Presence of Visible Emissions.	Totalized flow volume.
Measurement Approach	The presence of combustion in the flare shall be monitored by a well-maintained thermocouple with alarm that signals non-combustion of gas.	The flare should be monitored for visible emissions once during each week that the flare is operational.	Flow rate shall be measured continuously with a flow meter, and the volume shall be totalized once every 24hr period.
II. Indicator Range	Flame present (sensed) or no flame present (sensed).	Visible emissions present or not present, in accordance with 40 CFR 60, Appendix A, Reference Method 22.	Flow rate should be within the operating velocities specified in NSPS Subpart A.
III. Performance Criteria A. Data Representativeness	Destruction depends upon the presence of a flame. If the flame is not present, VOCs and H_2S are not being destroyed.	Efficient combustion is assumed if no visible emissions are observed.	Efficient combustion is assumed if flow rates are within the operating velocities and minimum btu specified in NSPS Subpart A.
B. QA/QC Practices and Criteria	Proper operation of the flare achieved by maintaining the non-combustion thermocouple with alarm system. Operators will record the date and result of each such maintenance activity, as well as repairs or replacements made.	Visible emissions to be determined in accordance with Method 22 of Appendix A of 40 CFR 60 subpart A.	Verification will be in accordance with Appendix A Test method used to measure flow.
C. Monitoring Frequency	The thermocouple and alarm system will be tested twice a year by turning off the thermocouples and recording the time required for the alarm to respond.	Visible emissions monitoring to occur once each week that the flare is operational.	Continuous monitoring with totalized flow rate measured once per 24hr period.
D. Data Collection Procedures	Records will be maintained of flare shutdown for any reason, including failure to deliver fuel, and of inspection and maintenance to the flare and flare pilot.	Records shall be maintained of all visible emissions observations.	Totalized flow recorded once per each 24 hr period that the flare is in operation.
E. Averaging Period	Not applicable.	A six-minute Method 22 observation will be performed weekly.	24 hour.

Justification

I. Background

The monitoring approach outlined here applies to the AGI and the acid gas flare that are control devices for the amine vent. The amine system is the CAM affected unit.

II. Rationale for Selection of Performance Indicators

The destruction and removal of VOC and H_2S is dependent upon combustion and on proper operation of the AGI. Thus, the monitoring approach is based on three primary indicators: correct operation of the flare, integrity of the ducting from the process equipment to the flare and integrity of the ducting from the amine unit to the AGI.

Measuring AGI injection pressure will indicate proper operation of the injection well. Proper operation of the AGI system results in zero emissions to the atmosphere. AGI injection pressure indicates that the acid gas from the Amine Sweetening System is being injected into the subterranean formation. Monitoring of this pressure can also indicate any problems with the injection well or injecting gas into the formation. A high injection pressure could result in over-pressuring of the receiving formation.

III. Rationale for Selection of Indicator Ranges

Maintaining the AGI injection pressure in the ranges specified will indicate proper operation of the injection well for acid gas injection. Based on Lucid's experience with this AGI System, the AGI injection pressure range represented in the Monitoring Plan is representative and is based on geologist surveying of the injection formation.

In the case of ensuring proper operation of the flare, the presence of a flame to initiate or maintain combustion has only two states: a flame is present or a flame is not present. By design, a well-maintained thermocouple-based alarm system will indicate the state of combustion. The Measurement of totalized flow volume will determine if the volumetric flow is in line with the design specifications, and the max velocity determined from earlier testing of the flare.

The permit issued by the NMED requires the incinerator to achieve 98 percent or greater destruction efficiency.

Lucid Energy Delaware, LLC / Red Hills Gas Processing Plant
CAM Plan for the Amine Vents Controlled by the Thermal Oxidizers

I. Background

A. Emissions Unit

Description: Amine Vents
Identification: 2-EP-4, 3-EP-4, 4-EP-4
Facility: Red Hills Gas Plant

B. Applicable Regulation, Emission Limit, and Pre-CAM Monitoring Requirements

Regulation: Operation and reporting requirements created in NSR Permit 4310-M5 et seq. to establish federally enforceable recognition of the amine vents.

Emission limits: In accordance with Table 106.A, a zero emissions limit are established for the Amine Vents 2-EP-4, 3-EP-4, and 4-EP-4.

Uncontrolled Emissions:

Unit	VOC pph	VOC tpy	H2S pph	H2S tpy
2-EP-4	66.22	290.07	5.26	23.03
3-EP-4	72.35	316.90	5.03	22.04
4-EP-4	68.61	300.5	5.29	23.17

Controlled Emissions (based on the control equipment unit emissions):

Unit	Control Unit	VOC pph	VOC tpy	H2S pph	H2S tpy
2-EP-4	EP-5	5.92	25.92	0.14	0.62
3-EP-4	EP-6	3.64	15.92	0.10	0.44
4-EP-4	EP-8	3.56	15.57	0.11	0.46

C. Control Technology, Capture System, Bypass, PER

Controls[1]: Thermal Oxidizer (units EP-5, EP-6 and EP-8)

Capture System: N/A
Potential pre-control device emissions: Under 40 CFR 64.2 this is a CAM affected unit.
Potential post-control device emissions: 98% controlled by Thermal Oxidizer.

Note: [1] Unit EP-5 controls unit 2-EP-4, unit EP-6 controls 3-EP-4, and EP-8 controls 4-EP-4.

II. Monitoring Approach

The key elements of the monitoring approach are presented in the attached table.

III. Response to Excursion

Excursions of the thermal oxidizer systems that monitors the presence of combustion or visual emissions will trigger an inspection, corrective action, and reporting. Maintenance personnel will inspect the thermal oxidizer within 24 hours and make needed repairs as soon as practicable.

Monitoring Approach: Red Hills Gas Plant Thermal Oxidizers (units EP-5, EP-6, and EP-8)

	Indicator No. 1	**Indicator No. 2**	**Indicator No. 3**
I. Indicator	Presence of combustion in the THERMAL OXIDIZER .	Combustion Temperature	Equipment Inspection
Measurement Approach	The presence of combustion in the thermal oxidizer shall be monitored by a well-maintained thermocouple with alarm that signals non-combustion of gas.	Temperature of TO shall be measured with a thermocouple.	The thermal oxidizer is inspected on a semi-annual basis to ensure that the process is properly controlled. The unit is inspected according to an NMED-approved inspection protocol which includes at minimum the methods for inspecting and adjusting proper minimum combustion temperature and proper air distribution.
II. Indicator Range	Flame present (sensed) or no flame present (sensed).	>1600 deg F	An excursion is defined as equipment malfunctions which result in a release of uncontrolled emissions from the amine vent operations.
III. Performance Criteria A. Data Representativeness	Destruction depends upon the presence of a flame. If the flame is not present, VOC is not being destroyed.	Destruction depends upon achieving a temperature of 1600 deg F or greater.	Inspections and maintenance are being conducted on the thermal oxidizer.
B. QA/QC Practices and Criteria	Proper operation of the thermal oxidizer achieved by maintaining the non-combustion thermocouple with alarm system. Operators will record the date and result of each such maintenance activity, as well as repairs or replacements made.	Proper operation of the thermal oxidizer shall eb achieved by maintaining the non-combustion thermocouple with alarm system. Operators will record the date a result of each maintenance activity, as well as repairs or replacements made.	The thermal oxidizer is inspected on a semi-annual basis to ensure that the process is properly controlled. The unit is inspected according to an NMED-approved inspection protocol which includes at minimum the methods for inspecting and adjusting proper minimum combustion temperature, and proper air distribution.
C. Monitoring Frequency	The thermocouple and alarm system will be tested twice a year by turning off the thermocouples and recording the time required for the alarm to respond.	One measurement will be recorded per 24-hours.	Semi-annually.
D. Data Collection Procedures	Records will be maintained of thermal oxidizer shutdown for any reason, including failure to deliver fuel, and of inspection and maintenance to the thermal oxidizer.	Temperature will be recorded automatically once per day with a data logger. Records will be available for review at the site.	Semi-annually inspections are performed and documented by the observer. Any repairs or adjustments are documented.
E. Averaging Period	Not applicable.	Not applicable.	Not applicable.

Justification

I. Background

The monitoring approach outlined here applies to the thermal oxidizer that is a control device for the amine vent emissions. The amine vent (units 2-EP-4, 3-EP-4 and 4-EP-4) are the CAM affected units.

II. Rationale for Selection of Performance Indicators

The destruction and removal of VOC is dependent upon combustion. Thus, the monitoring approach is based on two primary indicators: correct operation of the thermal oxidizer and integrity of the ducting from the process equipment to the thermal oxidizer.

III. Rationale for Selection of Indicator Ranges

In the case of ensuring proper operation of the thermal oxidizer, the presence of a flame to initiate or maintain combustion has only two states: a flame is present or a flame is not present. By design, a well-maintained thermocouple-based alarm system will indicate the state of combustion. The Measurement of totalized flow volume will determine if the volumetric flow is in line with the design specifications, and the max velocity determined from earlier testing of the thermal oxidizer.

The permit issued by the NMED requires the thermal oxidizer to achieve 98 percent DRE or greater destruction efficiency.

Lucid Energy Delaware, LLC / Red Hills Gas Processing Plant
CAM Plan for the Loading Operations Controlled by the ECDs

I. Background

A. Emissions Unit

Description:	Condensate Loading Emissions
Identification:	1-Load, 3-LOAD
Facility:	Red Hills Gas Plant

B. Applicable Regulation, Emission Limit, and Pre-CAM Monitoring Requirements

Regulation: Operation and reporting requirements created in NSR Permit 4310-M5 et seq. to establish federally enforceable recognition of the loading emissions.

Emission limits:

Uncontrolled:

Unit	VOC pph	VOC tpy
1-Load	*	129.20
3-LOAD	71.22	105.14

* Indicates that hourly emission limits are not appropriate.

Controlled:

Unit	VOC pph	VOC tpy
1-Load	*	0.0
3-LOAD	*	31.54

C. Control Technology, Capture System, Bypass, PER

Controls[1]:	Enclosed Combustion Device (units EP-7 and EP-12)
Capture System:	N/A
Potential pre-control device emissions:	Under 40 CFR 64.2 this is a CAM affected unit.
Potential post-control device emissions:	98% controlled by ECD.

Note: [1] Unit EP-7 controls unit 1-Load and EP-12 controls unit 3-LOAD.

II. Monitoring Approach

The key elements of the monitoring approach are presented in the attached table.

III. Response to Excursion

X Excursions of the enclosed combustion device (ECD) that monitors the presence of combustion or visual emissions will trigger an inspection, corrective action, and reporting. Maintenance personnel will inspect the ECD within 24 hours and make needed repairs as soon as practicable.

Monitoring Approach: Red Hills Gas Plant ECDs (units EP-7 and EP-12)

	Indicator No. 1	**Indicator No. 2**	**Indicator No. 3**
I. Indicator	Presence of combustion in the ECD	Combustion Temperature	Equipment Inspection
Measurement Approach	The presence of combustion in the ECD shall be monitored by a well-maintained thermocouple with alarm that signals non-combustion of gas.	Temperature of ECD shall be measured with a thermocouple.	The ECD is inspected on a semi-annual basis to ensure that the process is properly controlled. The unit is inspected according to an NMED-approved inspection protocol which includes at minimum the methods for inspecting and adjusting proper residence time within the combustion chamber, minimum combustion temperature, and proper air distribution.
II. Indicator Range	Flame present (sensed) or no flame present (sensed).	1000 – 2700 deg F	An excursion is defined as equipment malfunctions which result in a release of uncontrolled emissions from the condensate loading operations.
III. Performance Criteria A. Data Representativeness	Destruction depends upon the presence of a flame. If the flame is not present, VOC is not being destroyed.	Destruction depends upon achieving a temperature in the proper range.	Inspections and maintenance are being conducted on the ECD.
B. QA/QC Practices and Criteria	Proper operation of the ECD is achieved by maintaining the non-combustion thermocouple with alarm system. Operators will record the date and result of each such maintenance activity, as well as repairs or replacements made.	Proper operation of the ECD shall be achieved by maintaining the non-combustion thermocouple with alarm system. Operators will records the date and result of each such maintenance activity, as well as repairs r replacements made.	The ECD is inspected on a semi-annual basis to ensure that the process is properly controlled. The unit is inspected according to an NMED-approved inspection protocol which includes at minimum the methods for inspecting and adjusting proper residence time within the combustion chamber, minimum combustion temperature, and proper air distribution.
C. Monitoring Frequency	The thermocouple and alarm system will be tested twice a year by turning off the thermocouples and recording the time required for the alarm to respond.	One measurement will be recorded per 24 hours.	Semi-annually.
D. Data Collection Procedures	Records will be maintained of ECD shutdown for any reason, including failure to deliver fuel, and of inspection and maintenance to the ECD.	Temperature will be recorded automatically once per day with a data logger. Records will be available for review at the site.	Semi-annually inspections are performed and documented by the observer. Any repairs or adjustments are documented.
E. Averaging Period	Not applicable.	Not applicable.	Not applicable.

Justification

I. Background

The monitoring approach outlined here applies to the ECD that is a control device for the emissions lost during condensate loading operations. The condensate loading operation (Units 1-Load and 3-LOAD) are the CAM affected units.

II. Rationale for Selection of Performance Indicators

The destruction and removal of VOC is dependent upon combustion. Thus, the monitoring approach is based on two primary indicators: correct operation of the ECD and integrity of the ducting from the process equipment to the ECD.

III. Rationale for Selection of Indicator Ranges

In the case of ensuring proper operation of the ECD, the presence of a flame to initiate or maintain combustion has only two states: a flame is present or a flame is not present. By design, a well-maintained thermocouple-based alarm system will indicate the state of combustion. The Measurement of totalized flow volume will determine if the volumetric flow is in line with the design specifications, and the max velocity determined from earlier testing of the ECD.

The permit issued by the NMED requires the ECD to achieve 98 percent DRE or greater destruction efficiency.

Section 20

Other Relevant Information

Other relevant information. Use this attachment to clarify any part in the application that you think needs explaining. Reference the section, table, column, and/or field. Include any additional text, tables, calculations or clarifying information.

Additionally, the applicant may propose specific permit language for AQB consideration. In the case of a revision to an existing permit, the applicant should provide the old language and the new language in track changes format to highlight the proposed changes. If proposing language for a new facility or language for a new unit, submit the proposed operating condition(s), along with the associated monitoring, recordkeeping, and reporting conditions. In either case, please limit the proposed language to the affected portion of the permit.

No other relevant information is being included in this application.

Section 21

Addendum for Landfill Applications

Do not print this section unless this is a landfill application.

This Section is not applicable as this is not a landfill application.

Section 22: Certification

Company Name: Lucid Energy Delaware, LLC

I, Matt Eales, 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 11 day of November, 2021, upon my oath or affirmation, before a notary of the State of

New Mexico.

Matt Eales
*Signature

Nov 11, 2021
Date

Matt Eales
Printed Name

VP of EHS&R
Title

Scribed and sworn before me on this 11th day of November, 2021.

My authorization as a notary of the State of New Mexico expires on the

9th day of October, 2025.

Notary's Signature

11/11/2021
Date

Liz Saiz
Notary's Printed Name

OFFICIAL SEAL
LIZ SAIZ
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 10/9/2025

*For Title V applications, the signature must be of the Responsible Official as defined in 20.2.70.7.AE NMAC.