HLP engineering, inc.
A Professional Environmental Firm

September 16, 2022

Mississippi Department of Environmental Quality
Office of Pollution Control
Environmental Permits Division
515 E. Amite Street
Jackson, MS 39201

RE: Notice of Intent for Coverage Under the Oil Production General Permit
Kaiser-Francis Oil Company
Gilliland 34-1H
AI No.: 74992; Permit No.: 1840-00092
Monroe County, MS

In accordance with MAC Title 11, Part 2, submitted with this are two (2) bound sets of the referenced material. An electronic copy has also been submitted through the EPD Electronic Application Submittal webpage. Request is hereby made for coverage under the Oil Production General Permit (OPGP). It should be noted this facility is existing and was previously owned/operated by Metano Energy III LP which operated under Air Construction Permit No.: 1840-00092.

The facility functions as an oil & gas production site and operates controls such that criteria pollutant emissions will not exceed emission rates restricted in the Oil Production General Permit, nor will hazardous air pollutant (HAP) emissions exceed any HAP emission rates restricted in the Oil Production General Permit. Details of the operations, emission estimates, and associated emission programs are included herein and verify that the facility should be classified as a synthetic minor source under the State and Federal air permitting programs. All measures should be taken in the review process to assure that the minor classification is federally recognized.

A copy of the public notice is enclosed and will be published in the Northeast Mississippi Daily Journal. Additionally, a copy of the public notice and the complete OPGP NOI will be provided to the Hamilton Public Library. The public notice, notarized proof of publication, and library proof of receipt will be submitted to MDEQ when available.

If any other information is required regarding these matters, please do not hesitate to contact HLP Engineering, Inc. at (337) 839-1075. All written correspondence should be directed to: **Kaiser-Francis Oil Company, P.O. Box 21468, Tulsa, OK 74121-1468, Attn.: Brittany Wilkinson**. Thank you in advance for your assistance with this matter.

Sincerely,
HLP ENGINEERING, INC.

Jamie Nease
Enclosures

xc: Brittany Wilkinson - KFOC

Oil Production General Permit Public Notice
Mississippi Environmental Quality Permit Board
P. O. Box 2261
Jackson, Mississippi 39225
Telephone No. (601) 961-5171

Public Notice Start Date: TBD

Kaiser-Francis Oil Company Gilliland 34-1H located *at 33 42 52.50, -88 24 17.35* in *Hamilton, Monroe County,* Mississippi, *918-491-4439,* has applied to the Mississippi Department of Environmental Quality (MDEQ) for coverage and/or modification under MDEQ's Oil Production General Permit to construct and operate an oil production facility.

The Oil Production General Permit has been developed to ensure compliance with all State and Federal regulations. Facilities granted coverage under this permit and adhering to the conditions contained therein should operate within State and Federal environmental laws and standards concerning the operation of air emissions equipment.

The proposed project consists of construction and/or operation of *an oil and gas production facility including 1 oil well, 1 separator, 1 heater treater, 3 oil storage tanks, 1 water storage tank, 1 gasoline-fired tank bottoms pump engine, 1 control flare, and other ancillary activities associated with oil & gas production.* The facility will operate control(s) such that criteria pollutant emissions will not exceed emission rates restricted in the Oil Production General Permit, nor will hazardous air pollutant (HAP) emissions exceed any HAP emission rates restricted in the Oil Production General Permit. This project will result in new sources of potential emissions of regulated air pollutants. However, emissions will be below the Prevention of Significant Deterioration significance levels as specified in the Mississippi Regulations for the Prevention of Significant Deterioration of Air Quality, 11 Miss. Admin. Code Pt. 2, Ch. 5., and in 40 CFR Part 52.21. Potential emissions will also be below the Air Title V Major Source thresholds as specified in 11 Miss. Admin. Code Pt. 2, Ch. 6. and in 40 CFR Part 70.

Persons wishing to comment upon or object to the proposed request are invited to submit comments in writing to the **Air 1 Branch Chief, Environmental Permits Division** at the Permit Board's address shown above no later than 30-days from the date of publication of this notice. All comments received or postmarked by this date will be considered in the determination regarding the coverage approval. After receipt of public comments and thorough consideration of all comments, MDEQ will formulate its recommendations regarding coverage approval.

Additional details about the proposed project are available by writing or calling the **Air 1 Branch Chief, Environmental Permits Division** at the above Permit Board address and telephone number and on the MDEQ's website at: https://www.mdeq.ms.gov/ensearch/recently-received-general-permit-noi/. This information is also available for review at the following location during normal business hours:

Mississippi Department of Environmental Quality
Office of Pollution Control
515 East Amite Street,
Jackson, MS 39201
(601) 961-5171

Please bring the foregoing to the attention of persons whom you know will be interested.

Notice of Intent for Oil Production General Permit

Kaiser-Francis Oil Company

Gilliland 34-1H
Monroe County, MS
AI No.: 74992

September 2022

HLP engineering, inc.
A Professional Environmental Firm

Table of Contents

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Facility (Agency Interest) Information	**Section OPGP - A**

1. Name, Address, and Location of Facility

A. Owner/Company Name: Kaiser-Francis Oil Company

B. Facility Name (*if different than A. above*): Gilliland 34-1H

C. Facility Air Permit/Coverage No. *(if known)*: 1840-00092

D. Agency Interest No. *(if known)*: 74992

E. Physical Address

1. Street Address: The facility is located approximately 2.0 miles southeast of Hamilton, MS.
2. City: Hamilton — 3. State: MS
4. County: Monroe — 5. Zip Code: 39746
6. Telephone No.: 918-491-4439 — 7. Fax No.:
8. Are facility records kept at this location? ☐ Yes ☑ No. Please complete Item 10.

F. Mailing Address

1. Street Address or P.O. Box: P.O. Box 21468
2. City: Tulsa — 3. State: OK
4. Zip Code: 74121-1468

G. Latitude/Longitude Data

1. Collection Point (*check one*):
   ☐ Site Entrance ☑ Other: Well Surface Location
2. Method of Collection (*check one*):
   ☐ GPS Specify coordinate system (NAD 83, etc.)
   ☑ Map Interpolation (Google Earth, etc.) ☐ Other:
3. Latitude (*degrees/minutes/seconds*): 33 42 52.50
4. Longitude (*degrees/minutes/seconds*): 88 24 17.35
5. Elevation (*feet*): 250±

H. SIC Code: 1311

2. Name and Address of Facility Contact

A. Name: Brittany Wilkinson — Title: Air Quality Engineer

B. Mailing Address

1. Street Address or P.O. Box: P.O. Box 21468
2. City: Tulsa — 3. State: OK
4. Zip Code: 74121-1468 — 5. Fax No.:
6. Telephone No.: 918-491-4439
7. Email: brittanyw@kfoc.net

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Facility (Agency Interest) Information — **Section OPGP - A**

3. Name and Address of Air Contact (*if different from Facility Contact*)

A. Name: ______________________ Title: ______________

B. Mailing Address
1. Street Address or P.O. Box: ______________________
2. City: ______________________ 3. State: ______________
4. Zip Code: ______________________ 5. Fax No.: ______________
6. Telephone No.: ______________
7. Email: ______________________

4. Name and Address of Responsible Official for the Facility

The Form must be signed by a Responsible Official as defined in 11 Miss. Admin. Code Pt.2, R. 2.1.C(24).

A. Name: Aaron Daniels Title: EHS Manager

B. Mailing Address
1. Street Address or P.O. Box: P.O. Box 21468
2. City: Tulsa 3. State: OK
4. Zip Code: 74121-1468 5. Fax No.: ______________
6. Telephone No.: 918-491-4227
7. Email: AaronD@kfoc.net

C. Is the person above a duly authorized representative and not a corporate officer?
☐ Yes ☑ No
If yes, has written notification of such authorization been submitted to MDEQ?
☐ Yes ☐ No ☐ Request for authorization is attached

5. Type of Oil Production Notice of Intent (*Check all that apply*)

☑ Initial Coverage ☐ Re-Coverage for existing Coverage

☐ Modification with Public Notice ☐ Modification without Public Notice

☐ Update Compliance Plan

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Facility (Agency Interest) Information | **Section OPGP - A**

6. Equipment List (*Check all that apply*)

Complete supporting emission calculations must be included for each potential emission unit selected below.

- ☑ Heater Treater. Include a completed Section OPGP-C Form for each unit.
- ☑ Condensation Storage Vessel. Include a completed Section OPGP-E Form for each unit.
- ☑ Water Storage Vessel. Include a completed Section OPGP-E Form for each unit.
- ☑ Internal Combustion Engine. Include a completed Section OPGP-D Form for each unit.
- ☑ Flare. Include a completed Section OPGP-F Form for each unit.
- ☑ Oil Truck Loading (Section OPGP-B Form)
- ☑ Component Fugitive Emissions (Section OPGP-B Form)
- ☑ Other: Water Truck Loading, Pneumatic Controllers, Well Gas, Heater Treater Flash Gas

7. Process/Product Details

Maximum Anticipated Well(s) Production for Faciltiy:

Produced Material	Throughput	Units
Gas	0.175	MMCF/day
Oil	9	barrels/day
Water	5	barrels/day
Other (Specify)		

Maximum Anticipated Throughput for Principal Product(s) (*as applicable*):

Produced Material	Throughput	Units
Flared Gas	0.175	MMCF/day
Oil	12	barrels/day
Water	50	barrels/day
Other (Specify)		

8. Zoning

A. Is the facility (either existing or proposed) located in accordance with any applicable city and/or county zoning ordinances? If no, please explain
Yes

B. Is the facility (either existing or proposed) required to obtain any zoning variance to locate/expand the facility at this site? If yes, please explain.
No

C. Is the required USGS quadrangle map or equivalent attached? ☑ Yes ☐ No

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Facility (Agency Interest) Information	**Section OPGP - A**

9. MS Secretary of State Registration / Certificate of Good Standing

No permit will be issued to a company that is not authorized to conduct business in Mississippi. If the company applying for the permit is a corporation, limited liability company, a partnership or a business trust, the application package should include proof of registration with the Mississippi Secretary of State and/or a copy of the company's Certificate of Good Standing. The name listed on the permit will include the company name as it is registered with the Mississippi Secretary of State.

It should be noted that for an application submitted in accordance with 11 Miss. Admin. Code Pt. 2, R. 2.8.B. to renew a State Permit to Operate or in accordance with 11 Miss. Admin. Code Pt. 2, R. 6.2.A(1)(c). to renew a Title V Permit to be considered timely and complete, the applicant shall be registered and in good standing with the Mississippi Secretary of State to conduct business in Mississippi.

10. Address and Location of Facility Records

Physical Address

1. Street Address: 6733 S. Yale Avenue
2. City: Tulsa
3. State: OK
4. County: Tulsa
5. Zip Code: 74136
6. Telephone No.: 918-491-4439
7. Fax No.:

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Facility (Agency Interest) Information	**Section OPGP - A**

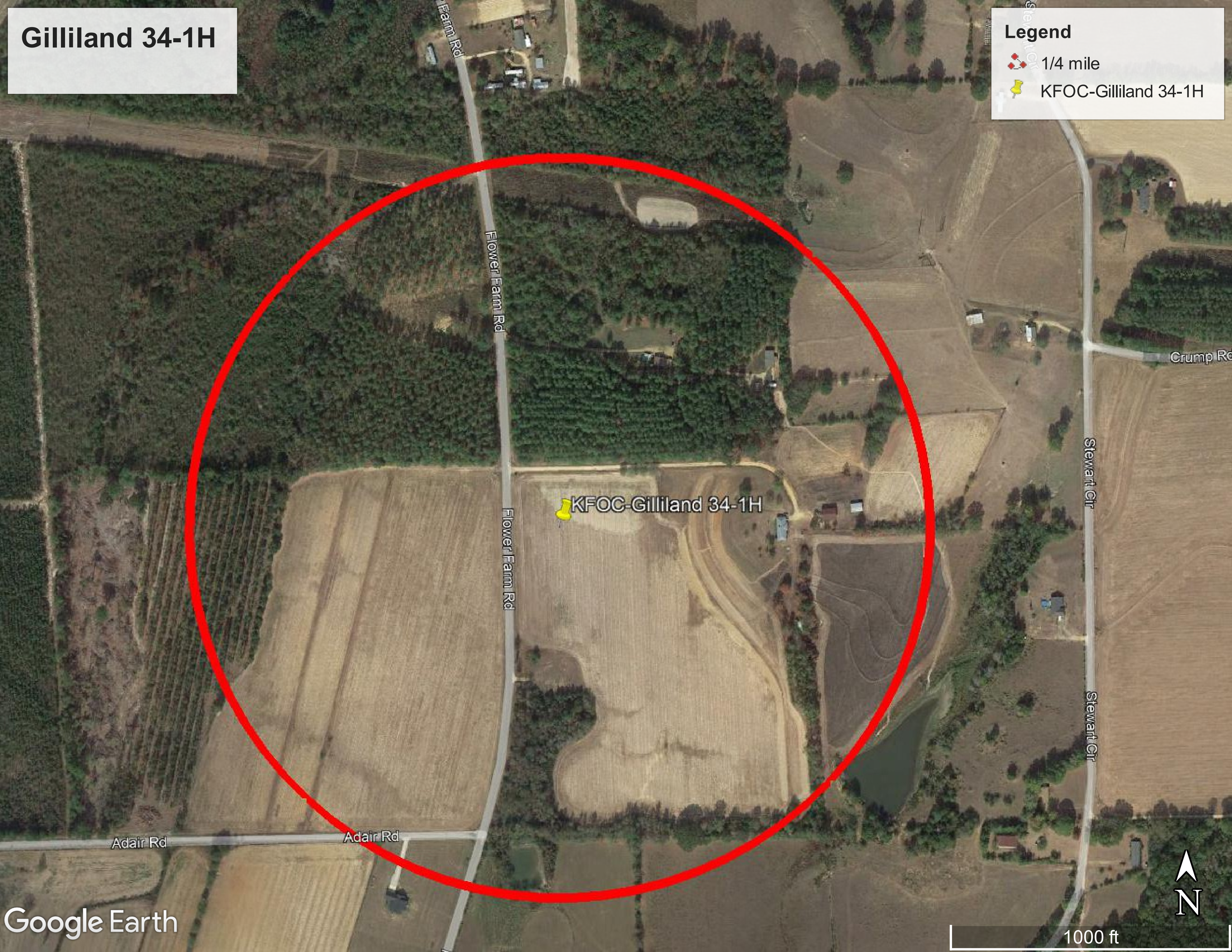
11. Certification

The Form must be signed by a Responsible Official as defined in 11 Miss. Admin. Code Pt. 2, R. 2.1.C.(24).

I certify that to the best of my knowledge and belief formed after reasonable inquiry, the statements and information in this application are true, complete, and accurate, and that as a responsible official, my signature shall constitute an agreement that the applicant assumes the responsibility for any alteration, additions, or changes in operation that may be necessary to achieve and maintain compliance with all applicable Rules and Regulations. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

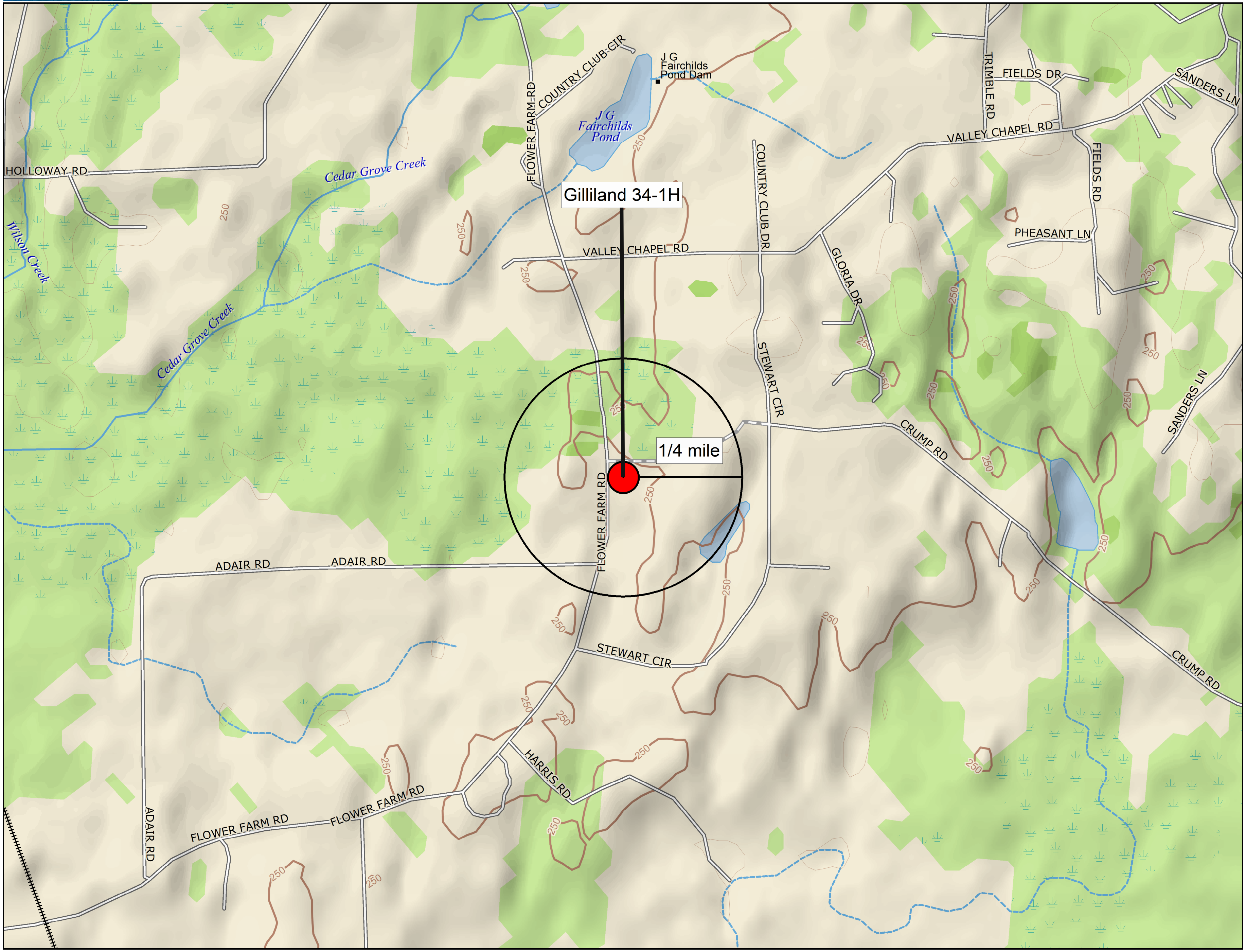
Signature of Responsible Official/DAR	9/8/2022 **Date**
Aaron Daniels **Printed Name**	9/8/2022 **Date**

Gilliland 34-1H



DeLORME

Topo North America™ 9



TN

MN (3.0°W)

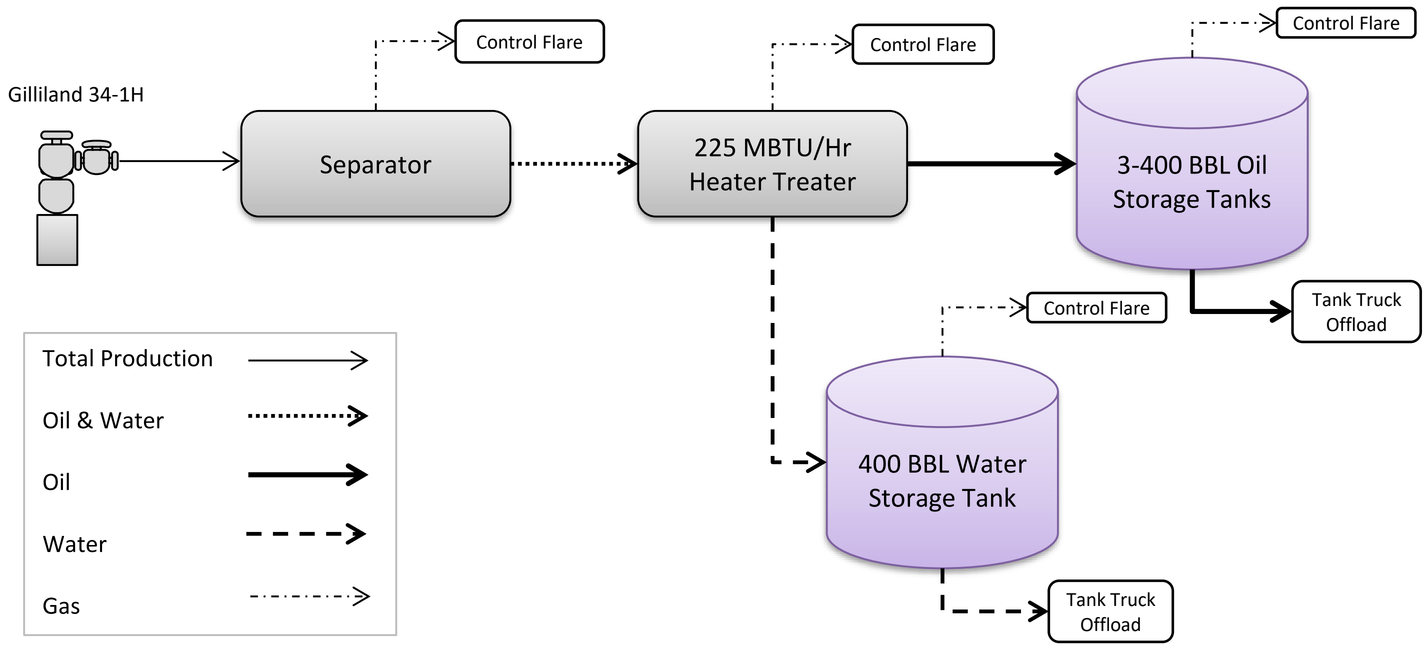
Scale 1 : 20,000

1" = 1,666.7 ft

Data Zoom 13-3

Simplified Process Flow Diagram

Kaiser-Francis Oil Company
Gilliland 34-1H
Monroe County, MS



The facility is used as a typical oil & gas production facility designed to treat and handle production from the Gilliland 34-1H well completion. Production from the well is routed to a separator. Gas from the separator is routed to a control flare for combustion. Oil and water from the separator are routed to a heater treater for further separation. Off-gas from the heater treater is routed to the aforementioned control flare for combustion. Oil and water from the heater treater are routed to on-site tanks for storage until hauled off-site by tank truck for sales and disposal, respectively. Vapors from the storage tanks are routed to the aforementioned control flare for combustion, except during brief intervals when thief hatches are opened for gauging, sampling, etc. One (1) gasoline-fired tank bottoms pump is also located at this facility. Emissions from the sources listed above, and any related sources, are addressed within this application.

Section OPGP-B.1: Maximum Uncontrolled Emissions (under normal operating conditions)

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Maximum Uncontrolled 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) in Section OGP-B.3 and GHGs in Section OGP-B.4. Emission Point 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. Emissions > 0.01 TPY must be included. Please do not change the column widths on this table.

Emission Point ID	TSP[1] (PM)		PM-10[1]		PM-2.5[1]		SO_2		NOx		CO		VOC		TRS[2]		Lead		Total HAPs	
	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**
HT-01	0.00	0.00	0.00	0.01	0.00	0.01	-	-	0.02	0.10	0.02	0.08	0.00	0.01	-	-	-	-	-	-
PE-01	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.12	0.50	0.08	0.34	0.12	0.50	-	-	-	-	-	-
OST-01	-	-	-	-	-	-	-	-	-	-	-	-	0.24	1.08	-	-	-	-	0.01	0.08
OST-02	-	-	-	-	-	-	-	-	-	-	-	-	0.24	1.08	-	-	-	-	0.01	0.08
OST-03	-	-	-	-	-	-	-	-	-	-	-	-	0.24	1.08	-	-	-	-	0.01	0.08
WST-01	-	-	-	-	-	-	-	-	-	-	-	-	0.02	0.08	-	-	-	-	0.00	0.01
FL-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LD-01	-	-	-	-	-	-	-	-	-	-	-	-	25.85	0.32	-	-	-	-	2.35	0.03
LD-02	-	-	-	-	-	-	-	-	-	-	-	-	0.26	0.01	-	-	-	-	0.02	0.00
LC-01	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.68	-	-	-	-	0.00	0.01
FE-01	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.73	-	-	-	-	0.00	0.01
12-22-WG	-	-	-	-	-	-	-	-	-	-	-	-	67.01	293.51	-	-	-	-	1.83	8.03
13-22-HT-FG	-	-	-	-	-	-	-	-	-	-	-	-	0.21	0.92	-	-	-	-	0.01	0.04
Totals	**0.01**	**0.03**	**0.01**	**0.04**	**0.01**	**0.04**	**0.01**	**0.03**	**0.14**	**0.60**	**0.10**	**0.42**	**94.51**	**300.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.24**	**8.37**

[1] **Condensables:** Include condensable particulate matter emissions in particulate matter calculations for PM-10 and PM-2.5, but not for TSP (PM).

[2] **TRS:** Total reduced sulfur (TRS) is the sum of the sulfur compounds hydrogen sulfide (H_2S), methyl mercaptan (CH_4S), dimethyl sulfide (C_2H_6S), and dimethyl disulfide ($C_2H_6S_2$).

Section OPGP-B.2: Proposed Allowable Emissions

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Proposed Allowable Emissions (Potential to Emit) are those emissions the facility is currently permitted to emit as limited by a specific permit requirement or federal/state standard (e.g., a MACT standard); or the emission rate at which the facility proposes to emit considering emissions control devices, restrictions to operating rates/hours, or other requested permit limits that reduce the maximum emission rates. Emission Point 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. Additional columns may be added if there are regulated pollutants (other than HAPs and GHGs) emitted at the facility.

Emission Point ID	TSP[1]		PM10[1]		PM2.5[1]		SO_2		NOx		CO		VOC		TRS		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**
HT-01	0.00	0.00	0.00	0.01	0.00	0.01	-	-	0.02	0.10	0.02	0.08	0.00	0.01	-	-	-	-
PE-01	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.12	0.50	0.08	0.34	0.12	0.50	-	-	-	-
OST-01	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	-	-	-	-
OST-02	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	-	-	-	-
OST-03	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	-	-	-	-
WST-01	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	-	-	-	-
FL-01	0.08	0.35	0.08	0.35	0.08	0.35	0.00	0.00	1.21	5.29	2.41	10.57	1.35	5.98	-	-	-	-
LD-01	-	-	-	-	-	-	-	-	-	-	-	-	25.85	0.32	-	-	-	-
LD-02	-	-	-	-	-	-	-	-	-	-	-	-	0.26	0.01	-	-	-	-
LC-01	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.68	-	-	-	-
FE-01	-	-	-	-	-	-	-	-	-	-	-	-	0.16	0.73	-	-	-	-
Totals	**0.09**	**0.38**	**0.09**	**0.39**	**0.09**	**0.39**	**0.01**	**0.03**	**1.35**	**5.89**	**2.51**	**10.99**	**27.90**	**8.23**	**0.00**	**0.00**	**0.00**	**0.00**

[1] **Condensables:** Include condensable particulate matter emissions in particulate matter calculations for PM-10 and PM-2.5, but not for TSP (PM).

[2] **TRS:** Total reduced sulfur (TRS) is the sum of the sulfur compounds hydrogen sulfide (H_2S), methyl mercaptan (CH_4S), dimethyl sulfide (C_2H_6S), and dimethyl disulfide ($C_2H_6S_2$).

Section OPGP-B.3: Proposed Allowable Hazardous Air Pollutants (HAPs)

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

In the table below, report the Proposed Allowable Emissions (Potential to Emit) for each HAP from each regulated emission unit if the HAP > 0.01 tpy. Each facility-wide Individual HAP total and the facility-wide Total HAPs shall be the sum of all HAP sources. Use the HAP nomenclature as it appears in the Instructions. Emission Point numbering must be consistent throughout the application package. For each HAP 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. Additional columns may be added as necessary to address each HAP.

Emission Point ID	Total HAPs		1,3-Butadiene		2,2,4-Trimethyl-pentane		Acetaldehyde		Acrolein		Benzene		Ethylbenzene		Formaldehyde		n-Hexane		Methanol		Toluene		Xylenes	
	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**
HT-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PE-01	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OST-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OST-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OST-03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WST-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FL-01	0.03	0.17	-	-	0.01	0.02	-	-	-	-	0.00	0.02	-	-	-	-	0.02	0.10			0.00	0.02	0.00	0.01
LD-01	2.35	0.03	-	-	-	-	-	-	-	-	0.03	0.00	-	-	-	-	2.32	0.03	-	-	-	-	-	-
LD-02	0.02	0.00	-	-	-	-	-	-	-	-	0.00	0.00	-	-	-	-	0.02	0.00	-	-	-	-	-	-
LC-01	0.00	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.01	-	-	-	-	-	-
FE-01	0.00	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.01	-	-	-	-	-	-
Totals:	**2.40**	**0.22**	**0.00**	**0.00**	**0.01**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.02**	**0.00**	**0.00**	**0.00**	**0.00**	**2.36**	**0.15**	**0.00**	**0.00**	**0.00**	**0.02**	**0.00**	**0.01**

Section OPGP-B.4: Greenhouse Gas Emissions

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Applicants must report potential emission rates in SHORT TONS per year, as opposed to metric tons required by Part 98. Emission Point numbering must be consistent throughout the application package and, for existing emission points, should match any MDEQ ID's in the current permit.

		CO_2 (non-biogenic) ton/yr	CO_2 (biogenic)[2] ton/yr	N_2O ton/yr	CH_4 ton/yr	SF_6 ton/yr	PFC/HFC[3] ton/yr					Total GHG Mass Basis ton/yr[5]	Total CO_2e ton/yr[6]
Emission Point ID	**GWPs [1]**	**1**	**1**	**298**	**25**	**22,800**	**footnote 4**						
HT-01	**mass GHG**	143.99	0.00	0.00	0.00	0.00	0.00					143.99	
	CO_2e	143.99	0.00	0.00	0.00	0.00	0.00						143.99
PE-01	**mass GHG**	59.03	0.00	0.00	0.00	0.00	0.00					59.03	
	CO_2e	59.03	0.00	0.00	0.00	0.00	0.00						59.03
OST-01	**mass GHG**	0.00	0.00	0.00	0.00	0.00	0.00					0.00	
	CO_2e	0.00	0.00	0.00	0.00	0.00	0.00						0.00
OST-02	**mass GHG**	0.00	0.00	0.00	0.00	0.00	0.00					0.00	
	CO_2e	0.00	0.00	0.00	0.00	0.00	0.00						0.00
OST-03	**mass GHG**	0.00	0.00	0.00	0.00	0.00	0.00					0.00	
	CO_2e	0.00	0.00	0.00	0.00	0.00	0.00						0.00
WST-01	**mass GHG**	0.00	0.00	0.00	0.00	0.00	0.00					0.00	
	CO_2e	0.00	0.00	0.00	0.00	0.00	0.00						0.00
FL-01	**mass GHG**	4488.05	0.00	0.01	22.59	0.00	0.00					4510.65	
	CO_2e	4488.05	0.00	2.98	564.75	0.00	0.00						5055.78
LD-01	**mass GHG**	0.00	0.00	0.00	0.02	0.00	0.00					0.02	
	CO_2e	0.00	0.00	0.00	0.50	0.00	0.00						0.50
LD-02	**mass GHG**	0.00	0.00	0.00	0.00	0.00	0.00					0.00	
	CO_2e	0.00	0.00	0.00	0.00	0.00	0.00						0.00
LC-01	**mass GHG**	0.01	0.00	0.00	2.61	0.00	0.00					2.62	
	CO_2e	0.01	0.00	0.00	65.25	0.00	0.00						65.26
FE-01	**mass GHG**	0.00	0.00	0.00	2.05	0.00	0.00					2.05	
	CO_2e	0.00	0.00	0.00	51.25	0.00	0.00						51.25
FACILITY TOTAL	**mass GHG**	**4691.08**	**0.00**	**0.01**	**27.27**	**0.00**	**0.00**					**4718.36**	
	CO_2e	**4691.08**	**0.00**	**2.98**	**681.75**	**0.00**	**0.00**						**5375.81**

[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 GWP values.

[2] Biogenic CO2 is defined as carbon dioxide emissions resulting from the combustion or decomposition of non-fossilized and biodegradable organic material originating from plants, animals, or micro-organisms.

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

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

[5] Greenhouse gas emissions on a **mass basis** is the ton per year greenhouse gas emission before adjustment with its GWP. Do not include biogenic CO_2 in this total.

[6] **CO_2e** means Carbon Dioxide Equivalent and is calculated by multiplying the TPY mass emissions of the greenhouse gas by its GWP. Do not include biogenic CO_2e in this total.

Section OPGP-B.5: Stack Parameters and Exit Conditions

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Emission Point numbering must be consistent throughout the application package.

Emission Point ID	Orientation (H-Horizontal V=Vertical)	Rain Caps (Yes or No)	Height Above Ground (ft)	Base Elevation (ft)	Exit Temp. (^oF)	Inside Diameter or Dimensions (ft)	Velocity (ft/sec)	Moisture by Volume (%)	Geographic Position (degrees/minutes/seconds) Latitude	Longitude
HT-01	V	No	15±	250±	500	0.5	8.4	0	33 42 52.50	88 24 17.35
PE-01	V	No	10±	250±	700	0.5	4.4	0	33 42 52.50	88 24 17.35
OST-01	V	No	22±	250±	80	0.2	<0.01	0	33 42 52.50	88 24 17.35
OST-02	V	No	22±	250±	80	0.2	<0.01	0	33 42 52.50	88 24 17.35
OST-03	V	No	22±	250±	80	0.2	<0.01	0	33 42 52.50	88 24 17.35
WST-01	V	No	22±	250±	80	0.2	<0.01	0	33 42 52.50	88 24 17.35
FL-01	V	No	15±	250±	1500	0.5	553	0	33 42 52.50	88 24 17.35
LD-01	V	No	5±	250±	80	0.3	0.85	0	33 42 52.50	88 24 17.35
LD-02	V	No	5±	250±	80	0.3	0.01	0	33 42 52.50	88 24 17.35

[1] A WAAS-capable GPS receiver should be used and in the WGS84 or NAD83 coordinate system.

Kaiser-Francis Oil Company
Gilliland 34-1H
Monroe County, MS

Section B.6: EMISSION POINT SOURCE LIST

Facility Ref. No.:	MDEQ EPN:	Footnote:	Emission Point Description:	Routes To:	Operating Rate/Capacity	Operating Schedule:		
						Hrs/Day or (Hrs/Yr)	Days/Wk	Wks/Yr
HT-01	AA-002		225 MBTU/Hr Heater Treater-Burner Stack		225 MBTU/Hr	24	7	52.143
PE-01	AA-008		Internal Combustion Engine-Exhaust Stack (Honda; Gasoline-Fired Tank Bottoms Pump)		8.7 HP	24	7	52.143
OST-01	AA-003	a	400 BBL Oil Storage Tank-Common Vent	FL-01	1,460 BOPY	24	7	52.143
OST-02	AA-004	a	400 BBL Oil Storage Tank-Common Vent	FL-01	1,460 BOPY	24	7	52.143
OST-03	AA-005	a	400 BBL Oil Storage Tank-Common Vent	FL-01	1,460 BOPY	24	7	52.143
WST-01	AA-006	a	400 BBL Water Storage Tank-Common Vent	FL-01	18,250 BWPY	24	7	52.143
FL-01	AA-001	b	Control Flare		64.2 MMSCF/Yr	24	7	52.143
LD-01	AA-010		Loading Losses-Oil Transfer to Tank Truck		4,380 BOPY	(24.3)	-	-
LD-02	AA-011		Loading Losses-Water Transfer to Tank Truck		18,250 BWPY	(101)	-	-
LC-01	AA-009		Pneumatic Controllers		149 MSCF/Yr	24	7	52.143
FE-01	AA-007		Fugitive Emissions		N/A	24	7	52.143
12-22-WG		c	Well Gas	FL-01	63.9 MMSCF/Yr	24	7	52.143
13-22-HT-FG		d	Heater Treater-Flash Gas	FL-01	43.1 MSCF/Yr	24	7	52.143

Footnotes:

a *Vapors from this source are routed to the control flare (EPN: FL-01) for combustion, except during brief intervals when thief hatches will be opened for purposes of sampling, gauging, etc.*

b *Routine emission limits for this source account for vapors from the storage tanks, well gas, off-gas from the heater treater, and the pilot gas stream. This source may also combust gas from the facility's pressure release system on an emergency and non-routine basis.*

c *Well gas is routed to the control flare (EPN: FL-01) for combustion.*

d *Off-gas from this source is routed to the control flare (EPN: FL-01) for combustion.*

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Fuel Burning Equipment – External Combustion Sources

Section OPGP-C

1. Emission Point Description

A. Emission Point Designation (Ref. No.): AA-002 (HT-01)

B. Equipment Description: Heater Treater-Burner Stack

C. Manufacturer: Unknown

D. Date of Manufacture and No.: Unknown

E. Maximum Heat Input (higher heating value): 0.225 MMBtu/hr

F. Nominal Heat Input Capacity: 0.225 MMBtu/hr

G. Use: ☐ Line Heater ☒ Heater Treater ☐ TEG Burner
☐ Space Heat ☐ Process Heat ☐ Other (describe): ________

H. Heat Mechanism: ☐ Direct ☒ Indirect

I. Burner Type (e.g., forced draft, natural draft, etc.): ________

J. Additional Design Controls (e.g., FGR, etc.): N/A

K. Status: ☒ Operating ☐ Proposed ☐ Under Construction

2017 or After

2. Fuel Type

Complete the following table, identifying each type of fuel and the amount used. Specify the units for heat content, hourly usage, and yearly usage.

FUEL TYPE	HEAT CONTENT	% SULFUR	% ASH	MAXIMUM HOURLY USAGE	MAXIMUM YEARLY USAGE
Produced Field Gas	1218 BTU/ft^3	<0.0007	N/A	185 scf	1.62 MMscf

Please list any fuel components that are hazardous air pollutants and the percentage in the fuel:

____

____

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Fuel Burning Equipment – Internal Combustion Engines

Section OPGP- D

1. Emission Point Description

A. Emission Point Designation (Ref. No.): AA-008 (PE-01)

B. Equipment Description (including serial number): Gasoline-Fired Tank Bottoms Pump Engine

C. Manufacturer: Honda

D. Date of Manufacture and Model No.: 2017

E. Maximum Heat Input (higher heating value): 0.08 MMBtu/hr

F. Rated Power: 8.7 hp ______ kW

G. Is the engine an EPA-certified engine? Yes (Yes or No)

H. Use: ☒ Non-emergency ☐ Emergency

I. Displacement per cylinder: ☒ < 10 Liters ☐ 10 to <30 Liters ☐ ≥ 30 Liters

J. Engine Ignition Type: ☒ Spark Ignition ☐ Compression Ignition

K. Engine Burn Type: *(check all that apply)* ☐ 4-stroke ☐ 2-stroke ☐ Rich Burn ☐ Lean Burn

L. Status: ☒ Operating ☐ Proposed ☐ Under Construction

M. Date of construction, reconstruction, or most recent modification (for existing sources) or date of anticipated construction: 2017 or After

2. Fuel Type

Complete the following table, identifying each type of fuel and the amount used. Specify units of measurement.

FUEL TYPE	HEAT CONTENT	% SULFUR	% ASH	MAXIMUM HOURLY USAGE	MAXIMUM YEARLY USAGE
Gasoline	20,300 BTU/lb	<0.0080	N/A	0.43 Gallons	3767 Gallons

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Tank Summary — Section OPGP-E

1. Emission Point Description

A. Emission Point Designation (Ref. No.): AA-003, AA-004, & AA-005 (OST-01, OST-02, & OST-3)

B. Product(s) Stored: Produced Oil

C. Status: ☒ Operating ☐ Proposed ☐ Under Construction

D. Date of construction, reconstruction, or most recent modification (for existing sources) or date of anticipated construction: 2017 or After

2. Tank Data

A. Tank Specifications:

1.	Design capacity	16,800	gallons		
2.	True vapor pressure at storage temperature:	4.513	psia @	67.63	ºF
3.	Maximum true vapor pressure (as defined in §60.111b)	5.246	psia @	76.08	ºF
4.	Reid vapor pressure at storage temperature:	6.27	psia @	67.63	ºF
5.	Density of product at storage temperature:	N/A	lb/gal		
6.	Molecular weight of product vapor at storage temp.	50	lb/lbmol		

B. Tank Orientation: ☒ Vertical ☐ Horizontal

C. Type of Tank:

☒ Fixed Roof ☐ External Floating Roof ☐ Internal Floating Roof

☐ Pressure ☐ Variable Vapor Space ☐ Other: ______________

D. Is the tank equipped with a Vapor Recovery System and/or flare? ☒ Yes ☐ No

If yes, describe below and include the efficiency of each.

Vapors from these sources are routed to the control flare (EPN: FL-01) for combustion with a combustion efficiency of 98%.

E. Closest City:

☐ Jackson, MS ☐ Meridian, MS ☒ Tupelo, MS ☐ Mobile, AL

☐ New Orleans, LA ☐ Memphis, TN ☐ Baton Rouge, LA

F. Is an E&P or similar report described in Condition 5.4(5) of the General Permit included for this tank in the Notice of Intent? ☒ Yes ☐ No

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Tank Summary	**Section OPGP-E**

3. Horizontal Fixed Roof Tank

A. Shell Length: ________ feet
B. Shell Diameter: ________ feet
C. Working Volume: ________ gal
D. Maximum Throughput: ________ gal/yr
E. Is the tank heated? ☐ Yes ☐ No
F. Is the tank underground? ☐ Yes ☐ No
G. Shell Color/Shade:
☐ ☐ Aluminum/Specular ☐ Aluminum/Diffuse
☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer
H. Shell Condition: ☐ Good ☐ Poor

4. Vertical Fixed Roof Tank

A. Dimensions:
1. Shell Height: 20 feet
2. Shell Diameter: 12 feet
3. Maximum Liquid Height: 19 feet
4. Average Liquid Height: 9.5 feet
5. Working Volume: 16,800 gal
6. Turnovers per year: 3.81
7. Maximum throughput: 1,460 BBLs/yr
8. Is the tank heated? ☐ Yes ☒ No

B. Shell Characteristics:
1. Shell Color/Shade:
☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
☐ Gray/Light ☒ Gray/Medium ☐ Red/Primer
2. Shell Condition: ☒ Good ☐ Poor

C. Roof Characteristics:
1. Roof Color/Shade:
☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
☐ Gray/Light ☒ Gray/Medium ☐ Red/Primer
2. Roof Condition: ☒ Good ☐ Poor
3. Type: ☒ Cone ☐ Dome
4. Height: 0.38 feet

Tank Summary	Section OPGP-E

5. Internal Floating Roof Tank

A. Tank Characteristics:
1. Diameter: ______________ feet
2. Tank Volume: ______________ gal
3. Turnovers per year: ______________
4. Maximum Throughput: ______________ gal/yr
5. Number of Columns: ______________
6. Self-Supporting Roof? ☐ Yes ☐ No
7. Effective Column Diameter:
   ☐ 9"x7" Built-up Column ☐ 8" Diameter Pipe ☐ Unknown
8. Internal Shell Condition:
   ☐ Light Rust ☐ Dense Rust ☐ Gunite Lining
9. External Shell Color/Shade:
   ☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
   ☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer
10. External Shell Condition: ☐ Good ☐ Poor
11. Roof Color/Shade:
   ☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
   ☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer
12. Roof Condition: ☐ Good ☐ Poor

B. Rim Seal System:
1. Primary Seal: ☐ Mechanical Shoe ☐ Liquid-mounted ☐ Vapor-mounted
2. Secondary Seal: ☐ Shoe-mounted ☐ Rim-mounted ☐ None

C. Deck Characteristics:
1. Deck Type: ☐ Bolted ☐ Welded
2. Deck Fitting Category: ☐ Typical ☐ Detail

6. External Floating Roof Tank

A. Tank Characteristics
1. Diameter: ______________ feet
2. Tank Volume: ______________ gal
3. Turnovers per year: ______________
4. Maximum Throughput: ______________ gal/yr
5. Internal Shell Condition:
   ☐ Light Rust ☐ Dense Rust ☐ Gunite Lining

Tank Summary — Section OPGP-E

6. External Floating Roof Tank (continued)

A. Tank Characteristics (continued):

6. Paint Color/Shade:

☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse

☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer

7. Paint Condition: ☐ Good ☐ Poor

B. Roof Characteristics

1. Roof Type: ☐ Pontoon ☐ Double Deck

2. Roof Fitting Category: ☐ Typical ☐ Detail

C. Tank Construction and Rim-Seal System:

1. Tank Construction: ☐ Welded ☐ Riveted

2. Primary Seal:

☐ Mechanical Shoe ☐ Liquid-mounted ☐ Vapor-mounted

3. Secondary Seal

☐ None ☐ Shoe-mounted ☐ Rim-mounted ☐ Weather shield

7. Pollutant Emissions

A. Fixed Roof Emissions:

Pollutant[1]	Working Loss (tons/yr)	Breathing Loss (tons/yr)	Total Emissions (tons/yr)
VOC	0.12*	0.50*	0.62*

**It should be noted that the emissions listed above represent the fixed roof emissions prior to emissions being routed to the control flare for combustion.*

B. Floating Roof Emissions:

Pollutant[1]	Rim Seal Loss (tons/yr)	Withdrawal Loss (tons/yr)	Deck Fitting Loss (tons/yr)	Deck Seam Loss (tons/yr)	Landing Loss[2] (tons/yr)	Total Emissions (tons/yr)

1. All regulated air pollutants including hazardous air pollutants emitted from this source should be listed in accordance with the OGP Application Instructions. A list of regulated air pollutants and a link to EPA's list of hazardous air pollutants is provided in the OGP Application Instructions.
2. Landing losses should be determined according to the procedures in *Organic Liquid Storage Tanks* chapter of EPA's AP-42 emission factors. If the roof is not landed at least once/yr, enter "NA".

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Tank Summary — Section OPGP-E

1. Emission Point Description

A. Emission Point Designation (Ref. No.): AA-006 (WST-01)

B. Product(s) Stored: Produced Water

C. Status: ☒ Operating ☐ Proposed ☐ Under Construction

D. Date of construction, reconstruction, or most recent modification (for existing sources) or date of anticipated construction: 2017 or After

2. Tank Data

A. Tank Specifications:

1.	Design capacity	16,800	gallons		
2.	True vapor pressure at storage temperature:	0.335	psia @	67.63	°F
3.	Maximum true vapor pressure (as defined in §60.111b)	0.446	psia @	76.08	°F
4.	Reid vapor pressure at storage temperature:	0.335	psia @	67.63	°F
5.	Density of product at storage temperature:	N/A	lb/gal		
6.	Molecular weight of product vapor at storage temp.	18.02	lb/lbmol		

B. Tank Orientation: ☒ Vertical ☐ Horizontal

C. Type of Tank:

☒ Fixed Roof ☐ External Floating Roof ☐ Internal Floating Roof

☐ Pressure ☐ Variable Vapor Space ☐ Other: ______________

D. Is the tank equipped with a Vapor Recovery System and/or flare? ☒ Yes ☐ No

If yes, describe below and include the efficiency of each.

Vapors from this source are routed to the control flare (EPN: FL-01) for combustion with a combustion efficiency of 98%.

E. Closest City:

☐ Jackson, MS ☐ Meridian, MS ☒ Tupelo, MS ☐ Mobile, AL

☐ New Orleans, LA ☐ Memphis, TN ☐ Baton Rouge, LA

F. Is an E&P or similar report described in Condition 5.4(5) of the General Permit included for this tank in the Notice of Intent? ☒ Yes ☐ No

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Tank Summary	**Section OPGP-E**

3. Horizontal Fixed Roof Tank

A. Shell Length: ____________ feet
B. Shell Diameter: ____________ feet
C. Working Volume: ____________ gal
D. Maximum Throughput: ____________ gal/yr
E. Is the tank heated? ☐ Yes ☐ No
F. Is the tank underground? ☐ Yes ☐ No
G. Shell Color/Shade:
☐ ☐ Aluminum/Specular ☐ Aluminum/Diffuse
☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer

H. Shell Condition: ☐ Good ☐ Poor

4. Vertical Fixed Roof Tank

A. Dimensions:
1. Shell Height: 20 feet
2. Shell Diameter: 12 feet
3. Maximum Liquid Height: 19 feet
4. Average Liquid Height: 9.5 feet
5. Working Volume: 16,800 gal
6. Turnovers per year: 47.68
7. Maximum throughput: 18,250 BBLs/yr
8. Is the tank heated? ☐ Yes ☒ No

B. Shell Characteristics:
1. Shell Color/Shade:
☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
☐ Gray/Light ☒ Gray/Medium ☐ Red/Primer
2. Shell Condition: ☒ Good ☐ Poor

C. Roof Characteristics:
1. Roof Color/Shade:
☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
☐ Gray/Light ☒ Gray/Medium ☐ Red/Primer
2. Roof Condition: ☒ Good ☐ Poor
3. Type: ☒ Cone ☐ Dome
4. Height: 0.38 feet

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Tank Summary — Section OPGP-E

5. Internal Floating Roof Tank

A. Tank Characteristics:
1. Diamete: ______________ feet
2. Tank Volume: ______________ gal
3. Turnovers per year: ______________
4. Maximum Throughput: ______________ gal/yr
5. Number of Columns: ______________
6. Self-Supporting Roof? ☐ Yes ☐ No
7. Effective Column Diameter:
   ☐ 9”x7” Built-up Column ☐ 8” Diameter Pipe ☐ Unknown
8. Internal Shell Condition:
   ☐ Light Rust ☐ Dense Rust ☐ Gunite Lining
9. External Shell Color/Shade:
   ☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
   ☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer
10. External Shell Condition: ☐ Good ☐ Poor
11. Roof Color/Shade:
   ☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
   ☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer
12. Roof Condition: ☐ Good ☐ Poor

B. Rim Seal System:
1. Primary Seal: ☐ Mechanical Shoe ☐ Liquid-mounted ☐ Vapor-mounted
2. Secondary Seal: ☐ Shoe-mounted ☐ Rim-mounted ☐ None

C. Deck Characteristics:
1. Deck Type: ☐ Bolted ☐ Welded
2. Deck Fitting Category: ☐ Typical ☐ Detail

6. External Floating Roof Tank

A. Tank Characteristics
1. Diameter: ______________ feet
2. Tank Volume: ______________ gal
3. Turnovers per year: ______________
4. Maximum Throughput: ______________ gal/yr
5. Internal Shell Condition:
   ☐ Light Rust ☐ Dense Rust ☐ Gunite Lining

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Tank Summary — Section OPGP-E

6. External Floating Roof Tank (continued)

A. Tank Characteristics (continued):

6. Paint Color/Shade:
   ☐ White/White ☐ Aluminum/Specular ☐ Aluminum/Diffuse
   ☐ Gray/Light ☐ Gray/Medium ☐ Red/Primer

7. Paint Condition: ☐ Good ☐ Poor

B. Roof Characteristics

1. Roof Type: ☐ Pontoon ☐ Double Deck

2. Roof Fitting Category: ☐ Typical ☐ Detail

C. Tank Construction and Rim-Seal System:

1. Tank Construction: ☐ Welded ☐ Riveted

2. Primary Seal:
   ☐ Mechanical Shoe ☐ Liquid-mounted ☐ Vapor-mounted

3. Secondary Seal
   ☐ None ☐ Shoe-mounted ☐ Rim-mounted ☐ Weather shield

7. Pollutant Emissions

A. Fixed Roof Emissions:

Pollutant[1]	Working Loss (tons/yr)	Breathing Loss (tons/yr)	Total Emissions (tons/yr)
VOC	0.04*	0.02*	0.06*

**It should be noted that the emissions listed above represent the fixed roof emissions prior to emissions being routed to the control flare for combustion.*

B. Floating Roof Emissions:

Pollutant[1]	Rim Seal Loss (tons/yr)	Withdrawal Loss (tons/yr)	Deck Fitting Loss (tons/yr)	Deck Seam Loss (tons/yr)	Landing Loss[2] (tons/yr)	Total Emissions (tons/yr)

1. All regulated air pollutants including hazardous air pollutants emitted from this source should be listed in accordance with the OGP Application Instructions. A list of regulated air pollutants and a link to EPA's list of hazardous air pollutants is provided in the OGP Application Instructions.
2. Landing losses should be determined according to the procedures in *Organic Liquid Storage Tanks* chapter of EPA's AP-42 emission factors. If the roof is not landed at least once/yr, enter "NA".

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Flare — Section OPGP-F

1. Equipment Description

A. Emission Point Designation (Ref. No.): AA-001 (FL-01)

B. Equipment Description (include the process(es) that the flare controls emissions from):
Control flare to combust emissions from oil storage tanks (EPNs: OST-01 through OST-03), water storage tank (EPN: WST-01), well gas (EPN: 12-22-WG), and heater treater flash gas (EPN: 13-22-HT-FG).

C. Manufacturer: N/A D. Model: N/A

E. Status: ☒ Operating ☐ Proposed ☐ Under Construction

F. ☐ Requesting a federally enforceable condition to route tank emissions to the flare.

2. System Data

A. Efficiency: 98 % Controlling the following pollutant(s): VOC, HAPs
Efficiency: ____ % Controlling the following pollutant(s): ____
Reason for different efficiency: ____

B. Flare Data (if applicable):

1. Flare type: ☒ Non-assisted ☐ Steam-assisted ☐ Air-assisted ☐ Other: ____
2. Net heating value of combusted gas: 1218 Btu/scf
3. Design exit velocity: N/A ft/sec
4. System: ☒ Auto-ignitor ☒ Continuous Flame
5. Is the presence of a flare pilot flame monitored? ☒ Yes ☐ No

   If yes, please describe the monitoring: The presence of the flare pilot flame is continuously monitored by use of a thermocouple.*
6. Is the auto-ignitor system monitored? ☒ Yes ☐ No

   If yes, please describe the monitoring: The flare is equipped with an auto-igniter.*

*KFOC will maintain a flare pilot flame or auto-igniter system at all times when emissions may be vented to the flare. KFOC will either continuously monitor & record the presence of the flare pilot flame by use of a thermocouple OR maintain & operate an auto-igniter system on the flare to ensure a flame is immediately restored when emissions are being sent to the flare.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

Part 1. Equipment List

List all equipment and the corresponding federal and/or state regulation that is applicable. Clearly identify federal regulations from state requirements. Provide the expected or actual construction date, startup date and removal date if the equipment is no longer on site.

EMISSION UNIT (Ref No.)	FEDERAL or STATE REGULATION Ex. 40 CFR Part _____, Subpart __________ Ex. 11 Miss. Admin. Code Pt. 2, R. 1.4.B(2).	CONSTRUCTION DATE	STARTUP DATE	REMOVAL DATE
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R. 1.3.A.	2017 or After	2017 or After	N/A
HT-01 *Heater Treater*	11 Miss Admin Code Pt. 2, R. 1.3 B.	2017 or After	2017 or After	N/A
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R. 1.3. D(1)(b).	2017 or After	2017 or After	N/A
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R. 1.3. D(1)(a).	2017 or After	2017 or After	N/A
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R.1.4.A(1).	2017 or After	2017 or After	N/A
PE-01 *Gasoline-Fired Engine*	40 CFR 60, Subpart JJJJ	2017 or After	2017 or After	N/A
PE-01 *Gasoline-Fired Engine*	40 CFR 63, Subpart ZZZZ	2017 or After	2017 or After	N/A
FL-01 *Control Flare*	11 Miss. Admin. Code Pt. 2, R.1.4.B(2).	2017 or After	2017 or After	N/A
FE-01 *Fugitive Emissions*	40 CFR 60, Subpart OOOOa	2017 or After	2017 or After	N/A

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

Part 2. Applicable Requirements

List all applicable state and federal requirements, including emission limits, operating restrictions, etc., and the applicable test methods or monitoring used to demonstrate compliance with each applicable requirement. Clearly identify federal regulations from state requirements. Provide the compliance status as of the day the application is signed.

EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R. 1.3.A.	Opacity	40%	N/A
HT-01 *Heater Treater*	11 Miss Admin Code Pt. 2, R. 1.3 B.	Opacity	Equivalent Opacity	N/A
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R. 1.3. D(1)(b).	PM	$E = 0.8808*I^{-0.1667}$	N/A
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R. 1.3. D(1)(a).	PM	0.6 lb/MMBTU	N/A
HT-01 *Heater Treater*	11 Miss. Admin. Code Pt. 2, R.1.4.A(1).	SO_2	4.8 lbs/MMBTU	N/A
PE-01 *Gasoline-Fired Engine*	40 CFR 60.4233(a)	NOx, CO, VOC	Comply with the emission standards in 40 CFR 60.4231(a) over the entire life of the engine.	If you operate and maintain the certified stationary SI internal combustion engine and control device according to the manufacturer's emission-related written instructions, you must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required if you are an owner or operator. You must also meet the requirements as specified in 40 CFR part 1068, subparts A through D, as they apply to you. If you adjust engine settings according to and consistent with the manufacturer's instructions, your stationary SI internal combustion engine will not be considered out of compliance. (40 CFR 60.4243(a)(1))

Compliance Plan — Section OPGP-G

Part 2. Applicable Requirements

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
PE-01 *Gasoline-Fired Engine*	40 CFR 60.4245(a)(1)-(3)	NOx, CO, VOC	Owners and operators of stationary SI ICE must keep records of the following: 1. All notifications submitted to comply with this subpart and all documentation supporting any notification. 2. Maintenance conducted on the engine. 3. Since the SI ICE is certified, documentation from the manufacturer that the engine is certified and meet the emission standards and information required in 40 CFR parts 1048, 1054, and 1060, as applicable.	Recordkeeping of all notifications, documentation, and maintenance shall be maintained.
PE-01 *Gasoline-Fired Engine*	40 CFR 63.6590(c)	HAPs	This engine is a new area source and meets the requirements of this subpart by meeting the requirements of 40 CFR 60-Subpart JJJJ.	N/A
FL-01 *Control Flare*	11 Miss. Admin. Code Pt. 2, R.1.4.B(2).	H_2S	1 grain H_2S per 100 standard cubic feet (1 gr/100 scf)	Recordkeeping of H_2S composition of gas by gas analysis; Maintenance of continuous flame for gas combustion.

Compliance Plan | Section OPGP-G

Part 2. Applicable Requirements

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FL-01 *Control Flare*	11 Miss. Admin. Code Pt. 2, R.2.2.B(10).	VOC, HAPs	Flare Operating Requirements	The flare shall be operated at all times when emissions may be vented to it from the oil storage tanks (EPNs: OST-01, OST-02, OST-03), water storage tank (EPN: WST-01), well gas (EPN: 12-22-WG), and heater treater flash gas (EPN: 13-22-HT-FG). The flare is anticipated to provide a significant reduction in hydrocarbon emissions. Based on manufacturer’s data, a minimum of 98% reduction can be expected. It should also be noted that the facility will operate the flare such that criteria pollutant emissions will not exceed emission rates restricted in the Oil Production General Permit, nor will hazardous air pollutant (HAP) emissions exceed any HAP emission rates restricted in the Oil Production General Permit.

Compliance Plan — Section OPGP-G

Part 2. Applicable Requirements

List all applicable state and federal requirements, including emission limits, operating restrictions, etc., and the applicable test methods or monitoring used to demonstrate compliance with each applicable requirement. Clearly identify federal regulations from state requirements. Provide the compliance status as of the day the application is signed.

EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FL-01 *Control Flare*	11 Miss. Admin. Code Pt. 2, R.2.2.B(11).	VOC, HAPs	Monitoring and recordkeeping	KFOC shall maintain a flare pilot flame or auto-igniter system at all times when emissions may be vented to the flare. KFOC will either continuously monitor & record the presence of the flare pilot flame by use of a thermocouple OR maintain & operate an auto-igniter system on the flare to ensure a flame is immediately restored when emissions are being sent to the flare. The flare shall be operated with no visible emissions as determined by EPA Method 22, except for periods not to exceed a total of five (5) minutes during any two (2) consecutive hours. Records of all visual observations/tests and corrective action shall be maintained.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Compliance Plan — Section OPGP-G

Part 2. Applicable Requirements

List all applicable state and federal requirements, including emission limits, operating restrictions, etc., and the applicable test methods or monitoring used to demonstrate compliance with each applicable requirement. Clearly identify federal regulations from state requirements. Provide the compliance status as of the day the application is signed.

EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5365a(i) 40 CFR 60.5397a(a) 40 CFR 60.5397a(a)(1)	VOC	Owners and operators of an affected facility, which is the collection of fugitive emission components at a well site that commenced construction or modification after 9/18/2015, must reduce VOC emissions by complying with §60.5397a(a)(1) as listed below, unless the affected facility meets the conditions specified in either paragraph (a)(1)(i) or (ii) of §60.5397a. 1) Monitor all fugitive emission components, as defined in §60.5430a, in accordance with §60.5397a(b)-(g); 2) Repair all sources of fugitive emissions (defined as any visible emission from a fugitive emissions component observed using optical gas imaging or an instrument reading of 500 ppm or greater using Method 21 of appendix A-7 to this part) in accordance with §60.5397a(h); and 3) Keep records in accordance with §60.5397a(i) and report in accordance with §60.5397a(j).	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

Part 2. Applicable Requirements

List all applicable state and federal requirements, including emission limits, operating restrictions, etc., and the applicable test methods or monitoring used to demonstrate compliance with each applicable requirement. Clearly identify federal regulations from state requirements. Provide the compliance status as of the day the application is signed.

EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5397a(a)(2) 40 CFR 60.5397a(a)(3)	VOC	If the affected facility meets the conditions specified in either paragraph (a)(1)(i) or (ii) of §60.5397a, owners and operators must comply with either §60.5397a(a)(1) or (a)(2). If complying with §60.5397a(a)(2), the following will apply until such time that any actions in §60.5397a(a)(2)(i) through (v) are performed. 1) Maintain the total production for the well site at or below 15 boe per day based on a rolling 12-month average, according to §60.5410a(k) and §60.5415a(i); 2) Comply with the reporting requirements in §60.5420a(b)(7)(i)(C) 3) Comply with the recordkeeping requirements in §60.5420a(c)(15)(ii) If any actions in §60.5397a(a)(2)(i) through (v) occur, owners and operators must comply with §60.5397a(a)(3).	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Compliance Plan | Section OPGP-G

Part 2. Applicable Requirements

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5397a(b) 40 CFR 60.5397a(c) 40 CFR 60.5397a(d) 40 CFR 60.5397a(e) 40 CFR 60.5397a(f)(1) 40 CFR 60.5397a(g)(1)	VOC	Develop an emissions monitoring plan that covers the collection of fugitive emissions components at the affected well site(s) and compressor station(s) within each company-defined area in accordance with paragraphs (c) & (d). Fugitive emissions monitoring plans must include the elements specified in paragraphs (c)(1) through (8), at a minimum. Each fugitive emissions monitoring plan must include the elements specified in paragraphs (d)(1) through (3), at a minimum, as applicable. Each monitoring survey shall observe each fugitive emissions component, as defined in §60.5430a, for fugitive emissions. Conduct an initial monitoring survey within 90 days of the startup of production, as defined in §60.5430a, for each collection of fugitive emissions components at a new well site or by June 3, 2017, whichever is later. For a modified well site, conduct an initial monitoring survey within 90 days of the first day of production after the modification, or by June 3, 2017, whichever is later. Subsequent monitoring surveys must be conducted at least semiannually after the initial survey. Consecutive semiannual monitoring surveys must be conducted at least 4 months apart and no more than 7 months apart.	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Compliance Plan — Section OPGP-G

Part 2. Applicable Requirements

List all applicable state and federal requirements, including emission limits, operating restrictions, etc., and the applicable test methods or monitoring used to demonstrate compliance with each applicable requirement. Clearly identify federal regulations from state requirements. Provide the compliance status as of the day the application is signed.

EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5397a(g)(3) 40 CFR 60.5397a(g)(4) 40 CFR 60.5397a(g)(5)	VOC	Fugitive emissions components that cannot be monitored without elevating the monitoring personnel more than 2 meters above the surface may be designated as difficult-to-monitor and must meet the specifications of §60.5397a(g)(3)(i) through (iv). Fugitive emissions components that cannot be monitored because monitoring personnel would be exposed to immediate danger while conducted a monitoring survey may be designated as unsafe-to-monitor and must meet the specifications of §60.5397a(g)(4)(i) through (iv). An affected facility is no longer required to comply with the requirements of paragraph (g)(1) of this section when the owner or operator removes all major production and processing equipment, as defined in §60.5430a, such that the well site becomes a wellhead only well site. If any major production and processing equipment is subsequently added to the well site, then the owner or operator must comply with the requirements in paragraphs (f)(1) and (g)(1) of this section.	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

Part 2. Applicable Requirements

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5397a(h) 40 CFR 60.5397a(h)(3) 40 CFR 60.5397a(h)(4)	VOC	Each identified source of fugitive emissions shall be repaired, as defined in §60.5430a, in accordance with paragraphs (h)(1) & (2) of this section. If the repair is technically infeasible, would require a vent blowdown, a compressor station shutdown, a well shutdown or well shut-in, or would be unsafe to repair during operation of the unit, the repair must be completed during the next scheduled compressor station shutdown for maintenance, scheduled well shutdown, scheduled well shut-in, after a scheduled vent blowdown, or within 2 years, whichever is earliest. For purposes of this paragraph (h)(3), a vent blowdown is the opening of one or more blowdown valves to depressurize major production and processing equipment, other than a storage vessel. Each identified source of fugitive emissions must be resurveyed to complete repair according to the requirements in paragraphs (h)(4)(i) through (iv) of this section, to ensure that there are no fugitive emissions.	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5397a(i) 40 CFR 60.5420a(c)(15) 40 CFR 60.5420a(c)	VOC	Records for each monitoring survey shall be maintained as specified §60.5420a(c)(15). For each collection of fugitive emissions components at a well site and each collection of fugitive emissions components at a compressor station, maintain the records identified in paragraphs (c)(15)(i) through (viii) of this section, as applicable. Records must be maintained either onsite or at the nearest local field office for at least 5 years.	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5397a(j) 40 CFR 60.5420a(b) 40 CFR 60.5420a(b)(11) 40 CFR 60.5410a	VOC	Annual reports shall be submitted for each collection of fugitive emissions components at a well site and each collection of fugitive emissions components at a compressor station that include the information specified in §60.5420a(b)(7). Multiple collection of fugitive emissions components at a well site or at a compressor station may be included in a single annual report. Submit an annual report containing the information specified in §60.5420a(b)(1)(i)-(iv)&(b)(7)(i)-(iii), as applicable. The initial annual report is due no later than 90 days after the end of the initial compliance period as determined according to §60.5410a. Subsequent annual reports are due no later than the same date each year as the initial annual report. Submit reports to the EPA via CEDRI, except as outlined in this paragraph (b)(11). (CEDRI can be accessed through the EPA's CDX (https://cdx.epa.gov/).) The initial compliance period begins on August 2, 2016, or upon initial startup, whichever is later, and ends no later than 1 year after the initial startup date for the affected facility or no later than 1 year after August 2, 2016. The initial compliance period may be less than one full year.	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE	
Compliance Plan	**Section OPGP-G**

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EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5410a(j) 40 CFR 60.5410a(k) 40 CFR 60.5415a(h)	VOC	To achieve initial compliance with the fugitive emission standards for each collection of fugitive emissions components at a well site and each collection of fugitive emissions components at a compressor station, comply with paragraphs (j)(1) through (5) of this section. To demonstrate initial compliance with the requirement to maintain the total well site production at or below 15 boe per day based on a rolling 12-month average, as specified in §60.5397a(a)(2), comply with paragraphs (k)(1) through (3) of this section. Demonstrate continuous compliance with the fugitive emission standards specified in §60.5397a(a)(1) according to paragraphs (h)(1) through (4) of this section.	KFOC will comply with all applicable requirements.

MDEQ NOTICE OF INTENT FOR COVERAGE UNDER THE OIL PRODUCTION GENERAL PERMIT TO CONSTRUCT/OPERATE AIR EMISSIONS EQUIPMENT AT A SYNTHETIC MINOR SOURCE

Compliance Plan — Section OPGP-G

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List all applicable state and federal requirements, including emission limits, operating restrictions, etc., and the applicable test methods or monitoring used to demonstrate compliance with each applicable requirement. Clearly identify federal regulations from state requirements. Provide the compliance status as of the day the application is signed.

EMISSION UNIT (Ref No.)	APPLICABLE REQUIREMENT (Specific Regulatory citation)	POLLUTANT	LIMITS/ REQUIREMENTS	TEST METHOD/ COMPLIANCE MONITORING
FE-01 *Fugitive Emissions*	40 CFR 60.5415a(i) 40 CFR 60.5415a(j)	VOC	For a well site complying with §60.5397a(a)(2), demonstrate continuous compliance according to paragraphs (i)(1) through (4) of this section. Perform the calculations shown in paragraphs (i)(1) through (4) of this section within 45 days of the end of each month. The rolling 12-month average of the total well site production determined according to paragraph (i)(4) of this section must be at or below 15 boe per day. To demonstrate that the well site produced at or below 15 boe per day for the first 30 days after startup of production as specified in §60.5397a(3), calculate the daily production for each individual well at the well site during the first 30 days of production after completing any action listed in §60.5397a(a)(2)(i) through (v) and sum the individual well production values to obtain the total well site production. The calculation must be performed within 45 days of the end of the first 30 days of production after completing any action listed in §60.5397a(a)(2)(i) through (v). To convert gas production to equivalent barrels of oil, divide cubic feet of gas produced by 6,000.	KFOC will comply with all applicable requirements.

Emission Calculations

POINT SOURCE I.D. NUMBER: ***HT-01***

EMISSION SOURCE DESCRIPTION: ***225 MBTU/Hr Heater Treater-Burner Stack***

DATA:

Emission Source:	***External Combustion Burner***
Annual Hours of Operation:	***8760***
Maximum Burner Rating (MMBTU/Hr):	***0.225***
Fuel Gas Heat of Combustion (BTU/scf): ***(based on an actual wet gas analysis)***	***1218***
Sulfur Concentration of Fuel Gas (ppmv): ***(conservative estimate)***	***7***
Fuel Source:	***Field Gas***

Max. Hourly Fuel Consumption (SCFH):	=	burner rating/fuel gas heat of combustion/80% efficiency	=	***230.91***
Max. Annual Fuel Consumption (MSCF/Yr):	=	hourly fuel consumption x annual hours	=	***2,022.77***

EMISSION FACTORS:

Unless otherwise noted, emission factors taken from EPA Publication AP-42, "Compilation of Air Pollution Emission Factors" - Natural Gas Combustion (Small Boilers), refer to supporting documentation.

SO_2 emission factor based on 100% conversion of sulfur compounds in fuel gas, using H_2S fuel composition noted above.

EMISSION CALCULATIONS:

POLLUTANT:	**EMISSION FACTOR ($LBS/10^6$ SCF)**	**CALCULATED EMISSION RATES:**	
		Hourly (lb/hr)	**Annual (TPY)**
Particulate Matter (filterable + condensable)	7.6	0.0018	0.0077
Sulfur Dioxide	1.182	0.0003	0.0012
Nitrogen Oxides	100	0.0231	0.1011
Carbon Monoxide	84	0.0194	0.0850
Methane (excluded from VOC total)	2.3	0.0005	0.0023
VOC	5.5	0.0013	0.0056
TOC	11	0.0025	0.0111
2-Methylnaphthalene (TAP)	0.0000240	0.0000	0.0000
3-Methylchloranthrene (TAP)	0.0000018	0.0000	0.0000
7,12-Dimethylbenz(a)anthrancene (TAP)	0.0000160	0.0000	0.0000
Acenaphthene (TAP)	0.0000018	0.0000	0.0000
Acenaphthylene (TAP)	0.0000018	0.0000	0.0000
Anthracene (TAP)	0.0000024	0.0000	0.0000
Benz(a)anthracene (TAP)	0.0000018	0.0000	0.0000
Benzene (TAP)	0.0021000	0.0000	0.0000
Benzo(a)pyrene (TAP)	0.0000012	0.0000	0.0000

POLLUTANT:	EMISSION FACTOR (LBS/10^6 SCF)	CALCULATED EMISSION RATES:	
		Hourly (lb/hr)	Annual (TPY)
Benzo(b)fluoranthene (TAP)	0.0000018	0.0000	0.0000
Benzo(g,h,I)perylene (TAP)	0.0000012	0.0000	0.0000
Benzo(k)fluoranthene (TAP)	0.0000018	0.0000	0.0000
Chrysene (TAP)	0.0000018	0.0000	0.0000
Dibenzo(a,h)anthrancene (TAP)	0.0000012	0.0000	0.0000
Dichlorobenzene (TAP)	0.0012000	0.0000	0.0000
Fluorathene (TAP)	0.0000030	0.0000	0.0000
Fluorene (TAP)	0.0000028	0.0000	0.0000
Formaldehyde (TAP)	0.0750000	0.0000	0.0001
Hexane (TAP)	1.8000000	0.0004	0.0018
Indeno(1,2,3-cd)pyrene (TAP)	0.0000018	0.0000	0.0000
Naphthalene (TAP)	0.0006100	0.0000	0.0000
Phenanathrene (TAP)	0.0000170	0.0000	0.0000
Pyrene (TAP)	0.0000050	0.0000	0.0000
Toluene (TAP)	0.0034000	0.0000	0.0000
Arsenic (TAP)	0.0002000	0.0000	0.0000
Beryllium (TAP)	0.0000120	0.0000	0.0000
Cadmium (TAP)	0.0011000	0.0000	0.0000
Chromium (TAP)	0.0014000	0.0000	0.0000
Cobalt (TAP)	0.0000840	0.0000	0.0000
Manganese (TAP)	0.0003800	0.0000	0.0000
Mercury (TAP)	0.0002600	0.0000	0.0000
Nickel (TAP)	0.0021000	0.0000	0.0000
Selenium (TAP)	0.0000240	0.0000	0.0000
	Total TAPs	0.00	0.00
	Total VOC-TAPs	0.00	0.00
	Total Non VOC & Non TAP-HC	0.00	0.00
	Total VOC	**0.00**	**0.01**

Emission Calculations

POINT SOURCE I.D. NUMBER:	***PE-01***
EMISSION SOURCE DESCRIPTION:	***Internal Combustion Engine-Exhaust Stack (Honda; Gasoline-Fired Tank Bottoms Pump)***

DATA:

Emission Source:	***Internal Combustion Engine***
Make:	***Honda***
Annual Hours of Operation:	***8760***
Maximum HP: *(provided by operator)*	***8.7***
Brake Specific Fuel Consumption: ***(BTU/BHP-Hr; conservative estimate)***	***9,000***
Max. Sulfur Concentration in Fuel Gas (%):	***0.0080***
Fuel Source:	***Gasoline***

Max. Hourly Energy Output (HP-Hr)	=	HP Rating x 1-hour	=	***8.7***
Max. Annual Energy Output (HP-Hr/Yr)	=	HP Rating x Annual Operating Hours	=	***76,212.00***

EMISSION FACTORS:

NOx & VOC emission factors were taken from the emission standard established in 40 CFR 60 Subpart JJJJ & 40 CFR 1054.105(a). In accordance with the standard, the summation of NOx & HC emissions may not exceed 8.0 g/KW-Hr (6.0 g/BHP-Hr); however, for purposes of permitting, the maximum emissions are used for each pollutant.
Emission factors for all other pollutants were taken from Chapter 3.2 of AP-42, 5th Edition, Supplement B, October 1996 for Gasoline or Diesel Industrial Engines; using brake specific fuel consumption (BSFC) noted above.

EMISSION CALCULATIONS:

POLLUTANT:	**EMISSION FACTOR (Grams/BHP-Hr)**	**CALCULATED EMISSION RATES:**		
		Average Hourly (lb/hr):	**Maximum Hourly (lb/hr):**	**Annual (TPY):**
PM_{10}	0.408	0.0078	0.0078	0.0343
$PM_{2.5}$	0.408	0.0078	0.0078	0.0343
Sulfur Dioxide	0.343	0.0066	0.0066	0.0288
Nitrogen Oxides	6.0	0.1151	0.1151	0.5041
Carbon Monoxide	4.041	0.0775	0.0775	0.3395
Aldehydes	0.286	0.0055	0.0055	0.0240
TOC (reported as VOC)	6.0	0.1151	0.1151	0.5041
	Total VOC	**0.12**	**0.12**	**0.50**

Emission Calculations

This is a sample calculation for EPNs: OST-01 through OST-03.

Emission calculations shown below are presented for informational purposes only as vapors from the oil storage tanks are routed to the control flare (EPN: FL-01) for combustion, except during brief intervals when thief hatches are opened for purposes of sampling, gauging, etc.

POINT SOURCE I.D. NUMBER: ***"See Above"***

EMISSION SOURCE DESCRIPTION: ***400 BBL Oil Storage Tank-Common Vent***

DATA:

Emission Source:	***Crude Oil Storage Vapors ('Working' & 'Standing')***
Average Daily Oil Throughput: **(Annual Average; BBLD/Tank - Q_{avg})**	***4***
Maximum Daily Oil Throughput: **(BBLD/Tank - Q_{max})**	***12***
Average VOC Working Losses - L_W (lb/yr):	***243.973***
Average VOC Standing Losses - L_S (lb/yr):	***992.960***
Basis of Estimates:	***AP-42, Chapter 7 (June 2020, Section 7.1.3.1); Refer to supporting documentation for summary***

Avg. Hourly Uncontrolled THC Losses (lb/hr)	=	(Lw + Ls) * 1.134/8760	=	**0.16**
Max. Hourly Uncontrolled THC Losses (lb/hr)	=	(Ls + (Lw * QMax ÷ Qavg)) * 1.134/8760	=	**0.22**
Annual Potential Uncontrolled THC Losses (TPY)	=	Hourly * 8760/2000	=	**0.70**

SPECIATION FACTORS:

Speciation factors were taken from "Air Emissions Species Manual - Volume I: Volatile Organic Compound Species Profiles", 2nd edition; Report No.: EPA-450/2-90-001a; page 258; reference supporting documentation.

UNCONTROLLED EMISSIONS SUMMARY:

POLLUTANT:	**Weight Percent**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Hydrogen Sulfide (excluded from VOC total)	0.00	0.0000	0.0000	0.0000
Methane (excluded from VOC total)	6.20	0.0099	0.0138	0.0435
Ethane (excluded from VOC total)	5.60	0.0090	0.0125	0.0393
Propane	17.60	0.0282	0.0393	0.1234
Iso-Butane	1.50	0.0024	0.0033	0.0105
N-Butane	27.10	0.0434	0.0605	0.1901
Iso-Pentane	1.50	0.0024	0.0033	0.0105
N-Pentane	14.60	0.0234	0.0326	0.1024
Heptane	9.20	0.0147	0.0205	0.0645
Octane	6.90	0.0110	0.0154	0.0484
Other NM/NE Hydrocarbons	1.80	0.0029	0.0040	0.0126

N-Hexane (TAP)	7.90	0.0126	0.0176	0.0554
Benzene (TAP)	0.10	0.0002	0.0002	0.0007
Total Weight Percent:	100.00			
Total TAP Emissions		0.01	0.02	0.06
Total VOC Emissions		**0.14**	**0.20**	**0.62**
Total Non VOC & Non TAP-HC		0.02	0.03	0.08
Total Hydrocarbon Emissions		0.16	0.22	0.70

DATA:

Emission Source:	***Flash Gas from Oil***
Flash Gas Specific Gravity:	***1.0172***
Average Oil Throughput: **(BBLD/Tank)**	***4***
Maximum Oil Throughput: **(BBLD/Tank)**	***12***
Basis of Emission Estimates:	***Comparable Analysis/Vasquez-Beggs Correlation***
Flash Gas Analysis Report Number:	***Southern Petroleum Laboratories Report No.: 2030-18060114-002A***

Estimates for gas volumes and composition associated with this stage of the process were derived from a laboratory test of an oil sample collected at another site under similar conditions (pressure & temperature), refer to supporting documentation. This representative analysis is expected to yield a comparable VOC total but individual component values may vary from site to site. The following table shows the field conditions compared to the results from the laboratory test:

API Oil Gravity @ 60°F	**Process Conditions**		**Gas/Oil Ratio**
	Pressure (PSIG)	**Temperature (°F)**	**(SCF/BBL)**
Actual Facility Conditions:			
41	30	120	
	0	80	Unknown
Laboratory Conditions:			
39.645	23	118	
	0	60	13.2582
		Prorated GOR Estimate:	**18.51**

Since an oil flash analysis has not been performed on an actual sample collected from this particular producing zone, the "Gas to Oil" (GOR) ratio estimated above will be compared with a value derived from the Vasquez-Beggs Correlation presented in the following table. For purposes of permitting, the higher of the two GOR values will be used within these emission estimates.

VASQUEZ-BEGGS CORRELATION		
I N P U T	*Stock Tank Oil API Gravity (API) =*	*41*
	Flash Gas Specific Gravity (SG_i) =	*1.0172*
	Flash Gas Pressure Drop (psig) (P_i) =	*30*
	Pressure Vessel Temperature (°F) (T_i) =	*120*
	Atmospheric Pressure (P_{atm}) =	*14.7*
	Dissolved Gas Gravity @ 100-psig (SG_x) = ***(SG_i)*[1.0+0.00005912*API*T_i*Log((P_i+P_{atm})/114.7)]***	*0.8961*

Constants			
	°API Gravity		
°API →	**< 30**	**≥ 30**	Constants Used based on API Gravity
C1	0.0362	0.0178	0.0178
C2	1.0937	1.187	1.187
C3	25.724	23.931	23.931

GOR = $(C1) * (SG_x) * ((P_i+P_{atm})^{C2}) * e^{[(C3)(API)/(T_i+460)]}$ = **7.88** scf/bbl

refer to "Correlations for Fluid Physical Property Prediction" Journal of Petroleum Technology, Society of Petroleum Engineers, 1980

Avg. Hourly Uncontrolled Flash Rate (SCF/Hr)	=	Oil Rate * GOR	=	**3.09**
Avg. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Flash Gas Gravity * Density of Air * Flash Rate	=	**0.24**
Max. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Avg. Emissions * Ratio of Max. Oil Rate to Avg. Oil Rate	=	**0.72**
Annual Potential Uncontrolled Flash Emissions (TPY)	=	Hourly * 8760/2000	=	**1.05**

SPECIATION FACTORS:

Speciation of the flash gas mixture taken from the referenced laboratory results; refer to supporting documentation

UNCONTROLLED EMISSIONS SUMMARY:

POLLUTANT:	**Weight Percent**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Nitrogen (excluded from VOC total)	0.000	0.0000	0.0000	0.0000
Carbon Dioxide (excluded from VOC total)	9.770	0.0235	0.0704	0.1027
Methane (excluded from VOC total)	29.072	0.0698	0.2094	0.3056
Ethane (excluded from VOC total)	17.787	0.0427	0.1281	0.1870
Hydrogen Sulfide (excluded from VOC total)	0.000	0.0000	0.0000	0.0000
Propane	18.960	0.0455	0.1366	0.1993
Iso-Butane	3.177	0.0076	0.0229	0.0334
N-Butane	9.336	0.0224	0.0673	0.0981
Iso-Pentane	3.492	0.0084	0.0252	0.0367
N-Pentane	3.043	0.0073	0.0219	0.0320
Iso-Hexane	1.804	0.0043	0.0130	0.0190
N-Hexane (TAP)	0.931	0.0022	0.0067	0.0098
Methylcyclopentane	0.000	0.0000	0.0000	0.0000
Benzene (TAP)	0.331	0.0008	0.0024	0.0035

Cyclohexane	0.000	0.0000	0.0000	0.0000
Heptanes	1.405	0.0034	0.0101	0.0148
Methylcyclohexane	0.000	0.0000	0.0000	0.0000
Toluene (TAP)	0.163	0.0004	0.0012	0.0017
2,2,4-Trimethylpentane (TAP)	0.010	0.0000	0.0001	0.0001
Octanes	0.539	0.0013	0.0039	0.0057
Ethylbenzene (TAP)	0.012	0.0000	0.0001	0.0001
Xylenes (TAP)	0.071	0.0002	0.0005	0.0007
Nonanes	0.097	0.0002	0.0007	0.0010
Decanes Plus	0.001	0.0000	0.0000	0.0000
Total Weight Percent:	100.000			
	Total TAP Emissions	0.00	0.01	0.02
	Total VOC Emissions	**0.10**	**0.31**	**0.46**
	Total Non VOC & Non TAP-HC	0.11	0.34	0.49
	Total Emissions	0.24	0.72	1.05

Uncontrolled VOC Emission Total (TPY)	Storage Vapors + Oil Flash Gas	=	**1.08**

DATA:

Emission Source:	***Losses When Opening Thief Hatches***
Specific Gravity of Gas:	***1.0172***
Maximum Thief Hatch Venting (Hrs/Yr) **(Under Normal/Routine Operating Conditions)**	***34***
Number of Tanks in Vent System:	***3***
Max. Minutes a Hatch is Opened in a Single Hour:	***15***
Maximum Hourly Emission Rate (lb/hr): **(from preceding tank emission estimates)**	***0.24***

Avg. Hourly Emissions (lb/hr)	=	Annual Total/8760 (hrs/yr)	=	**0.00**
Maximum Hourly Emissions (lb/hr)	=	Max. Emission Rate * Max. Minutes/Hr Hatch is Open	=	**0.24**
Maximum Annual Emissions (TPY)	=	Max. Hourly THC Rate * Hours/Yr Hatch is Open	=	**0.01**

EMISSION SUMMARY (based on the above referenced oil flash analysis):

POLLUTANT:	**Weight Percent**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Nitrogen (excluded from VOC total)	0.000	0.000	0.000	0.000
Carbon Dioxide (excluded from VOC total)	9.770	0.000	0.023	0.001
Methane (excluded from VOC total)	29.072	0.001	0.070	0.002
Ethane (excluded from VOC total)	17.787	0.000	0.043	0.001
Hydrogen Sulfide (excluded from VOC total)	0.000	0.000	0.000	0.000
Propane	18.960	0.000	0.046	0.001
Iso-Butane	3.177	0.000	0.008	0.000
N-Butane	9.336	0.000	0.022	0.000

Iso-Pentane	3.492	0.000	0.008	0.000
N-Pentane	3.043	0.000	0.007	0.000
Iso-Hexane	1.804	0.000	0.004	0.000
N-Hexane (TAP)	0.931	0.000	0.002	0.000
Methylcyclopentane	0.000	0.000	0.000	0.000
Benzene (TAP)	0.331	0.000	0.001	0.000
Cyclohexane	0.000	0.000	0.000	0.000
Heptanes	1.405	0.000	0.003	0.000
Methylcyclohexane	0.000	0.000	0.000	0.000
Toluene (TAP)	0.163	0.000	0.000	0.000
2,2,4-Trimethylpentane (TAP)	0.010	0.000	0.000	0.000
Octanes	0.539	0.000	0.001	0.000
Ethylbenzene (TAP)	0.012	0.000	0.000	0.000
Xylenes (TAP)	0.071	0.000	0.000	0.000
Nonanes	0.097	0.000	0.000	0.000
Decanes Plus	0.001	0.000	0.000	0.000
Other NM/NE HC	0.000	0.000	0.000	0.000
Total Weight Percent:	100.000			
Total TAP Emissions		0.00	0.00	0.00
Total VOC Emissions		**0.00**	**0.10**	**0.00**
Total Non VOC & Non TAP-HC		0.00	0.11	0.00
Total Emissions		0.00	0.24	0.01

Emission Calculations

Emission calculations shown below are presented for informational purposes only as vapors from the water storage tank are routed to the control flare (EPN: FL-01) for combustion, except during brief intervals when thief hatches are opened for purposes of sampling, gauging, etc.

POINT SOURCE I.D. NUMBER: ***WST-01***

EMISSION SOURCE DESCRIPTION: ***400 BBL Water Storage Tank-Common Vent***

DATA:

Emission Source:	***Water Storage Vapors ('Working' & 'Standing')***
Average Daily Water Throughput: **(Annual Average; BBLD - Q_{avg})**	***50***
Maximum Daily Water Throughput: **(BBLD - Q_{max})**	***50***
Average VOC Working Losses - L_W (lb/yr):	***81.503***
Average VOC Standing Losses - L_S (lb/yr):	***30.524***
Basis of Estimates:	***AP-42, Chapter 7 (June 2020, Section 7.1.3.1);*** ***Refer to supporting documentation for summary***

Avg. Hourly Uncontrolled THC Losses (lb/hr)	=	(Lw + Ls) * 1.134/8760	=	**0.01**
Max. Hourly Uncontrolled THC Losses (lb/hr)	=	(Ls + (Lw * QMax ÷ Qavg)) * 1.134/8760	=	**0.01**
Annual Potential Uncontrolled THC Losses (TPY)	=	Hourly * 8760/2000	=	**0.06**

SPECIATION FACTORS:

Speciation factors were taken from "Air Emissions Species Manual - Volume I: Volatile Organic Compound Species Profiles", 2nd edition; Report No.: EPA-450/2-90-001a; page 258; reference supporting documentation.

UNCONTROLLED EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Hydrogen Sulfide (excluded from VOC total)	0.00	0.0000	0.0000	0.0000
Methane (excluded from VOC total)	6.20	0.0009	0.0009	0.0039
Ethane (excluded from VOC total)	5.60	0.0008	0.0008	0.0036
Propane	17.60	0.0026	0.0026	0.0112
Iso-Butane	1.50	0.0002	0.0002	0.0010
N-Butane	27.10	0.0039	0.0039	0.0172
Iso-Pentane	1.50	0.0002	0.0002	0.0010
N-Pentane	14.60	0.0021	0.0021	0.0093
Heptane	9.20	0.0013	0.0013	0.0058
Octane	6.90	0.0010	0.0010	0.0044
Other NM/NE Hydrocarbons	1.80	0.0003	0.0003	0.0011

N-Hexane (TAP)	7.90	0.0011	0.0011	0.0050
Benzene (TAP)	0.10	0.0000	0.0000	0.0001
Total Weight Percent:	100.00			
Total TAP Emissions		0.00	0.00	0.01
Total VOC Emissions		**0.01**	**0.01**	**0.06**
Total Non VOC & Non TAP-HC		0.00	0.00	0.01
Total Hydrocarbon Emissions		0.01	0.01	0.06

DATA:

Emission Source:	***Flash Gas from Brine Solution***
Approx. Pressure Drop of Brine Solution: (psig)	***30***
Approx. Temperature of Brine Solution: (^oF)	***120***
Flash Gas Specific Gravity: ***(based on an actual wet gas analysis)***	***0.6927***
Avg. Water Throughput: (BBLD)	***50***
Max. Water Throughput: (BBLD)	***50***
Gas to Water Ratio: (SCF/BBL of Brine; GWR)	***0.3***
Basis of Emission Estimates:	***API Documentation & Actual Wet Gas Analysis (Refer to supporting documentation)***
Flash Gas Analysis Report Number:	***Southern Petroleum Laboratories Report No.: 2030-22040183-001A***

Avg. Hourly Uncontrolled Flash Rate (SCF/Hr)	=	Brine Rate * GWR	=	**0.63**
Avg. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Flash Gas Gravity * Density of Air * Flash Rate	=	**0.03**
Max. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Avg. Emissions * Ratio of Max. Water Rate to Avg. Water Rate	=	**0.03**
Annual Potential Uncontrolled Flash Emissions (TPY)	=	Hourly * 8760/2000	=	**0.13**

EMISSION ESTIMATES:

The magnitude of the solubility of natural gas in the interstitial water present in oil sands was studied by The American Petroleum Institute (API) and presented in a 1944 document entitled, "P-V-T and Solubility Relations". Results of these studies have been projected to provide estimates of gas volumes present in the brine solution handled at this site within the specific pressure and temperature ranges expected. The composition of this gas is based on the referenced analysis.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	1.1487	0.0004	0.0004	0.0015
Carbon Dioxide (excluded from VOC total)	0.1675	0.0001	0.0001	0.0002
Methane (excluded from VOC total)	66.2849	0.0221	0.0221	0.0871
Ethane (excluded from VOC total)	15.0336	0.0050	0.0050	0.0198
Hydrogen Sulfide (excluded from VOC total)	0.0000	0.0000	0.0000	0.0000
Propane	9.0628	0.0030	0.0030	0.0119
Iso-Butane	1.1902	0.0004	0.0004	0.0016
N-Butane	3.3173	0.0011	0.0011	0.0044

Iso-Pentane	0.8633	0.0003	0.0003	0.0011
N-Pentane	0.9645	0.0003	0.0003	0.0013
Iso-Hexane	1.1928	0.0004	0.0004	0.0016
N-Hexane (TAP)	0.2763	0.0001	0.0001	0.0004
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.0561	0.0000	0.0000	0.0001
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	0.1492	0.0000	0.0000	0.0002
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.0569	0.0000	0.0000	0.0001
2,2,4-Trimethylpentane (TAP)	0.0661	0.0000	0.0000	0.0001
Octanes Plus	0.1501	0.0001	0.0001	0.0002
Ethylbenzene (TAP)	0.0032	0.0000	0.0000	0.0000
Xylenes (TAP)	0.0166	0.0000	0.0000	0.0000
Total Weight Percent:	100.0000			
Total TAP Emissions		0.00	0.00	0.00
Total VOC Emissions		**0.01**	**0.01**	**0.02**
Total Non VOC & Non TAP-HC		0.03	0.03	0.11
Total Emissions		0.03	0.03	0.13

Uncontrolled VOC Emission Total (TPY)	Storage Vapors + Brine Flash Gas	=	**0.08**

DATA:

Emission Source:	***Losses When Opening Thief Hatches***
Specific Gravity of Gas:	***0.6927***
Maximum Thief Hatch Venting (Hrs/Yr) **(Under Normal/Routine Operating Conditions)**	***47***
Max. Minutes a Hatch is Opened in a Single Hour:	***15***
Maximum Hourly Emission Rate (lb/hr): **(from preceding tank emission estimates)**	***0.01***

Avg. Hourly Emissions (lb/hr)	=	Annual Total/8760 (hrs/yr)	=	**0.00**
Maximum Hourly Emissions (lb/hr)	=	Max. Emission Rate * Max. Minutes/Hr Hatch is Open	=	**0.01**
Maximum Annual Emissions (TPY)	=	Max. Hourly THC Rate * Hours/Yr Hatch is Open	=	**0.00**

EMISSION SUMMARY (based on the above referenced actual wet gas analysis):

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	1.1487	0.000	0.000	0.000
Carbon Dioxide (excluded from VOC total)	0.1675	0.000	0.000	0.000
Methane (excluded from VOC total)	66.2849	0.000	0.007	0.001
Ethane (excluded from VOC total)	15.0336	0.000	0.002	0.000

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Hydrogen Sulfide (excluded from VOC total)	0.0000	0.000	0.000	0.000
Propane	9.0628	0.000	0.001	0.000
Iso-Butane	1.1902	0.000	0.000	0.000
N-Butane	3.3173	0.000	0.000	0.000
Iso-Pentane	0.8633	0.000	0.000	0.000
N-Pentane	0.9645	0.000	0.000	0.000
Iso-Hexane	1.1928	0.000	0.000	0.000
N-Hexane (TAP)	0.2763	0.000	0.000	0.000
Methylcyclopentane	0.0000	0.000	0.000	0.000
Benzene (TAP)	0.0561	0.000	0.000	0.000
Cyclohexane	0.0000	0.000	0.000	0.000
Heptanes	0.1492	0.000	0.000	0.000
Methylcyclohexane	0.0000	0.000	0.000	0.000
Toluene (TAP)	0.0569	0.000	0.000	0.000
2,2,4-Trimethylpentane (TAP)	0.0661	0.000	0.000	0.000
Octanes Plus	0.1501	0.000	0.000	0.000
Ethylbenzene (TAP)	0.0032	0.000	0.000	0.000
Xylenes (TAP)	0.0166	0.000	0.000	0.000
Total Weight Percent:	100.0000			
Total TAP Emissions		0.00	0.00	0.00
Total VOC Emissions		**0.00**	**0.00**	**0.00**
Total Non VOC & Non TAP-HC		0.00	0.01	0.00
Total Emissions		0.00	0.01	0.00

Emission Calculations

POINT SOURCE I.D. NUMBER: *FL-01*

EMISSION SOURCE DESCRIPTION: *Control Flare*

DATA:

Emission Source:	***Unburned Hydrocarbons and Products of Combustion***
Atmospheric Gas Streams:	
Gas Stream #1:	***Storage Tank Vapors***
Gas Heat of Combustion (BTU/Ft^3-calculated value):	***1897***
Low Pressure Gas Streams:	
Gas Stream #2a:	***Well Gas***
Gas Heat of Combustion (BTU/Ft^3-actual wet gas analysis):	***1218***
Gas Stream #2b:	***Heater Treater-Flash Gas***
Gas Heat of Combustion (BTU/Ft^3-representative analysis):	***1735***
Pilot Feed:	***Yes***
Gas Heat of Combustion (BTU/Ft^3-actual wet gas analysis):	***1218***
Combustion Efficiency:	***98% for all HC***

Gas Stream #1: Storage Tank Vapors

Gas volume estimates are supported by the calculations associated with EPNs: OST-01 through OST-03 & WST-01 and are outlined below:

INPUT

Maximum Gas Flowrate (scf/hr)	*Operating Time (hrs/year)*	*Burn Efficiency (%)*	*Gas Heat of Combustion (BTU/FT^3)*	*Specific Gravity of Gas*
13.53	*8760*	*98*	*1897*	*1.1976*

CALCULATIONS

Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*13.53*	*x*	*0.98*	*x*	*8,760*
	=	***116,152***	***scf/yr***	=	***13.26 SCF/hr***	
Heat Content (annual hourly average)	=	*gas rate (scf/yr)*	*x*	*gas heat of combustion (BTU/scf)*		
	=	*116,152*	*x*	*1897*		
	=				***0.0252 MMBTU/Hr***	
Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*1.1976*	*x*	*0.0764*	*x*	*13.53*
	=	***1.24***	***lbs/hr***			
Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*1.1976*	*x*	*0.0000382*	*x*	*118,523*
	=	***5.42***	***TPY***			

SPECIATION FACTORS:

Speciation of the flash gas mixture is based on a weighted average of those streams from the tank vents directed to the flare; refer to the weighted average calculation in supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	0.031	0.0004	0.0004	0.0017
Carbon Dioxide (excluded from VOC total)	5.642	0.0698	0.0698	0.3059
Methane (excluded from VOC total)	21.003	0.0052	0.0052	0.0228
Ethane (excluded from VOC total)	12.882	0.0032	0.0032	0.0140
Hydrogen Sulfide (TAP; excluded from VOC total)	0.000	0.0000	0.0000	0.0000
Propane	18.150	0.0045	0.0045	0.0197
Iso-Butane	2.459	0.0006	0.0006	0.0027
N-Butane	16.205	0.0040	0.0040	0.0176
Iso-Pentane	2.631	0.0007	0.0007	0.0029
N-Pentane	7.562	0.0019	0.0019	0.0082
Iso-Hexanes	1.073	0.0003	0.0003	0.0012
N-Hexane (TAP)	3.673	0.0009	0.0009	0.0040
Methylcyclopentane	0.000	0.0000	0.0000	0.0000
Benzene (TAP)	0.232	0.0001	0.0001	0.0003
Cyclohexane	0.000	0.0000	0.0000	0.0000
Heptanes	4.487	0.0011	0.0011	0.0049
Methylcyclohexane	0.000	0.0000	0.0000	0.0000
Toluene (TAP)	0.096	0.0000	0.0000	0.0001
2,2,4-Trimethylpentane (TAP)	0.006	0.0000	0.0000	0.0000
Octanes	3.053	0.0008	0.0008	0.0033
Ethylbenzene (TAP)	0.007	0.0000	0.0000	0.0000
Xylenes (TAP)	0.041	0.0000	0.0000	0.0000
Nonanes	0.056	0.0000	0.0000	0.0001
Decanes Plus	0.000	0.0000	0.0000	0.0000
Other NM/NE HC	0.712	0.0002	0.0002	0.0008
TOTAL WEIGHT PERCENT:	100.000			
TOTAL TAP EMISSIONS:		0.00	0.00	0.00
TOTAL VOC EMISSIONS:		**0.01**	**0.01**	**0.07**
TOTAL Non-VOC & Non-TAP HC:		0.01	0.01	0.04
TOTAL EMISSIONS:		0.09	0.09	0.41

Gas Stream #2a: Well Gas

Gas volume estimates are supported by the calculations for EPN: 12-22-WG:

INPUT				
Maximum Gas Flowrate (scf/hr)	*Operating Time (hrs/year)*	*Burn Efficiency (%)*	*Gas Heat of Combustion (BTU/FT^3)*	*Specific Gravity of Gas*
7,291.67	*8760*	*98*	*1218*	*0.6927*

CALCULATIONS						
Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*7,291.67*	*x*	*0.98*	*x*	*8,760*
	=	***62,597,529***	***scf/yr***	=	***7,145.84 SCF/hr***	
Heat Content (annual hourly average)	=	*gas rate (scf/yr)*	*x*	*gas heat of combustion (BTU/scf)*		
	=	*62,597,529*	*x*	*1218*		
	=	***8.7036 MMBTU/Hr***				
Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*0.6927*	*x*	*0.0764*	*x*	*7,291.67*
	=	***385.89***	***lbs/hr***			
Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*0.6927*	*x*	*0.0000382*	*x*	*63,875,029*
	=	***1,690.21***	***TPY***			

SPECIATION FACTORS:

Speciation of the well gas is based on an actual wet gas analysis; refer to Southern Petroleum Laboratories Report No.: 2030-22040183-001 in supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	1.1487	4.4325	4.4325	19.4146
Carbon Dioxide (excluded from VOC total)	0.1675	0.6462	0.6462	2.8304
Methane (excluded from VOC total)	66.2849	5.1158	5.1158	22.4070
Ethane (excluded from VOC total)	15.0336	1.1603	1.1603	5.0820
Hydrogen Sulfide (TAP; excluded from VOC total)	0.0000	0.0000	0.0000	0.0000
Propane	9.0628	0.6994	0.6994	3.0636
Iso-Butane	1.1902	0.0919	0.0919	0.4023
N-Butane	3.3173	0.2560	0.2560	1.1214
Iso-Pentane	0.8633	0.0666	0.0666	0.2918
N-Pentane	0.9645	0.0744	0.0744	0.3260
Iso-Hexanes	1.1928	0.0921	0.0921	0.4032
N-Hexane (TAP)	0.2763	0.0213	0.0213	0.0934
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000

Benzene (TAP)	0.0561	0.0043	0.0043	0.0189
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	0.1492	0.0115	0.0115	0.0504
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.0569	0.0044	0.0044	0.0192
2,2,4-Trimethylpentane (TAP)	0.0661	0.0051	0.0051	0.0224
Octanes Plus	0.1501	0.0116	0.0116	0.0507
Ethylbenzene (TAP)	0.0032	0.0002	0.0002	0.0011
Xylenes (TAP)	0.0166	0.0013	0.0013	0.0056
TOTAL WEIGHT PERCENT:	100.0000			
TOTAL TAP EMISSIONS:		0.03	0.04	0.16
TOTAL VOC EMISSIONS:		**1.34**	**1.34**	**5.87**
TOTAL Non-VOC & Non-TAP HC:		6.28	6.28	27.49
TOTAL EMISSIONS:		12.70	12.70	55.60

Gas Stream #2b: Heater Treater-Flash Gas

Gas volume estimates are supported by the calculations for EPN: 13-22-HT-FG:

INPUT

Maximum Gas Flowrate (scf/hr)	*Operating Time (hrs/year)*	*Burn Efficiency (%)*	*Gas Heat of Combustion (BTU/FT^3)*	*Specific Gravity of Gas*
4.92	*8760*	*98*	*1735*	*1.0331*

CALCULATIONS

Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*4.92*	*x*	*0.98*	*x*	*8,760*
	=	***42,237 scf/yr***		=	***4.82 SCF/hr***	
Heat Content (annual hourly average)	=	*gas rate (scf/yr)*	*x*	*gas heat of combustion (BTU/scf)*		
	=	*42,237*	*x*	*1735*		
	=	***0.0084 MMBTU/Hr***				
Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*1.0331*	*x*	*0.0764*	*x*	*4.92*
	=	***0.39 lbs/hr***				
Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*1.0331*	*x*	*0.0000382*	*x*	*43,099*
	=	***1.70 TPY***				

SPECIATION FACTORS:

Speciation of the flash gas mixture taken from PENCOR Report No.: 32905-5007058311 in supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	0.663	0.0026	0.0026	0.0113
Carbon Dioxide (excluded from VOC total)	0.886	0.0034	0.0034	0.0151
Methane (excluded from VOC total)	31.103	0.0024	0.0024	0.0106
Ethane (excluded from VOC total)	13.599	0.0011	0.0011	0.0046
Hydrogen Sulfide (TAP; excluded from VOC total)	0.000	0.0000	0.0000	0.0000
Propane	17.574	0.0014	0.0014	0.0060
Iso-Butane	7.411	0.0006	0.0006	0.0025
N-Butane	10.840	0.0008	0.0008	0.0037
Iso-Pentane	5.195	0.0004	0.0004	0.0018
N-Pentane	4.017	0.0003	0.0003	0.0014
Iso-Hexanes	2.715	0.0002	0.0002	0.0009
N-Hexane (TAP)	1.562	0.0001	0.0001	0.0005
Methylcyclopentane	0.650	0.0001	0.0001	0.0002
Benzene (TAP)	0.130	0.0000	0.0000	0.0000
Cyclohexane	0.319	0.0000	0.0000	0.0001
Heptanes	0.888	0.0001	0.0001	0.0003
Methylcyclohexane	0.268	0.0000	0.0000	0.0001
Toluene (TAP)	0.212	0.0000	0.0000	0.0001
2,2,4-Trimethylpentane (TAP)	0.124	0.0000	0.0000	0.0000
Octanes	0.254	0.0000	0.0000	0.0001
Ethylbenzene (TAP)	0.005	0.0000	0.0000	0.0000
Xylenes (TAP)	0.022	0.0000	0.0000	0.0000
Nonanes	0.092	0.0000	0.0000	0.0000
Decanes Plus	1.471	0.0001	0.0001	0.0005
Other Nm/NE HC	0.000	0.0000	0.0000	0.0000
TOTAL WEIGHT PERCENT:	100.000			
TOTAL TAP EMISSIONS:		0.00	0.00	0.00
TOTAL VOC EMISSIONS:		**0.00**	**0.00**	**0.02**
TOTAL Non-VOC & Non-TAP HC:		0.00	0.00	0.02
TOTAL EMISSIONS:		0.01	0.01	0.06

Pilot Gas (maximum gas flowrate based on conservative estimate):

INPUT				
Maximum Gas Flowrate (scf/hr)	*Operating Time (hrs/year)*	*Burn Efficiency (%)*	*Gas Heat of Combustion (BTU/FT^3)*	*Specific Gravity of Gas*
21.00	*8760*	*98*	*1218*	*0.6927*

CALCULATIONS						
Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*21.00*	*x*	*0.98*	*x*	*8,760*
	=	***180,281***	***scf/yr***	=	***20.58 SCF/hr***	
Heat Content (annual hourly average)	=	*gas rate (scf/yr)*	*x*	*gas heat of combustion (BTU/scf)*		
	=	*180,281*	*x*	*1218*		
	=				***0.0251 MMBTU/Hr***	

Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*0.6927*	*x*	*0.0764*	*x*	*21.00*
	=	***1.11***	***lbs/hr***			

Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*0.6927*	*x*	*0.0000382*	*x*	*183,960*
	=	***4.87***	***TPY***			

SPECIATION FACTORS:

Speciation of the pilot gas is based on an actual wet gas analysis; refer to Southern Petroleum Laboratories Report No.: 2030-22040183-001A in supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	1.1487	0.0128	0.0128	0.0559
Carbon Dioxide (excluded from VOC total)	0.1675	0.0019	0.0019	0.0082
Methane (excluded from VOC total)	66.2849	0.0147	0.0147	0.0645
Ethane (excluded from VOC total)	15.0336	0.0033	0.0033	0.0146
Hydrogen Sulfide (TAP; excluded from VOC total)	0.0000	0.0000	0.0000	0.0000
Propane	9.0628	0.0020	0.0020	0.0088
Iso-Butane	1.1902	0.0003	0.0003	0.0012
N-Butane	3.3173	0.0007	0.0007	0.0032
Iso-Pentane	0.8633	0.0002	0.0002	0.0008
N-Pentane	0.9645	0.0002	0.0002	0.0009
Iso-Hexanes	1.1928	0.0003	0.0003	0.0012
N-Hexane (TAP)	0.2763	0.0001	0.0001	0.0003
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000

Benzene (TAP)	0.0561	0.0000	0.0000	0.0001
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	0.1492	0.0000	0.0000	0.0001
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.0569	0.0000	0.0000	0.0001
2,2,4-Trimethylpentane (TAP)	0.0661	0.0000	0.0000	0.0001
Octanes Plus	0.1501	0.0000	0.0000	0.0001
Ethylbenzene (TAP)	0.0032	0.0000	0.0000	0.0000
Xylenes (TAP)	0.0166	0.0000	0.0000	0.0000
TOTAL WEIGHT PERCENT:	100.0000			
TOTAL TAP EMISSIONS:		0.00	0.00	0.00
TOTAL VOC EMISSIONS:		**0.00**	**0.00**	**0.02**
TOTAL Non-VOC & Non-TAP HC:		0.02	0.02	0.08
TOTAL EMISSIONS:		0.04	0.04	0.16

Total of Average Hourly VOC emissions estimated for this source:	**1.35**	**Lbs/Hr**
Total of Maximum Hourly VOC emissions estimated for this source:	**1.35**	**Lbs/Hr**
Total of Maximum Annual VOC emissions estimated for this source:	**5.98**	**TPY**

CALCULATIONS - Selected Combustion Products

Summary of all routine streams combusted by this flare:

Gas Stream	*Annual Operating Hours*	*Average Flowrate (SCF/Hr)*	*Maximum Flowrate (SCF/Hr)*	*Average Heat Rate (MMBTU/Hr)*	*Maximum Heat Rate (MMBTU/Hr)*
1. Storage Tank Vapors	8760	13.53	13.53	0.0252	0.0252
2a. Well Gas	8760	7291.67	7291.67	8.7036	8.7036
2b. Heater Treater-Flash Gas	8760	4.92	4.92	0.0084	0.0084
Pilot Feed	8760	21.00	21.00	0.0251	0.0251
	Totals:	***7,331.12***	***7,331.12***	***8.76***	***8.76***

Emission factor for soot is from AP-42 "Compilation of Air Pollution Emission Factors" for an industrial burn flare stack (refer to supporting documentation for copies).

SO_2 emissions based on the composite H_2S composition of the flare gas streams assuming stoichiometric combustion.

POLLUTANT:	**Emission Factor (lb/SCF)**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Soot (expressed as PM_{10})	0.000011	0.08	0.08	0.35
Soot (expressed as $PM_{2.5}$)	0.000011	0.08	0.08	0.35
SO_2	N/A	0.00	0.00	0.00

Emission factors for nitrogen oxide and carbon monoxide are from a 1983 CMA document entitled "A Report on a Flare Efficiency Study", for a non-assisted industrial burn flares. (refer to supporting documentation for copies).

POLLUTANT:	**Emission Factor (lb/10^6 BTU)**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Nitrogen Oxides	0.1380	1.21	1.21	5.29
CO	0.2755	2.41	2.41	10.57

Emission Calculations

POINT SOURCE I.D. NUMBER: ***LD-01***

EMISSION SOURCE DESCRIPTION: ***Loading Losses-Oil Transfer to Tank Truck***

DATA:

Emission Source:	***Vapors from Oil Truck Loading***
Maximum Annual Loading Volume-Barrels (Q):	***4,380***
Average Oil Temperature - °F:	***80***
Average Oil Temperature - °R (T):	***540***
API Oil Gravity@ 100 °F (APIG):	***44.5***
Vapor Molecular Weight - lb/lb/mole (M):	***50***
Saturation Factor (S):	***0.6***
Reid Vapor Pressure = -1.699 + (0.179 x APIG): **(from Eq. 3-5 of API Pub. No.: 4683)**	***6.27***
True Vapor Pressure (P): **(from Fig. 7.1-13b of AP-42)**	***5.64***
Loading Rate-Barrels/Hr (R): **(conservative estimate)**	***180***
Basis of Loading Loss Estimates:	***AP-42; June 2008 edition; refer to supporting documentation***

Annual Uncontrolled Total Emissions (TPY)	= 12.46 * S * P * M/T*Q*42/2000/1000 gallons loaded	=	**0.36**
Hourly Uncontrolled Total Emissions (lb/hr)	= 12.46 * S * P * M/T*R*42/1000 gallons loaded	=	**29.31**
Max. Hourly Uncontrolled Total Emissions (lb/hr)	= 12.46 * S * P * M/T*R*42/1000 gallons loaded	=	**29.31**

SPECIATION FACTORS:

Speciation factors were taken from "Air Emissions Species Manual - Volume I: Volatile Organic Compound Species Profiles", 2nd edition; Report No.: EPA-450/2-90-001a; page 258; reference supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Hydrogen Sulfide (excluded from VOC total)	0.00	0.0000	0.0000	0.0000
Methane (excluded from VOC total)	6.20	1.8172	1.8172	0.0223
Ethane (excluded from VOC total)	5.60	1.6414	1.6414	0.0202
Propane	17.60	5.1586	5.1586	0.0634
Iso-Butane	1.50	0.4397	0.4397	0.0054
N-Butane	27.10	7.9430	7.9430	0.0976
Iso-Pentane	1.50	0.4397	0.4397	0.0054
N-Pentane	14.60	4.2793	4.2793	0.0526
Heptane	9.20	2.6965	2.6965	0.0331
Octane	6.90	2.0224	2.0224	0.0248
Other NM/NE Hydrocarbons	1.80	0.5276	0.5276	0.0065

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
N-Hexane (TAP)	7.90	2.3155	2.3155	0.0284
Benzene (TAP)	0.10	0.0293	0.0293	0.0004
Total Weight Percent	100.00			
Total TAP Emissions		2.35	2.37	0.03
Total VOC Emissions		**25.85**	**25.85**	**0.32**
Total Non VOC & Non TAP-HC		3.46	3.46	0.04
Total Emissions		29.31	29.31	0.36

Calculated Max. Gas Flowrate (SCFH) = **216.93**

Emission Calculations

POINT SOURCE I.D. NUMBER: *LD-02*

EMISSION SOURCE DESCRIPTION: *Loading Losses-Water Transfer to Tank Truck*

DATA:

Emission Source:	***Vapors from Water Truck Loading***
Maximum Annual Loading Volume-Barrels (Q):	***18,250***
Average Oil Temperature - °F:	***80***
Average Oil Temperature - °R (T):	***540***
API Oil Gravity@ 100 °F (APIG):	***44.5***
Vapor Molecular Weight - lb/lb/mole (M):	***50***
Saturation Factor (S):	***0.6***
Reid Vapor Pressure = -1.699 + (0.179 x APIG): **(from Eq. 3-5 of API Pub. No.: 4683)**	***6.27***
True Vapor Pressure (P): **(from Fig. 7.1-13b of AP-42)**	***5.64***
Loading Rate-Barrels/Hr (R): **(conservative estimate)**	***180***
Basis of Loading Loss Estimates:	***AP-42; June 2008 edition; refer to supporting documentation***

Annual Uncontrolled Total Emissions (TPY)	= 12.46 * S * P * M/T*Q*42/2000/1000 gallons loaded * 99% Red	=	**0.01**
Hourly Uncontrolled Total Emissions (lb/hr)	= 12.46 * S * P * M/T*R*42/1000 gallons loaded * 99% Red	=	**0.29**
Max. Hourly Uncontrolled Total Emissions (lb/hr)	= 12.46 * S * P * M/T*R*42/1000 gallons loaded * 99% Red	=	**0.29**

**Emissions are calculated using the total volume of produced water loaded as crude oil and are then reduced based on the assumption that this total volume is 99% water and 1% hydrocarbons.*

SPECIATION FACTORS:

Speciation factors were taken from "Air Emissions Species Manual - Volume I: Volatile Organic Compound Species Profiles", 2nd edition; Report No.: EPA-450/2-90-001a; page 258; reference supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	**Weight Percent**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Hydrogen Sulfide (excluded from VOC total)	0.00	0.0000	0.0000	0.0000
Methane (excluded from VOC total)	6.20	0.0180	0.0180	0.0006
Ethane (excluded from VOC total)	5.60	0.0162	0.0162	0.0006
Propane	17.60	0.0510	0.0510	0.0018
Iso-Butane	1.50	0.0044	0.0044	0.0002
N-Butane	27.10	0.0786	0.0786	0.0027
Iso-Pentane	1.50	0.0044	0.0044	0.0002
N-Pentane	14.60	0.0423	0.0423	0.0015
Heptane	9.20	0.0267	0.0267	0.0009
Octane	6.90	0.0200	0.0200	0.0007

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Other NM/NE Hydrocarbons	1.80	0.0052	0.0052	0.0002
N-Hexane (TAP)	7.90	0.0229	0.0229	0.0008
Benzene (TAP)	0.10	0.0003	0.0003	0.0000
Total Weight Percent	100.00			
Total TAP Emissions		0.02	0.02	0.00
Total VOC Emissions		**0.26**	**0.26**	**0.01**
Total Non VOC & Non TAP-HC		0.03	0.03	0.00
Total Emissions		0.29	0.29	0.01

Calculated Max. Gas Flowrate (SCFH) = **2.15**

Emission Calculations

POINT SOURCE I.D. NUMBERS: ***LC-01***

EMISSION SOURCE DESCRIPTION: ***Pneumatic Controllers***

DATA:

Emission Source:	***Natural Gas Supplied to Controllers & Transmitters***
Fuel Gas Specific Gravity: ***(based on an actual wet gas analysis)***	***0.6927***
Basis of Emission Estimates:	***Manufacturers' Specifications or EPA Publication & Actual Wet Gas Analysis (See supporting documentation)***
Fuel Gas Analysis Report Number:	***Southern Petroleum Laboratories Report No.: 2030-22040183-001A***

"INTERMITTENT-BLEED TYPE": *(Consumption data based on standard type devices for similar applications, as provided by manufacturers' data from Norriseal and Kimray, Inc. or from an EPA publication entitled, "Lessons Learned from Natural Gas STAR Partners).*

Service	Maximum Supply Pressure (PSIG)	Max. Throughput (BBLD)	Maximum Actuator Diameter (inches)	Equivalent Vessel Diameter (inches)	Minimum Dump Height (inches)	Estimated Stroke Rate (strokes/hr)	Estimated Gas Rate Required (SCFH)
Level Controllers (Process Separators)	*30*	*62*	*9*	*24*	*8*	*7*	*1*
Pressure Controllers (Process Vessels)	*30*	*N/A*	*4"*	*N/A*	*N/A*	*1400*	*11*
Pressure Controllers (Fired Equipment)	*30*	*N/A*	*4"*	*N/A*	*N/A*	*600*	*5*
						TOTAL GAS CONSUMPTION :	*17*

Avg. Hourly Uncontrolled Supply Gas Emissions (lb/hr)	=	Hourly Gas Rate * Gas Density	=	**0.90**
Max. Hourly Uncontrolled Supply Gas Emissions (lb/hr)	=	Hourly Gas Rate * Gas Density	=	**0.90**
Annual Potential Uncontrolled Supply Gas Emissions (TPY)	=	Hourly Rate * 8760 hrs/yr/2000 lbs/ton	=	**3.94**

SPECIATION FACTORS:

Speciation of the supply gas is based on the referenced analysis.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	1.1487	0.0103	0.0103	0.0453
Carbon Dioxide (excluded from VOC total)	0.1675	0.0015	0.0015	0.0066

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Methane (excluded from VOC total)	66.2849	0.5966	0.5966	2.6116
Ethane (excluded from VOC total)	15.0336	0.1353	0.1353	0.5923
Hydrogen Sulfide (TAP; excluded from VOC total)	0.0000	0.0000	0.0000	0.0000
Propane	9.0628	0.0816	0.0816	0.3571
Iso-Butane	1.1902	0.0107	0.0107	0.0469
N-Butane	3.3173	0.0299	0.0299	0.1307
Iso-Pentane	0.8633	0.0078	0.0078	0.0340
N-Pentane	0.9645	0.0087	0.0087	0.0380
Iso-Hexanes	1.1928	0.0107	0.0107	0.0470
N-Hexane (TAP)	0.2763	0.0025	0.0025	0.0109
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.0561	0.0005	0.0005	0.0022
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	0.1492	0.0013	0.0013	0.0059
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.0569	0.0005	0.0005	0.0022
2,2,4-Trimethylpentane (TAP)	0.0661	0.0006	0.0006	0.0026
Octanes Plus	0.1501	0.0014	0.0014	0.0059
Ethylbenzene (TAP)	0.0032	0.0000	0.0000	0.0001
Xylenes (TAP)	0.0166	0.0001	0.0001	0.0007
TOTAL WEIGHT PERCENT:	100.0000			
TOTAL TAP EMISSIONS:		0.00	0.00	0.01
TOTAL VOC EMISSIONS:		**0.16**	**0.16**	**0.68**
TOTAL Non-VOC & Non-TAP HC		0.73	0.73	3.20
TOTAL Emissions		0.90	0.90	3.94

Emission Calculations

POINT SOURCE I.D. NUMBERS: ***FE-01***

EMISSION SOURCE DESCRIPTION: ***Fugitive Emissions***

DATA:

Emission Source:	***Fugitive from Light Liquid & Gas-Service Components***
Basis of Emission Estimates:	***U.S. EPA***

EMISSION CALCULATIONS:

	Count - by Service			**THC Emission Factors (c) (kg/hr/source)**		**Calculated THC Emissions**			
						Hourly Emissions (lb/hr)		**Annual Emissions (TPY)**	
	Lt. Liquid	**Gas**	**Total**	**Lt. Liquid Service**	**Gas Service**	**LL**	**Gas**	**LL**	**Gas**
Connectors	34	193	227	2.1E-04	2.0E-04	0.016	0.085	0.07	0.37
Flanges	34	0	34	1.1E-04	3.9E-04	0.008	0.000	0.04	0.00
Open Ends	0	8	8	1.4E-03	2.0E-03	0.000	0.035	0.00	0.15
Pumps[(a)]	0		0	1.3E-02	2.4E-03	0.000	N/A	0.00	N/A
Valves	19	59	78	2.5E-03	4.5E-03	0.105	0.585	0.46	2.56
"Others"[(b)]	1	0	1	7.5E-03	8.8E-03	0.017	0.000	0.07	0.00
TOTALS:	**88**	**260**	**348**			**0.15**	**0.71**	**0.64**	**3.09**

(a) Process Pumps Only

(b) "Others" equipment derived from compressors, diaphragms, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents

(c) Refer to EPA Publication No. 453/R-95-017, "Protocol for Equipment Leak Emission Estimates", copy included in supporting documentation

LIGHT LIQUID-SERVICE SPECIATION FACTORS:

Speciation of the emission stream from components in light liquid service was taken from EPA Publication No.: 453/R-95-017; "Protocol for Equipment Leak Emission Estimates".

EMISSIONS SUMMARY:

Component	**Weight Percent**	**Calculated Emission Rate**	
		Avg. Hourly (lb/hr)	**Avg. Annual (TPY)**
Hydrogen Sulfide (TAP; excluded from VOC total)	0.0	0.0000	0.0000
NMEHC (expressed as VOC)	29.2	0.0424	0.1858
Benzene (TAP)	0.027	0.0000	0.0002
Ethylbenzene (TAP)	0.0170	0.0000	0.0001

Toluene (TAP)	0.075	0.0001	0.0005
Xylenes (m,p,o) (TAP)	0.036	0.0001	0.0002
TOTAL TAP EMISSIONS:		0.00	0.00
TOTAL VOC EMISSIONS:		**0.04**	**0.19**

GAS SERVICE SPECIATION FACTORS:

Speciation of the emission stream from components in gas service is based on an actual wet gas analysis; refer to Southern Petroleum Laboratories Report No.: 2030-22040183-001A in supporting documentation.

EMISSIONS SUMMARY:

Component	Weight Percent	Calculated Emission Rate	
		Avg. Hourly (lb/hr)	Avg. Annual (TPY)
Nitrogen (excluded from VOC total)	1.1487	0.0081	0.0355
Carbon Dioxide (excluded from VOC total)	0.1675	0.0012	0.0052
Methane (excluded from VOC total)	66.2849	0.4678	2.0489
Ethane (excluded from VOC total)	15.0336	0.1061	0.4647
Hydrogen Sulfide (TAP; excluded from VOC total)	0.0000	0.0000	0.0000
Propane	9.0628	0.0640	0.2801
Iso-Butane	1.1902	0.0084	0.0368
N-Butane	3.3173	0.0234	0.1025
Iso-Pentane	0.8633	0.0061	0.0267
N-Pentane	0.9645	0.0068	0.0298
Iso-Hexanes	1.1928	0.0084	0.0369
N-Hexane (TAP)	0.2763	0.0019	0.0085
Methylcyclopentane	0.0000	0.0000	0.0000
Benzene (TAP)	0.0561	0.0004	0.0017
Cyclohexane	0.0000	0.0000	0.0000
Heptanes	0.1492	0.0011	0.0046
Methylcyclohexane	0.0000	0.0000	0.0000
Toluene (TAP)	0.0569	0.0004	0.0018
2,2,4-Trimethylpentane (TAP)	0.0661	0.0005	0.0020
Octanes Plus	0.1501	0.0011	0.0046
Ethylbenzene (TAP)	0.0032	0.0000	0.0001
Xylenes (TAP)	0.0166	0.0001	0.0005
TOTAL WEIGHT PERCENT:	100.0000		
TOTAL TAP EMISSIONS:		0.00	0.01
TOTAL VOC EMISSIONS:		**0.12**	**0.54**
TOTAL Non-VOC & Non-TAP HC:		0.57	2.51
TOTAL Emissions:		0.71	3.09

Facility-Wide VOC Fugitive Totals	=	**0.16 lb/hr**	**0.73 TPY**

Emission Calculations

Emission calculations shown below are presented for informational purposes only as well gas is routed to the control flare (EPN: FL-01) for combustion.

POINT SOURCE I.D. NUMBER: ***12-22-WG***

EMISSION SOURCE DESCRIPTION: ***Well Gas***

DATA:

Emission Source:	***Well Gas***
Gas Specific Gravity:	***0.6927***
Maximum Gas Rate (MSCFD): ***(conservative estimate provided by operator)***	***175***
Basis of Emission Estimates:	***Conservative Estimate Provided By Operator & Actual Wet Gas Analysis (Refer to supporting documentation)***
Well Gas Analysis Report Number:	***Southern Petroleum Laboratories Report No.: 2030-22040183-001A***

Avg. Hourly Uncontrolled Gas Rate (SCF/Hr)	=	Max. Gas Rate * 1000/24	=	**7291.67**
Avg. Hourly Uncontrolled Total Emissions (lb/hr)	=	Gas Gravity * Density of Air * Hourly Gas Rate	=	**385.89**
Max. Hourly Uncontrolled Total Emissions (lb/hr)	=	Gas Gravity * Density of Air * Hourly Gas Rate	=	**385.89**
Annual Potential Uncontrolled Total Emissions (TPY)	=	Hourly * 8760/2000	=	**1690.20**

SPECIATION FACTORS:

Speciation of the well gas is based on the referenced analysis.

EMISSIONS SUMMARY:

POLLUTANT:	**Weight Percent**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Nitrogen (excluded from VOC total)	1.1487	4.4325	4.4325	19.4145
Carbon Dioxide (excluded from VOC total)	0.1675	0.6462	0.6462	2.8304
Methane (excluded from VOC total)	66.2849	255.7880	255.7880	1120.3460
Ethane (excluded from VOC total)	15.0336	58.0135	58.0135	254.0977
Hydrogen Sulfide (excluded from VOC total)	0.0000	0.0000	0.0000	0.0000
Propane	9.0628	34.9724	34.9724	153.1786
Iso-Butane	1.1902	4.5928	4.5928	20.1163
N-Butane	3.3173	12.8014	12.8014	56.0698
Iso-Pentane	0.8633	3.3315	3.3315	14.5918
N-Pentane	0.9645	3.7218	3.7218	16.3013
Iso-Hexane	1.1928	4.6030	4.6030	20.1612
N-Hexane (TAP)	0.2763	1.0662	1.0662	4.6701
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.0561	0.2163	0.2163	0.9474

Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	0.1492	0.5759	0.5759	2.5224
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.0569	0.2197	0.2197	0.9622
2,2,4-Trimethylpentane (TAP)	0.0661	0.2551	0.2551	1.1175
Octanes Plus	0.1501	0.5792	0.5792	2.5367
Ethylbenzene (TAP)	0.0032	0.0124	0.0124	0.0545
Xylenes (TAP)	0.0166	0.0639	0.0639	0.2801
Nonanes	0.0000	0.0000	0.0000	0.0000
Decanes Plus	0.0000	0.0000	0.0000	0.0000
Total Weight Percent:	100.0000			
Total TAP Emissions		1.83	1.83	8.03
Total VOC Emissions		**67.01**	**67.01**	**293.51**
Total Non VOC & Non TAP-HC		313.80	313.80	1374.44
Total Emissions		385.89	385.89	1690.20

Uncontrolled VOC Emission Total (TPY)	Well Gas	=	**293.51**

Emission Calculations

Emission calculations shown below are presented for informational purposes only as off-gas from the heater treater is routed to the control flare (EPN: FL-01) for combustion.

POINT SOURCE I.D. NUMBER: ***13-22-HT-FG***

EMISSION SOURCE DESCRIPTION: ***Heater Treater-Flash Gas***

DATA:

Emission Source:	***Heater Treater Flash Gas***
Flash Gas Specific Gravity:	***1.0331***
Maximum Oil Throughput: **(BBLD)**	***12***
Basis of Emission Estimates:	***Comparable Analysis/Vasquez-Beggs Correlation***
Flash Gas Analysis Report Number:	***PENCOR Report No.: 32905-5007058311***

Estimates for gas volumes and composition associated with this stage of the process were derived from a laboratory test of an oil sample collected at another site under similar conditions (pressure & temperature), refer to supporting documentation. This representative analysis is expected to yield a comparable VOC total but individual component values may vary from site to site. The following table shows the field conditions compared to the results from the laboratory test:

API Oil Gravity @ 60°F	**Process Conditions**		**Gas/Oil Ratio**
	Pressure (PSIG)	**Temperature (°F)**	**(SCF/BBL)**
Actual Facility Conditions:			
41	60	80	
	30	120	Unknown
Laboratory Conditions:			
39.1	48	70	
	20	125	9
		Prorated GOR Estimate:	**9.84**

Since an oil flash analysis has not been performed on an actual sample collected from this particular producing zone, the "Gas to Oil" (GOR) ratio estimated above will be compared with a value derived from the Vasquez-Beggs Correlation presented in the following table. For purposes of permitting, the higher of the two GOR values will be used within these emission estimates.

VASQUEZ-BEGGS CORRELATION		
I N P U T	*Stock Tank Oil API Gravity (API) =*	*41*
	Flash Gas Specific Gravity (SG_i) =	*1.0331*
	Flash Gas Pressure Drop (psig) (P_i) =	*30*
	Pressure Vessel Temperature (°F) (T_i) =	*80*
	Atmospheric Pressure (P_{atm}) =	*14.7*
	Dissolved Gas Gravity @ 100-psig (SG_x) = ***(SG_i)*[1.0+0.00005912*API*T_i*Log((P_i+P_{atm})/114.7)]***	*0.9511*

Constants

°API →	°API Gravity < 30	°API Gravity ≥ 30	Constants Used based on API Gravity
C1	0.0362	0.0178	0.0178
C2	1.0937	1.187	1.187
C3	25.724	23.931	23.931

GOR = **$(C1) * (SG_x) * ((P_i+P_{atm})^{C2}) * e^{[(C3)(API)/(T_i+460)]}$ = 9.48** scf/bbl

refer to "Correlations for Fluid Physical Property Prediction" Journal of Petroleum Technology, Society of Petroleum Engineers, 1980

Avg. Hourly Uncontrolled Flash Rate (SCF/Hr)	=	Oil Rate * GOR	=	**4.92**
Avg. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Flash Gas Gravity * Density of Air * Flash Rate	=	**0.39**
Max. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Flash Gas Gravity * Density of Air * Flash Rate	=	**0.39**
Annual Potential Uncontrolled Flash Emissions (TPY)	=	Hourly * 8760/2000	=	**1.71**

SPECIATION FACTORS:

Speciation of the flash gas mixture taken from the referenced laboratory results; refer to supporting documentation.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES Average Hourly (lb/hr)	CALCULATED EMISSION RATES Maximum Hourly (lb/hr)	CALCULATED EMISSION RATES Annual (TPY)
Nitrogen (excluded from VOC total)	0.663	0.0026	0.0026	0.0113
Carbon Dioxide (excluded from VOC total)	0.886	0.0034	0.0034	0.0151
Methane (excluded from VOC total)	31.103	0.1208	0.1208	0.5313
Ethane (excluded from VOC total)	13.599	0.0528	0.0528	0.2323
Hydrogen Sulfide (excluded from VOC total)	0.000	0.0000	0.0000	0.0000
Propane	17.574	0.0682	0.0682	0.3002
Iso-Butane	7.411	0.0288	0.0288	0.1266
N-Butane	10.840	0.0421	0.0421	0.1852
Iso-Pentane	5.195	0.0202	0.0202	0.0887
N-Pentane	4.017	0.0156	0.0156	0.0686
Iso-Hexane	2.715	0.0105	0.0105	0.0464
N-Hexane (TAP)	1.562	0.0061	0.0061	0.0267
Methylcyclopentane	0.650	0.0025	0.0025	0.0111

Benzene (TAP)	0.130	0.0005	0.0005	0.0022
Cyclohexane	0.319	0.0012	0.0012	0.0054
Heptanes	0.888	0.0034	0.0034	0.0152
Methylcyclohexane	0.268	0.0010	0.0010	0.0046
Toluene (TAP)	0.212	0.0008	0.0008	0.0036
2,2,4-Trimethylpentane (TAP)	0.124	0.0005	0.0005	0.0021
Octanes	0.254	0.0010	0.0010	0.0043
Ethylbenzene (TAP)	0.005	0.0000	0.0000	0.0001
Xylenes (TAP)	0.022	0.0001	0.0001	0.0004
Nonanes	0.092	0.0004	0.0004	0.0016
Decanes Plus	1.471	0.0057	0.0057	0.0251
Total Weight Percent:	100.000			
	Total TAP Emissions	0.01	0.01	0.04
	Total VOC Emissions	**0.21**	**0.21**	**0.92**
	Total Non VOC & Non TAP-HC	0.17	0.17	0.76
	Total Emissions	0.39	0.39	1.71

Uncontrolled VOC Emission Total (TPY)	Heater Treater Flash Gas	=	**0.92**

Michael Watson
SECRETARY OF STATE

This is not an official certificate of good standing.

Name History

Name	Name Type
KAISER-FRANCIS OIL COMPANY	Legal

Business Information

Business Type:	Profit Corporation
Business ID:	507505
Status:	Good Standing
Effective Date:	01/18/1983
State of Incorporation:	DE
Principal Office Address:	6733 S. Yale Avenue Tulsa, OK 74136

Registered Agent

Name

C T CORPORATION SYSTEM
645 LAKELAND EAST DR STE 101
FLOWOOD, MS 39232

Officers & Directors

Name	Title
Robert Waldo 6733 S. Yale Avenue Tulsa, OK 74136	President
Don P Millican 6733 S. Yale Avenue Tulsa, OK 74136	Director, Vice President
Ken Kinnear 6733 S. Yale Avenue Tulsa, OK 74136	Treasurer
Frederic Dorwart 124 E. Fourth Street Tulsa, OK 74103	Secretary

Broussard Laboratory
101 Ibex Lane
Broussard, LA 70518
Phone 337-210-8044

Certificate of Analysis

Number: 2030-22040183-001A

Apr. 20, 2022

Mike Raines
Kaiser Francis
5733 S Yale Avenue
Tulsa, OK 74136

Field:	Gilliland	Sampled By:	CC-Kaiser
Station Name:	34 1-H	Sample Of:	Gas Spot
Cylinder No:	2030-1767	Sample Date:	03/30/2022
Analyzed:	04/20/2022 09:31:25 by TAM	Sample Conditions:	
		Method:	GPA-2261

Analytical Data

Components	Mol. %	Wt. %	GPM at 15.025 psia		
Nitrogen	0.819	1.147		GPM TOTAL C2+	4.783
Carbon Dioxide	0.076	0.167		GPM TOTAL C3+	2.051
Methane	82.526	66.182		GPM TOTAL iC5+	0.389
Ethane	9.986	15.010	2.732		
Propane	4.105	9.049	1.157		
Iso-Butane	0.409	1.188	0.137		
n-Butane	1.140	3.312	0.368		
Iso-Pentane	0.239	0.862	0.089		
n-Pentane	0.267	0.963	0.099		
Hexanes	0.191	0.823	0.080		
Heptanes Plus	0.242	1.297	0.121		
	100.000	100.000	4.783		

Physical Properties	**Total**	**C7+**
Relative Density Real Gas	0.6927	3.7019
Calculated Molecular Weight	20.00	107.22
Compressibility Factor	0.9967	
GPA 2172 Calculation:		
Calculated Gross BTU per ft³ @ 15.025 psia & 60°F		
Real Gas Dry BTU	1239	6007
Water Sat. Gas Base BTU	1218	5905

Hydrocarbon Laboratory Manager

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

Southern Petroleum Laboratories Report No.: 2030-22040183-001A

COMPONENT	mole %	MOLE FRACTION	MW	fuel weight	WT frac	Wt %	dh*	Heat Value (BTU/SCF)	Carbon Weight %	C-H ratio	
Nitrogen	0.8190	0.008	28.0134	0.23	0.0115	1.1487	0	0.00	0.0000	0	0
Carbon Dioxide	0.0760	0.001	44.01	0.03	0.0017	0.1675	0	0.00	0.0091	0	0
Methane	82.5260	0.825	16.043	13.24	0.6628	66.2849	1010	833.51	9.9033	0.25	0.206315
Ethane	9.9860	0.100	30.07	3.00	0.1503	15.0336	1770	176.71	2.3962	0.33333	0.033286334
Hydrogen Sulfide	0.0000	0.000	34.08	0.00	0.0000	0.0000	637.1	0.00	0.0000	0	0
Propane	4.1050	0.041	44.097	1.81	0.0906	9.0628	2516	103.29	1.4780	0.375	0.01539375
I-Butane	0.4090	0.004	58.123	0.24	0.0119	1.1902	3252	13.30	0.1963	0.4	0.001636
N-Butane	1.1400	0.011	58.123	0.66	0.0332	3.3173	3262	37.19	0.5472	0.4	0.00456
I-Pentane	0.2390	0.002	72.15	0.17	0.0086	0.8633	4001	9.56	0.1434	0.41667	0.000995841
N-Pentane	0.2670	0.003	72.15	0.19	0.0096	0.9645	4009	10.70	0.1602	0.41667	0.001112509
Other hexanes	0.2765	0.003	86.177	0.24	0.0119	1.1928	4750	13.13	0.1991	0.42857	0.00118487
N-hexane	0.0640	0.001	86.177	0.06	0.0028	0.2763	4756	3.05	0.0461	0.42857	0.000274459
benzene	0.0143	0.000	78.114	0.01	0.0006	0.0561	3742	0.54	0.0103	1	0.000143323
heptane	0.0297	0.000	100.204	0.03	0.0015	0.1492	5503	1.64	0.0250	0.4375	0.000130144
toluene	0.0123	0.000	92.141	0.01	0.0006	0.0569	4475	0.55	0.0104	0.875	0.000107979
iso-octane	0.0116	0.000	114.231	0.01	0.0007	0.0661	6232	0.72	0.0111	0.4444	5.13775E-05
octanes+	0.0208	0.000	144.231	0.03	0.0015	0.1501	6500	1.35	0.0249	0.4444	9.23641E-05
ethylbenzene	0.0006	0.000	106.167	0.00	0.0000	0.0032	5222	0.03	0.0006	0.8	4.8496E-06
xylene	0.0031	0.000	106.167	0.00	0.0002	0.0166	5209	0.16	0.0030	0.8	2.49408E-05
TOTALS	**100.0000**	**1.000**		**19.97**	**1.0000**	**100.0000**		***1205***	***15.1642***		0.265313741
				sg	**0.6888**						
hexanes+	0.4330			**VOC wt%**	**17.3654**			Carbon wt%	75.92032		
				Toxic wt%	**0.4752**						

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor (lb/10^6 scf)	Emission Factor Rating	Emission Factor (lb/10^6 scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from lb/10^6 scf to kg/10^6 m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from 1b/10^6 scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6$ scf$]$ = (3.67) (CON) (C)(D), where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, $4.2x10^4$ $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 grains/10^6 scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content (grains/10^6 scf) to 2,000 grains/10^6 scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor (lb/10^6 scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylchloranthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
207-08-9	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D
74-98-6	Propane	1.6E+00	E

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
7440-38-2	Arsenic[b]	2.0E-04	E
7440-39-3	Barium	4.4E-03	D
7440-41-7	Beryllium[b]	<1.2E-05	E
7440-43-9	Cadmium[b]	1.1E-03	D
7440-47-3	Chromium[b]	1.4E-03	D
7440-48-4	Cobalt[b]	8.4E-05	D
7440-50-8	Copper	8.5E-04	C
7439-96-5	Manganese[b]	3.8E-04	D
7439-97-6	Mercury[b]	2.6E-04	D
7439-98-7	Molybdenum	1.1E-03	D
7440-02-0	Nickel[b]	2.1E-03	C
7782-49-2	Selenium[b]	<2.4E-05	E
7440-62-2	Vanadium	2.3E-03	D
7440-66-6	Zinc	2.9E-02	E

[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. Emission factors preceeded by a less-than symbol are based on method detection limits. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by l6. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020.

[b] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

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Table 3.3-1. EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES[a]

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01) Emission Factor (lb/hp-hr) (power output)	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01) Emission Factor (lb/MMBtu) (fuel input)	Diesel Fuel (SCC 2-02-001-02, 2-03-001-01) Emission Factor (lb/hp-hr) (power output)	Diesel Fuel (SCC 2-02-001-02, 2-03-001-01) Emission Factor (lb/MMBtu) (fuel input)	EMISSION FACTOR RATING
NO_x	0.011	1.63	0.031	4.41	D
CO	6.96 E-03[d]	0.99[d]	6.68 E-03	0.95	D
SO_x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10[b]	7.21 E-04	0.10	2.20 E-03	0.31	D
CO_2[c]	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 μm aerodynamic diameter. All particulate is assumed to be ≤ 1 μm in size.

[c] Assumes 99% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

[d] Instead of 0.439 lb/hp-hr (power output) and 62.7 lb/mmBtu (fuel input), the correct emissions factors values are 6.96 E-03 lb/hp-hr (power output) and 0.99 lb/mmBtu (fuel input), respectively. This is an editorial correction. March 24, 2009

Table 3.3-2. SPECIATED ORGANIC COMPOUND EMISSION FACTORS FOR UNCONTROLLED DIESEL ENGINES[a]

EMISSION FACTOR RATING: E

Pollutant	Emission Factor (Fuel Input) (lb/MMBtu)
Benzene[b]	9.33 E-04
Toluene[b]	4.09 E-04
Xylenes[b]	2.85 E-04
Propylene	2.58 E-03
1,3-Butadiene[b,c]	<3.91 E-05
Formaldehyde[b]	1.18 E-03
Acetaldehyde[b]	7.67 E-04
Acrolein[b]	<9.25 E-05
Polycyclic aromatic hydrocarbons (PAH)	
Naphthalene[b]	8.48 E-05
Acenaphthylene	<5.06 E-06
Acenaphthene	<1.42 E-06
Fluorene	2.92 E-05
Phenanthrene	2.94 E-05
Anthracene	1.87 E-06
Fluoranthene	7.61 E-06
Pyrene	4.78 E-06
Benzo(a)anthracene	1.68 E-06
Chrysene	3.53 E-07
Benzo(b)fluoranthene	<9.91 E-08
Benzo(k)fluoranthene	<1.55 E-07
Benzo(a)pyrene	<1.88 E-07
Indeno(1,2,3-cd)pyrene	<3.75 E-07
Dibenz(a,h)anthracene	<5.83 E-07
Benzo(g,h,l)perylene	<4.89 E-07
TOTAL PAH	1.68 E-04

[a] Based on the uncontrolled levels of 2 diesel engines from References 6-7. Source Classification Codes 2-02-001-02, 2-03-001-01. To convert from lb/MMBtu to ng/J, multiply by 430.
[b] Hazardous air pollutant listed in the *Clean Air Act*.
[c] Based on data from 1 engine.

Table 3.3-3. EFFECT OF VARIOUS EMISSION CONTROL TECHNOLOGIES ON DIESEL ENGINES[a]

Technology	Affected Parameter	
	Increase	Decrease
Fuel modifications		
Sulfur content increase	PM, wear	
Aromatic content increase	PM, NO_x	
Cetane number		PM, NO_x
10% and 90% boiling point		PM
Fuel additives		PM, NO_x
Water/Fuel emulsions		NO_x
Engine modifications		
Injection timing retard	PM, BSFC	NO_x, power
Fuel injection pressure	PM, NO_x	
Injection rate control		NO_x, PM
Rapid spill nozzles		PM
Electronic timing & metering		NO_x, PM
Injector nozzle geometry		PM
Combustion chamber modifications		NO_x, PM
Turbocharging	PM, power	NO_x
Charge cooling		NO_x
Exhaust gas recirculation	PM, power, wear	NO_x
Oil consumption control		PM, wear
Exhaust after-treatment		
Particulate traps		PM
Selective catalytic reduction		NO_x
Oxidation catalysts		TOC, CO, PM

[a] Reference 8. PM = particulate matter. BSFC = brake-specific fuel consumption.

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Tank Emission Calculations Based on AP 42 Chapter 7 (June 2020, Section 7.1.3.1), Fixed Roof

Tank ID	**OST-01 through OST-03**
Tank Description	**400 BBL Oil Storage Tank-Common Vent**
Company Name	**Kaiser-Francis Oil Company**

Tank Orientation	**Vertical**	*Tank Shell Color/Shade*	**Gray - Medium**	*Major City for Meterological Data*	**Tupelo, MS**
Tank Diameter (D ft)	**12.00**	*Tank Shell Paint Condition*	**average**	*Site Elevation (ft)*	**300**
Vertical Height/Horizontal Length (H_S ft)	**20.00**	*Tank Roof Color/Shade*	**Gray - Medium**	*Atmospheric Pressure (P_A psia)*	**14.537**
Roof Height (H_R ft)	**0.38**	*Tank Roof Paint Condition*	**average**	*Table 7.1-2 Liquid*	**Crude Oil**
Max Liquid Height (H_{LX} ft)	**19.00**	*Roof Type*	**vertical tank with cone roof**	*RVP**	**6.27**
Avg Liquid Height (H_L ft)	**9.50**	*Tank Insulation*	**no insulation**	*API gravity**	**41.0**
Breather Vent Pressure Setting (P_{BP} psig)		*Tank Underground?*	**no**	*°F basis for gv**	**60.0**
Breather Vent Vacuum Setting (P_{BV} psig)		*Annual Throughput (Q bbl/year)*	**1,460.00**	*bubble point psia*	
actual tank pressure (P_I psig)	**0.0**	*Annual Turnovers, N*	**3.81**	*API gravity at 60F*	**41.0**
Shell Paint Solar Absorptance (S_A)	**0.71**	*Annual Hours*	**8,760**	*API gravity at 100F*	**44.5**
Roof Paint Solar Absorptance (R_A)	**0.71**	*tank max liquid volume (V_{LX} ft^3)*	**2,148.85**		
breather vent pressure range (ΔP_B psi)	**0.00**	*vapor space outage (H_{VO} ft)*	**10.625**	*Working Loss Product Factor (K_P)*	**0.75**
roof outage (H_{RO} ft)	**0.1250**	*vapor space volume (V_V ft^3)*	**1,201.66**	*working loss turnover factor K_N*	**1.000**

*sales oil data determines RVP per API pub 4683

Tank contents (if not selected from Table 7.1-2):

Antoine constants ($\log_{10}$, mmHg, °C)

component	*mole%*	*MW*	*lb/mole*	*wt%*	*A*	*B*	*C*
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
	0.000		0.000	0.000			

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
hourly average maximum ambient temperature (T_{AX} °F)	51.30	55.80	64.30	73.00	80.60	87.40	90.10	90.10	84.20	74.20	62.90	52.80	72.20
hourly average minimum ambient temperature (T_{AN} °F)	33.20	35.90	43.00	51.00	60.20	68.10	71.50	70.60	63.40	51.60	42.00	34.80	52.10
daily total solar insolation factor (I btu/ft^2 day)	730	964	1309	1682	1912	2026	1990	1849	1536	1201	832	648	1390
daily average ambient temperature (T_{AA} °F)	42.25	45.85	53.65	62.00	70.40	77.75	80.80	80.35	73.80	62.90	52.45	43.80	62.15
liquid bulk temperature (T_B °F)	43.80	47.90	56.44	65.58	74.47	82.07	85.04	84.29	77.07	65.46	54.22	45.18	65.11
average vapor temperature (T_V °F)	46.45	51.39	61.17	71.67	81.39	89.40	92.24	90.98	82.63	69.80	57.23	47.52	70.14
daily ambient temperature range (ΔT_A °R)	18.10	19.90	21.30	22.00	20.40	19.30	18.60	19.50	20.80	22.60	20.90	18.00	20.10
daily vapor temperature range (ΔT_V °R)	23.44	27.62	33.50	39.28	41.43	42.28	41.28	39.91	36.37	32.87	26.95	22.47	33.81
daily average liquid surface temperature (T_{LA} °F)	45.13	49.65	58.81	68.63	77.93	85.73	88.64	87.63	79.85	67.63	55.73	46.35	67.63
daily maximum liquid surface temperature (T_{LX} °F)	50.99	56.55	67.18	78.45	88.29	96.30	98.96	97.61	88.94	75.85	62.47	51.97	76.08
daily minimum liquid surface temperature (T_{LN} °F)	39.26	42.74	50.43	58.80	67.57	75.16	78.32	77.66	70.76	59.41	48.99	40.74	59.17
vapor pressure at daily avg liq surface temp T_{LA} (P_{VA} psia)	2.950	3.223	3.837	4.595	5.418	6.194	6.504	6.396	5.602	4.513	3.621	3.022	4.513
vapor pressure at daily max liq surface temp T_{LX} (P_{VX} psia)	3.307	3.678	4.477	5.467	6.466	7.381	7.705	7.539	6.537	5.225	4.107	3.370	5.246
vapor pressure at daily min liq surface temp T_{LN} (P_{VN} psia)	2.624	2.814	3.272	3.837	4.509	5.162	5.455	5.392	4.774	3.881	3.182	2.703	3.863
daily vapor pressure range (ΔP_V)	0.6832	0.8640	1.2045	1.6301	1.9577	2.2187	2.2503	2.1468	1.7632	1.3440	0.9250	0.6674	1.3822
vapor space expansion factor (K_E)	0.1054	0.1306	0.1772	0.2383	0.2918	0.3435	0.3554	0.3366	0.2647	0.1964	0.1370	0.1024	0.2020
vapor molecular weight (M_V lb/lbmole)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
monthly hours with avg = total annual	744	672	744	720	744	720	744	744	720	744	720	744	8,760
throughputs (ft^3/month) and avg = total annual	696	629	696	674	696	674	696	696	674	696	674	696	8,196
monthly turnovers (N/month) with avg = total annual	0.32	0.29	0.32	0.31	0.32	0.31	0.32	0.32	0.31	0.32	0.31	0.32	3.81
vented vapor saturation factor (K_S)	0.3758	0.3553	0.3164	0.2787	0.2468	0.2228	0.2145	0.2173	0.2407	0.2824	0.3291	0.3701	0.2824
vent setting correction factor (K_B)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
vapor density (W_V lb/ft^3)	0.0272	0.0294	0.0343	0.0403	0.0467	0.0526	0.0549	0.0541	0.0481	0.0397	0.0326	0.0278	0.0397
standing storage losses (L_S lb/month & avg is lb/yr)	57.71	56.39	72.94	82.86	99.15	108.08	116.68	115.00	98.97	84.40	67.12	58.99	1018.29
working losses (L_W lb/month & avg is lb/yr)	14.18	13.86	17.92	20.36	24.36	26.56	28.67	28.25	24.32	20.74	16.49	14.49	250.20
total losses (L_T lb/month & avg is lb/yr)	71.89	70.25	90.86	103.22	123.51	134.64	145.35	143.25	123.29	105.13	83.61	73.49	1268.49
max hourly Q in bbl/hour	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	
max hourly working loss at P_{VX} & Q/hr & K_N=1 (L_W lb/hr)	0.019	0.021	0.024	0.028	0.033	0.037	0.039	0.038	0.034	0.028	0.023	0.019	
breathing/standing loss (L_S lb/hr)	0.078	0.084	0.098	0.134	0.168	0.201	0.210	0.198	0.154	0.113	0.093	0.079	
max hourly total loss (L_T lb/hr)	0.097	0.105	0.122	0.162	0.201	0.238	0.248	0.236	0.187	0.141	0.116	0.099	

L_S sum months	L_W sum months	L_T sum months
1018.29	250.20	1268.49

The monthly sums will be greater than the annual average since the monthly variables yield higher emissions

Emissions Summary:	**avg lbs/hr**	**max lbs/hr**	**lbs/yr**
Standing/Breathing Loss L_S	**0.113**	**0.210**	**992.960**
Working Loss L_W	**0.028**	**0.039**	**243.973**
Total Loss L_T	**0.141**	**0.248**	**1,236.933**

max hourly total loss may not add up to L_S + L_W as their max values may be in different months

VOC Profile Speciation Report

Profile Name : Fixed Roof Tank - Crude Oil Production
Profile Number : 0296
Data Quality : C

Control Device : Uncontrolled
Reference(s) : 59, 72
Data Source : Engineering evaluation of test data and literature data

SCC Assignments: 40301010, 40301011, 40301012, 40301109

Saroad	CAS Number	Name	Spec_MW	Spec_WT	Peak
43115		C-7 CYCLOPARAFFINS	98.19	1.30	
43116		C-8 CYCLOPARAFFINS	112.23	0.50	
43122		ISOMERS OF PENTANE	72.15	1.50	
43201	74-82-8	METHANE	16.04	6.20	
43202	74-84-0	ETHANE	30.07	5.60	
43204	74-98-6	PROPANE	44.09	17.60	
43212	106-97-8	N-BUTANE	58.12	27.10	
43214	75-28-5	ISO-BUTANE	58.12	1.50	
43220	109-66-0	N-PENTANE	72.15	14.60	
43231	110-54-3	HEXANE	86.17	7.90	
43232	142-82-5	HEPTANE	100.20	9.20	
43233	111-65-9	OCTANE	114.23	6.90	
45201	71-43-2	BENZENE	78.11	0.10	
TOTAL				100.00	

Certificate of Analysis

Number: 2030-18060114-002A

Carencro Laboratory
4790 NE Evangeline Thruway
Carencro, LA 70520
Phone 337-896-3055

James Shumaker
Goodrich Petroleum
801 Louisiana
Suite 700
Houston, TX 77002

June 18, 2018

Field: WILKINSON
Station Name: CMR FOSTER CREEK 31-22 H1
Station Number: 2377
Sample Point: HEATER TREATER

Sampled By: CF-SPL
Sample Of: Liquid Spot
Sample Date: 06/08/2018
Sample Conditions: 23 psig, @ 118 °F
Cylinder No: 2030-00895

Analytical Data

Test	Method	Result	Units	Detection Limit	Lab Tech.	Analysis Date
Color Visual	Proprietary	Crude			EG	06/13/2018
API Gravity @ 60° F	ASTM D-5002	39.645	°		EG	06/13/2018
Specific Gravity @ 60/60° F	ASTM D-5002	0.8268	_		EG	06/13/2018
Density @ 60° F	ASTM D-5002	0.8260	g/ml		EG	06/13/2018
Shrinkage Factor	Proprietary	0.9935			EG	06/13/2018
Flash Factor	Proprietary	13.2582	Cu. Ft./S.T. Bbl		EG	06/13/2018

Patti L. Petro

Hydrocarbon Laboratory Manager

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

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Carencro, LA 70520
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OIL AND GAS MEASUREMENT AND ANALYSIS

CERTIFICATE OF ANALYSIS
18060114-002A

Customer:	Goodrich Petroleum	**Report Date:**	06/18/18
Attn:	James Shumaker		
	801 Louisiana	**PO / Ref. No.:**	
	Suite 700		
	Houston, TX 77002		
Company:	Goodrich Petroleum	**Sample Of:**	Flash Gas
Field:	Wilkinson	**Sample Date/Time:**	6/8/2018
Well:	CMR Foster Creek 31-22 H1	**Sample Psig & Temp:**	23 psi @ 118 °F
		Sampled By:	CF-SPL
Sample Point:	2237 Heater Treater	**Cylinder # :**	2030-00895
Comments:	EOS Flash Gas Composition		
	Staged Flash from 23 psi @ 118°F to 0 psi @ 60°F		

	MOL %	WEIGHT %	GPM's @ 15.025
NITROGEN			
METHANE	52.984	29.072	
CO2	6.491	9.770	
ETHANE	17.295	17.787	6.631
PROPANE	12.571	18.960	4.679
I-BUTANE	1.598	3.177	0.501
N-BUTANE	4.696	9.336	1.527
I-PENTANE	1.415	3.492	0.396
N-PENTANE	1.233	3.043	0.349
I-HEXANE	0.612	1.804	0.151
N-HEXANE	0.316	0.931	0.079
2,2,4 TRIMETHYLPENTANE	0.002	0.010	0.000
BENZENE	0.124	0.331	0.045
HEPTANES	0.425	1.405	0.094
TOLUENE	0.052	0.163	0.016
OCTANES	0.141	0.539	0.028
E-BENZENE	0.003	0.012	0.001
m,o,&p-XYLENE	0.019	0.071	0.005
NONANES	0.022	0.097	0.004
DECANES PLUS	0.000	0.001	0.000
TOTALS	100.000	100.000	14.507

CALCULATED VALUES

REAL DRY BTU AT 15.025 PSIA, 60 DEG.F	1564.0	
REAL WET BTU AT 15.025 PSIA, 60 DEG.F	1537.3	
RELATIVE DENSITY	1.0172	
COMPRESSIBILITY FACTOR	0.99279	
	C2+	C5+
GPM's @ 15.025 psia, 60 Deg.F	14.507	1.170

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Tank Emission Calculations Based on AP 42 Chapter 7 (June 2020, Section 7.1.3.1), Fixed Roof

Tank ID	**WST-01**
Tank Description	**400 BBL Water Storage Tank-Common Vent**
Company Name	**Kaiser-Francis Oil Company**

Tank Orientation	**Vertical**	*Tank Shell Color/Shade*	**Gray - Medium**	*Major City for Meterological Data*	**Tupelo, MS**
Tank Diameter (D ft)	**12.00**	*Tank Shell Paint Condition*	**average**	*Site Elevation (ft)*	**300**
Vertical Height/Horizontal Length (H_S ft)	**20.00**	*Tank Roof Color/Shade*	**Gray - Medium**	*Atmospheric Pressure (P_A psia)*	**14.537**
Roof Height (H_R ft)	**0.38**	*Tank Roof Paint Condition*	**average**	*Table 7.1-2 Liquid*	
Max Liquid Height (H_{LX} ft)	**19.00**	*Roof Type*	**vertical tank with cone roof**	*RVP**	
Avg Liquid Height (H_L ft)	**9.50**	*Tank Insulation*	**no insulation**	*API gravity**	
Breather Vent Pressure Setting (P_{BP} psig)		*Tank Underground?*	**no**	*°F basis for gv**	
Breather Vent Vacuum Setting (P_{BV} psig)		*Annual Throughput (Q bbl/year)*	**18,250.00**	*bubble point psia*	
actual tank pressure (P_I psig)	**0.0**	*Annual Turnovers, N*	**47.68**	*API gravity at 60F*	
Shell Paint Solar Absorptance (S_A)	**0.71**	*Annual Hours*	**8,760**	*API gravity at 100F*	
Roof Paint Solar Absorptance (R_A)	**0.71**	*tank max liquid volume (V_{LX} ft^3)*	**2,148.85**		
breather vent pressure range (ΔP_B psi)	**0.00**	*vapor space outage (H_{VO} ft)*	**10.625**	*Working Loss Product Factor (K_P)*	**0.75**
roof outage (H_{RO} ft)	**0.1250**	*vapor space volume (V_V ft^3)*	**1,201.66**	*working loss turnover factor K_N*	**1.000**

*sales oil data determines RVP per API pub 4683

Tank contents (if not selected from Table 7.1-2):

Antoine constants (log_{10}, mmHg, °C)

component	*mole%*	*MW*	*lb/mole*	*wt%*	*A*	*B*	*C*
Water	100.000	18.015	18.01500	100.00000	8.108	1750.300	235.000
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
0	0.000						
	100.000		18.015	100.000			

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
hourly average maximum ambient temperature (T_{AX} °F)	51.30	55.80	64.30	73.00	80.60	87.40	90.10	90.10	84.20	74.20	62.90	52.80	72.20
hourly average minimum ambient temperature (T_{AN} °F)	33.20	35.90	43.00	51.00	60.20	68.10	71.50	70.60	63.40	51.60	42.00	34.80	52.10
daily total solar insolation factor (I btu/ft^2 day)	730	964	1309	1682	1912	2026	1990	1849	1536	1201	832	648	1390
daily average ambient temperature (T_{AA} °F)	42.25	45.85	53.65	62.00	70.40	77.75	80.80	80.35	73.80	62.90	52.45	43.80	62.15
liquid bulk temperature (T_B °F)	43.80	47.90	56.44	65.58	74.47	82.07	85.04	84.29	77.07	65.46	54.22	45.18	65.11
average vapor temperature (T_V °F)	46.45	51.39	61.17	71.67	81.39	89.40	92.24	90.98	82.63	69.80	57.23	47.52	70.14
daily ambient temperature range (ΔT_A °R)	18.10	19.90	21.30	22.00	20.40	19.30	18.60	19.50	20.80	22.60	20.90	18.00	20.10
daily vapor temperature range (ΔT_V °R)	23.44	27.62	33.50	39.28	41.43	42.28	41.28	39.91	36.37	32.87	26.95	22.47	33.81
daily average liquid surface temperature (T_{LA} °F)	45.13	49.65	58.81	68.63	77.93	85.73	88.64	87.63	79.85	67.63	55.73	46.35	67.63
daily maximum liquid surface temperature (T_{LX} °F)	50.99	56.55	67.18	78.45	88.29	96.30	98.96	97.61	88.94	75.85	62.47	51.97	76.08
daily minimum liquid surface temperature (T_{LN} °F)	39.26	42.74	50.43	58.80	67.57	75.16	78.32	77.66	70.76	59.41	48.99	40.74	59.17
vapor pressure at daily avg liq surface temp T_{LA} (P_{VA} psia)	0.148	0.176	0.245	0.346	0.474	0.610	0.669	0.648	0.505	0.335	0.220	0.155	0.335
vapor pressure at daily max liq surface temp T_{LX} (P_{VX} psia)	0.185	0.226	0.330	0.482	0.662	0.849	0.920	0.884	0.676	0.442	0.280	0.191	0.446
vapor pressure at daily min liq surface temp T_{LN} (P_{VN} psia)	0.118	0.135	0.181	0.245	0.334	0.432	0.480	0.470	0.373	0.251	0.171	0.125	0.249
daily vapor pressure range (ΔP_V)	0.0665	0.0912	0.1489	0.2365	0.3279	0.4168	0.4405	0.4140	0.3032	0.1914	0.1083	0.0664	0.1969
vapor space expansion factor (K_E)	0.0511	0.0606	0.0750	0.0910	0.1004	0.1074	0.1070	0.1027	0.0890	0.0758	0.0599	0.0490	0.0780
vapor molecular weight (M_V lb/lbmole)	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02
monthly hours with avg = total annual	744	672	744	720	744	720	744	744	720	744	720	744	8,760
throughputs (ft^3/month) and avg = total annual	8,702	7,860	8,702	8,421	8,702	8,421	8,702	8,702	8,421	8,702	8,421	8,702	102,456
monthly turnovers (N/month) with avg = total annual	4.05	3.66	4.05	3.92	4.05	3.92	4.05	4.05	3.92	4.05	3.92	4.05	47.68
vented vapor saturation factor (K_S)	0.9231	0.9100	0.8786	0.8368	0.7894	0.7442	0.7263	0.7325	0.7787	0.8414	0.8899	0.9197	0.8414
vent setting correction factor (K_B)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
vapor density (W_V lb/ft^3)	0.0005	0.0006	0.0008	0.0011	0.0015	0.0019	0.0020	0.0020	0.0016	0.0011	0.0007	0.0005	0.0011
standing storage losses (L_S lb/month & avg is lb/yr)	1.20	1.27	1.93	2.59	3.59	4.41	4.98	4.83	3.70	2.59	1.69	1.25	34.05
working losses (L_W lb/month & avg is lb/yr)	3.20	3.40	5.16	6.91	9.60	11.79	13.29	12.90	9.87	6.93	4.51	3.35	90.90
total losses (L_T lb/month & avg is lb/yr)	4.40	4.67	7.10	9.50	13.19	16.20	18.26	17.73	13.56	9.52	6.19	4.60	124.95
max hourly Q in bbl/hour	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70	
max hourly working loss at P_{VX} & Q/hr & K_N=1 (L_W lb/hr)	0.004	0.005	0.007	0.010	0.013	0.016	0.018	0.017	0.014	0.009	0.006	0.005	
breathing/standing loss (L_S lb/hr)	0.002	0.002	0.003	0.004	0.006	0.007	0.008	0.007	0.005	0.003	0.002	0.002	
max hourly total loss (L_T lb/hr)	0.006	0.007	0.010	0.014	0.019	0.024	0.026	0.025	0.019	0.013	0.009	0.006	

L_S sum months	L_W sum months	L_T sum months
34.05	90.90	124.95

The monthly sums will be greater than the annual average since the monthly variables yield higher emissions

Emissions Summary:	**avg lbs/hr**	**max lbs/hr**	**lbs/yr**
Standing/Breathing Loss L_S	**0.003**	**0.008**	**30.524**
Working Loss L_W	**0.009**	**0.018**	**81.503**
Total Loss L_T	**0.013**	**0.026**	**112.027**

max hourly total loss may not add up to L_S + L_W as their max values may be in different months

DRILLING AND PRODUCTION PRACTICE

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1945

To calculate the properties of the interstitial water in the reservoir, it is observed from Table 4 that the change in formation volume of pure water at 3,000 psi, absolute, and 200 deg F (due to the solution of 15.4 cu ft per bbl of gas) is 1.0330 minus 1.0271, or 0.0059 bbl per bbl. As the solubility in the interstitial water is only 13.6 cu ft per bbl, the change in formation volume would be expected to be $\frac{13.6}{15.4}$ (0.0059), or 0.0052. Hence, the formation volume of the interstitial water is calculated to be 1.0271 plus 0.0052, or 1.0323 bbl per bbl. A similar calculation at a reservoir pressure of 2,000 psi, absolute, yields a formation volume of 1.0340 bbl per bbl—which indicates that, even though the interstitial water contains less dissolved gas at 2,000 psi, absolute, than it did at 3,000 psi, absolute, its volume is greater at the lower pressure. This result is interesting, because it is opposite to the behavior of natural-gas–crude-oil mixtures.

The compressibility of the saturated interstitial water is found from Fig. 2 by multiplying the correction factor for the gas solubility, 1.12 for a 13.6-cu-ft-per-bbl mixture, times the compressibility, 3.12 times 10^{-6}, of pure water, which gives 3.50 times 10^{-6} bbl per bbl per lb per sq in.

The use of data on the formation volumes of the saturated interstitial water, together with the data on the compressibilities, permits accurate accounting of the interstitial-water behavior for material-balance calculations when the accuracy of the other data justifies the additional refinement.

TABLE 4

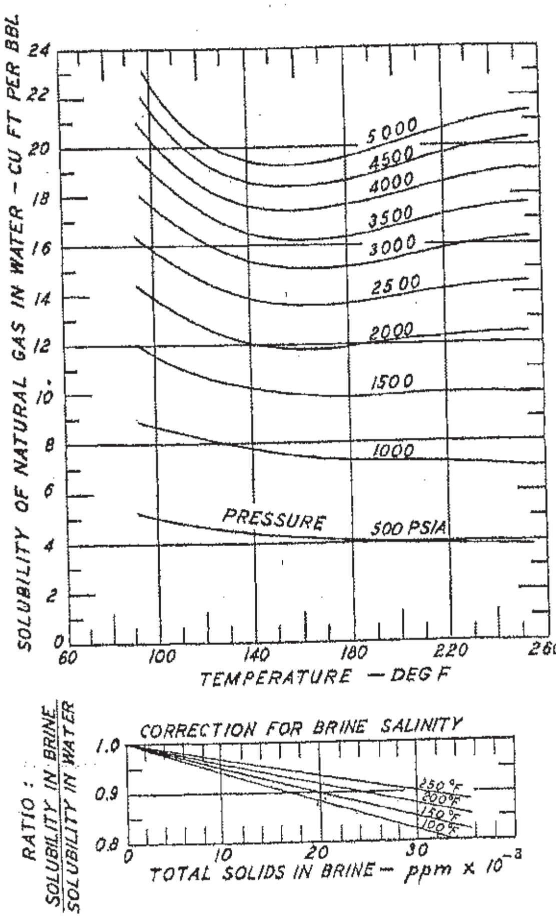
Formation Volumes of Pure Water and Mixtures of Natural Gas and Water

Saturation Pressure (PSI, Absolute)	Formation Volumes—Barrel Per Barrel: 100 Deg F	150 Deg F	200 Deg F	250 Deg F
	Natural Gas and Water			
5,000	0.9989	1.0126	1.0301	1.0522
4,000	1.0003	1.0140	1.0316	1.0537
3,000	1.0017	1.0154	1.0330	1.0552
2,000	1.0031	1.0168	1.0345	1.0568
1,000	1.0045	1.0183	1.0361	1.0584
Pressure (PSI, Absolute)	Pure Water *			
5,000	0.9910	1.0039	1.0210	1.0418
4,000	0.9938	1.0067	1.0240	1.0452
3,000	0.9966	1.0095	1.0271	1.0487
2,000	0.9995	1.0125	1.0304	1.0523
1,000	1.0025	1.0153	1.0335	1.0560
Vapor pressure of water	1.0056	1.0187	1.0370	1.0598

* See reference No. 3.

Water production from so-called "clean" gas wells or high gas-oil-ratio (distillate) wells may be a combination of the water that exists as vapor in the reservoir gas and liquid water that is brought to the surface by mechanical entrainment in the gas. The water produced by condensation is free of salts, whereas the entrained water may contain a considerable amount of dissolved salts.

The amount of water that will be produced from a well as vapor can be determined from Table 5 and Fig. 3. For example, consider the case of a gas reservoir at 3,000 psi, absolute, and 200 deg F, in which the interstitial water has a salinity of 30,000 ppm. From Table 5 and Fig. 3, the amount of water vapor in the formation gas is shown to be 0.82 bbl per 1,000 MCF of dry gas when vaporized from pure water, or 0.82 times 0.93, which equals 0.76 bbl per 1,000 MCF for the gas in equilibrium with the saline interstitial water. If the foregoing reservoir gas is put through a trap operating at 500 psi, absolute, and 100 deg F, the amount of water which can remain as vapor in the gas at these conditions is shown in Table 5 to be 0.31 bbl per 1,000



Solubility of Natural Gas in Water.

FIG. 1

Weighted Average for Storage Tank Vapors to Control Flare (EPN: FL-01)

Working & Breathing Losses from 1-OST:	**0.16**	**lb/hr**
Oil Flash Vapors from 1-OST:	**3.09**	**SCFH**
Total Number of OSTs:	**3**	
Working & Breathing Losses from 1-WST:	**0.01**	**lb/hr**
Brine Flash Vapors from 1-WST:	**0.63**	**SCFH**
Total Number of WSTs:	**1**	

	3.63	**SCFH**	**9.27**	**SCFH**	**0.63**	**SCFH**	**Weighted Avg.**					
Compound	**Vol % Total Working & Breathing Losses**	**SCFH Total Working & Breathing Losses**	**Vol % Total Oil Flash Vapors**	**SCFH Total Oil Flash Vapors**	**Vol % Total Brine Flash Vapors**	**SCFH Total Brine Flash Vapors**	**Total Vol %**	**MW**	**Wt of Gas**	**Wt %**	**dH**	**Heating Value**
Water	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	18	0.000	**0.000**	0	0.00
Nitrogen	0.000	0.000	0.000	0.000	0.8190	0.0052	0.038	28.0134	0.011	**0.031**	0	0.00
Carbon Dioxide	0.000	0.000	6.491	0.602	0.0760	0.0005	4.452	44.01	1.959	**5.642**	0	0.00
Methane	19.820	0.719	52.984	4.912	82.5260	0.5199	45.468	16.043	7.294	**21.003**	1010	459.23
Ethane	9.551	0.346	17.295	1.603	9.9860	0.0629	14.878	30.07	4.474	**12.882**	1770	263.29
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	34.08	0.000	**0.000**	637	0.00
Propane	20.470	0.742	12.571	1.165	4.1050	0.0259	14.295	44.097	6.303	**18.150**	2516	359.66
Iso-Butane	1.324	0.048	1.598	0.148	0.4090	0.0026	1.469	58.123	0.854	**2.459**	3252	47.78
N-Butane	23.913	0.867	4.696	0.435	1.1400	0.0072	9.683	58.123	5.628	**16.205**	3262	315.88
Iso-Pentane	1.066	0.039	1.415	0.131	0.2390	0.0015	1.267	72.15	0.914	**2.631**	4001	50.68
N-Pentane	10.378	0.376	1.233	0.114	0.2670	0.0017	3.640	72.15	2.626	**7.562**	4009	145.92
Other/Iso Hexane	0.000	0.000	0.612	0.057	0.2765	0.0017	0.432	86.177	0.373	**1.073**	4750	20.54
N-Hexane	4.702	0.171	0.316	0.029	0.0640	0.0004	1.480	86.177	1.276	**3.673**	4756	70.40
Methylcyclopentane	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	84.1608	0.000	**0.000**	4501	0.00
Benzene	0.066	0.002	0.124	0.011	0.0143	0.0001	0.103	78.114	0.081	**0.232**	3742	3.87
CycloHexane	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	84.1608	0.000	**0.000**	4482	0.00
Heptanes	4.709	0.171	0.425	0.039	0.0297	0.0002	1.555	100.204	1.558	**4.487**	5503	85.57
Methylcyclohexane	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	98.188	0.000	**0.000**	5216	0.00
Toluene	0.000	0.000	0.052	0.005	0.0123	0.0001	0.036	92.141	0.033	**0.096**	4475	1.62
2,2,4-Trimethylpentane	0.000	0.000	0.002	0.000	0.0116	0.0001	0.002	114.231	0.002	**0.006**	6232	0.12
Octanes	3.098	0.112	0.141	0.013	0.0208	0.0001	0.928	114.231	1.060	**3.053**	6249	58.01
Ethylbenzene	0.000	0.000	0.003	0.000	0.0006	0.0000	0.002	106.167	0.002	**0.007**	5222	0.12
Xylenes	0.000	0.000	0.019	0.002	0.0031	0.0000	0.013	106.167	0.014	**0.041**	5209	0.69
Nonanes	0.000	0.000	0.022	0.002	0.0000	0.0000	0.015	128.258	0.019	**0.056**	6997	1.05
Decanes	0.000	0.000	0.000	0.000	0.0000	0.0000	0.000	142.285	0.000	**0.000**	7743	0.00
Other NM/NE HC	0.904	0.033	0.000	0.000	0.0000	0.0000	0.242	102.09	0.247	**0.712**	5200	12.60
Totals	100.000	3.63	100.000	9.27	100.0000	0.63	100.000		34.730	**100.000**		**1897.02**
		Total Stream Flowrate:	**13.53**	**SCFH**				**SG**	**1.1976**			

Specific Gravity of Tank Vapor Stream 1.7685

Heating Value of Tank Vapor Stream 2891.9

Multi-Stage Separator Test

PENCOR ID No. 32905-01

Separator Conditions Pressure (psig)	Separator Conditions Temperature (°F)	Liquid Density (g/cm^3)	Gas Density (g/cm^3)	Gas Gravity	Solution GOR, Rs (scf/stb)	Solution GOR, Rs (scf/sep bbl)	Liberated GOR, Rl (scf/stb)	Separator Shrinkage (stb / bbl @ P,T)
48	**70**	**0.819**	**N/A**	**N/A**	**25**	**25**	**0**	**0.984**
20	125	0.793	0.002	1.033	16	16	9	0.956
0	80	0.822	0.002	1.734	0	0	16	1.000

Summary Data

Total Separator Gas-Oil Ratio	25	scf/stb
Stock Tank Oil Gravity	40.6	°API at 80 °F
Separator Volume Factor	1.016	bbls@ Psat/stb
Color	Crude	

Notes:

- stb: stock tank barrel @ 80 °F.
- sep bbl: volume of separator liquid at P,T.
- Solution GOR is given as the gas volume per stock tank barrel (stb) and per separator barrel (sep bbl).
- Separator Volume Factor is the inverse of the Separator Shrinkage Factor.
- Standard Conditions: 0 psig at 80 °F.

H.L.P. Engineering, Inc.
Engr: Mr. Thomas LaSalle

LA Environmental Laboratory Accreditation
Cert. No. 01995
ConocoPhillips
TB Well No. 2
Caillou Island Field
Terrebonne Parish, Louisiana

Compositional Analysis of Multi-Stage Flash Gas
Sampled: 20 psig at 125 °F

Component	Mole %	GPM @ 15.025 psia	Wt %	Mole Wt.
Nitrogen	0.703	0.000	0.663	28.013
Carbon Dioxide	0.599	0.000	0.886	44.010
Methane	57.652	0.000	31.103	16.043
Ethane	13.449	3.662	13.599	30.070
Propane	11.851	3.331	17.574	44.097
Iso-Butane	3.792	1.265	7.411	58.123
N-Butane	5.546	1.784	10.840	58.123
Iso-Pentane	2.141	0.800	5.195	72.150
N-Pentane	1.655	0.612	4.017	72.150
Iso-Hexanes	0.937	0.396	2.715	86.177
N-Hexane	0.539	0.226	1.562	86.177
Methylcyclopentane	0.230	0.083	0.650	84.161
Benzene	0.049	0.014	0.130	78.114
Cyclohexane	0.113	0.039	0.319	84.161
Heptanes	0.263	0.124	0.888	100.204
Methylcyclohexane	0.081	0.033	0.268	98.188
Toluene	0.068	0.023	0.212	92.141
Iso-Octane	0.032	0.017	0.124	114.231
Octanes	0.066	0.035	0.254	114.231
Ethyl Benzene	0.001	0.001	0.005	106.167
Xylenes	0.006	0.003	0.022	106.167
Nonanes	0.021	0.012	0.092	128.258
Decane Plus	0.206	0.184	1.471	212.384
Totals	100.000	12.644	100.000	

53.75

Calculated Properties of Gas

Gas Specific Gravity	(Air = 1.00)		=	1.0331	
Net Heat of Combustion	(Btu/Cu.Ft. @ 15.025 Psia @ 60 °F)	Dry	=	1,614.0	Real
Gross Heat of Combustion	(Btu/Cu.Ft. @ 15.025 Psia @ 60 °F)	Dry	=	1,765.5	Real
Gross Heat of Combustion - Sat.	(Btu/Cu.Ft. @ 15.025 Psia @ 60 °F)	Wet	=	1,734.6	Water Sat.
Gas Compressibility	(@ 1 Atm. @ 60 °F)	Z	=	0.9934	

June 1998
RG-109

TNRCC

Air Permit Technical Guidance for Chemical Sources:

Flares and Vapor Oxidizers

printed on
recycled paper

New Source Review Permits Division

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Flare Emission Factors

The usual flare destruction efficiencies and emission factors are provided in Table 4. The high-Btu waste streams referred to in the table have a heating value greater than 1,000 Btu/scf.

Flare Destruction Efficiencies

Claims for destruction efficiencies greater than those listed in Table 4 will be considered on a case-by-case basis. The applicant may make one of the three following demonstrations to justify the higher destruction efficiency: (1) general method, (2) 99.5 percent justification, or (3) flare stack sampling.

Table 4. Flare Factors

Waste Stream	Destruction/Removal Efficiency (DRE)		
VOC	98 percent (generic)		
	99 percent for compounds containing no more than 3 carbons that contain no elements other than carbon and hydrogen in addition to the following compounds: methanol, ethanol, propanol, ethylene oxide and propylene oxide		
H_2S	98 percent		
NH_3	case by case		
CO	case by case		
Air Contaminants	**Emission Factors**		
thermal NO_x	steam-assist:	high Btu	0.0485 lb/MMBtu
		low Btu	0.068 lb/MMBtu
	other:	high Btu	0.138 lb/MMBtu
		low Btu	0.0641 lb/MMBtu
fuel NO_x	NO_x is 0.5 wt percent of inlet NH_3, other fuels case by case		
CO	steam-assist:	high Btu	0.3503 lb/MMBtu
		low Btu	0.3465 lb/MMBtu
	other:	high Btu	0.2755 lb/MMBtu
		low Btu	0.5496 lb/MMBtu
PM	none, required to be smokeless		
SO_2	100 percent S in fuel to SO_2		

Technical Guidance Package for Chemical Sources

Flare Sources

Texas
Natural
Resource
Conservati
on
Commissio
n

John Hall, Chairman
Pam Reed, Commissioner
Peggy Garner, Commissioner
Dan Pearson, Executive Director

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November 1994

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(512) 239-1250

greater than standard destruction efficiencies (>SDE) are claimed. The determinations shall indicate the maximum or minimum values required for flare performance at the claimed efficiency. The determinations shall be made during the testing protocols used to demonstrate >SDE.

A. Tip Velocities and Flow rates (maximum)

B. Heating Values (minimum)

4. The applicant shall install, calibrate, operate and maintain a flow meter to monitor actual stream flow rates to, and calculate tip velocities of, flares for which >SDE are claimed.

5. Records shall be maintained which indicate on a continuous basis the flow rates and heating values of the streams directed to the flares for which >SDE are claimed.

6. Flow rates of streams to flares for which >SDE are claimed shall not exceed the lesser of the indicated maxima; (1) flow rates which produce the tip velocities specified in 40 CFR 60.18, or (2) flow rates demonstrated during testing to correspond to the demonstrated flare efficiency.

7. Tip velocities of flares for which >SDE are claimed shall not exceed the lesser of the indicated maxima; (1) tip velocities specified in 40 CFR 60.18, or (2) tip velocities demonstrated during testing to correspond to the demonstrated flare efficiency.

8. Heating values of streams directed to flares for which >SDE are claimed shall be no less than the greater of the indicated minima; (1) 300 BTU/scf for streams directed to non-assisted flares and 400 BTU/scf for streams directed to assisted flares, or (2) heating values demonstrated during testing to correspond to the demonstrated flare efficiency.

9. The applicant shall provide vendor data supportive of the claimed flare efficiency.

NO_x and CO Emissions

The following NO_x and CO factors were derived by the Chemical Section of the New Source Review Division based on data published in the 1983 CMA document entitled, *A Report on A Flare Efficiency Study*. These factors should be used in estimating NO_x and CO emissions rather than the emission factors found in Section 11.5 of AP-42.

Table 3: Flare Factors.

Type	Waste Gas	NO_x lb/MM Btu	CO lb/MM Btu
Steam Assisted	High Btu (>1000/scf)	0.0485	0.3503
Steam Assisted	Low Btu (192-1000/scf)	0.0680	0.3465
Air & Nonassisted	High Btu (>1000/scf)	0.1380	0.2755
Air & Nonassisted	Low Btu (184-1000/scf)	0.0641	0.5496

Example 2:

For the sample case, calculate the mole percent of each constituent in the waste stream for both the average and maximum scenarios by dividing the individual flow rates by the total flow rates and multiplying by 100 percent.

Table 4: Calculation of constituents in mole percent.

	Average Case		Maximum Case	
	scfm	mole %	scfm	mole %
Butane+	10.16	5.08	12.70	5.08
Propylene	5.94	2.97	7.43	2.97
Propane	5.08	2.54	6.35	2.54
Ethylene	84.74	42.37	105.93	42.37
Ethane	37.28	18.64	46.60	18.64
Hydrogen	22.04	11.02	27.55	11.02
Ammonia	4.24	2.12	5.30	2.12
Inerts	30.50	15.26	38.13	15.26
Totals	200.00	100.00	250.00	100.00

In this case, our calculations are simplified since the average and maximum case waste streams have the same compositions. If they were of different composition, the following heating value calculations would be required for both cases. Note that the maximum case shows the maximum vent stream to the flare under normal operating conditions for the purpose of calculating emissions from the flare (upset and maintenance conditions are not considered).

Next, estimate the net, or lower, heating value of the waste stream

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 13.5-2 (English Units). VOC and CO EMISSIONS FACTORS FOR ELEVATED FLARE OPERATIONS FOR CERTAIN REFINERY AND CHEMICAL MANUFACTURING PROCESSES[a,b]

Pollutant	SCC[e]	Emissions Factor ($lb/10^6$ Btu)[f]	Representativeness
Volatile organic compounds[c]	30190099; 30600904; 30119701; 30119705; 30119709; 30119741; 30119799; 30130115; 30600201; 30600401; 30600508; 30600903; 30600999; 30601701; 30601801; 30688801; 40600240	0.66	Poorly
Carbon monoxide[d]		0.31	Poorly

[a] The emissions factors in this table represent the emissions exiting the flare. Since the flare is not the originating source of the VOC emissions, but rather the device controlling these pollutants routed from a process at the facility, the emissions factor is representative of controlled emissions rates for VOC. This values is not representative of the uncontrolled VOC routed to the flare from the associated process, and as such, it may not be appropriate for estimating the uncontrolled VOC emissions or potential to emit from the associated process.

[b] These factors apply to well operated flares achieving at least 98% destruction efficiency and operating in compliance with the current General Provisions requirements of 40 CFR Part 60, i.e. >300 btu/scf net heating value in the vent gas and less than the specified maximum flare tip velocity. The VOC emissions factor data set had an average destruction efficiency of 98.9%, and the CO emissions factor data set had an average destruction efficiency of 99.1% (based on test reports where destruction efficiency was provided). These factors are based on steam-assisted and air-assisted flares burning a variety of vent gases.

[c] References 4 through 9 and 11.

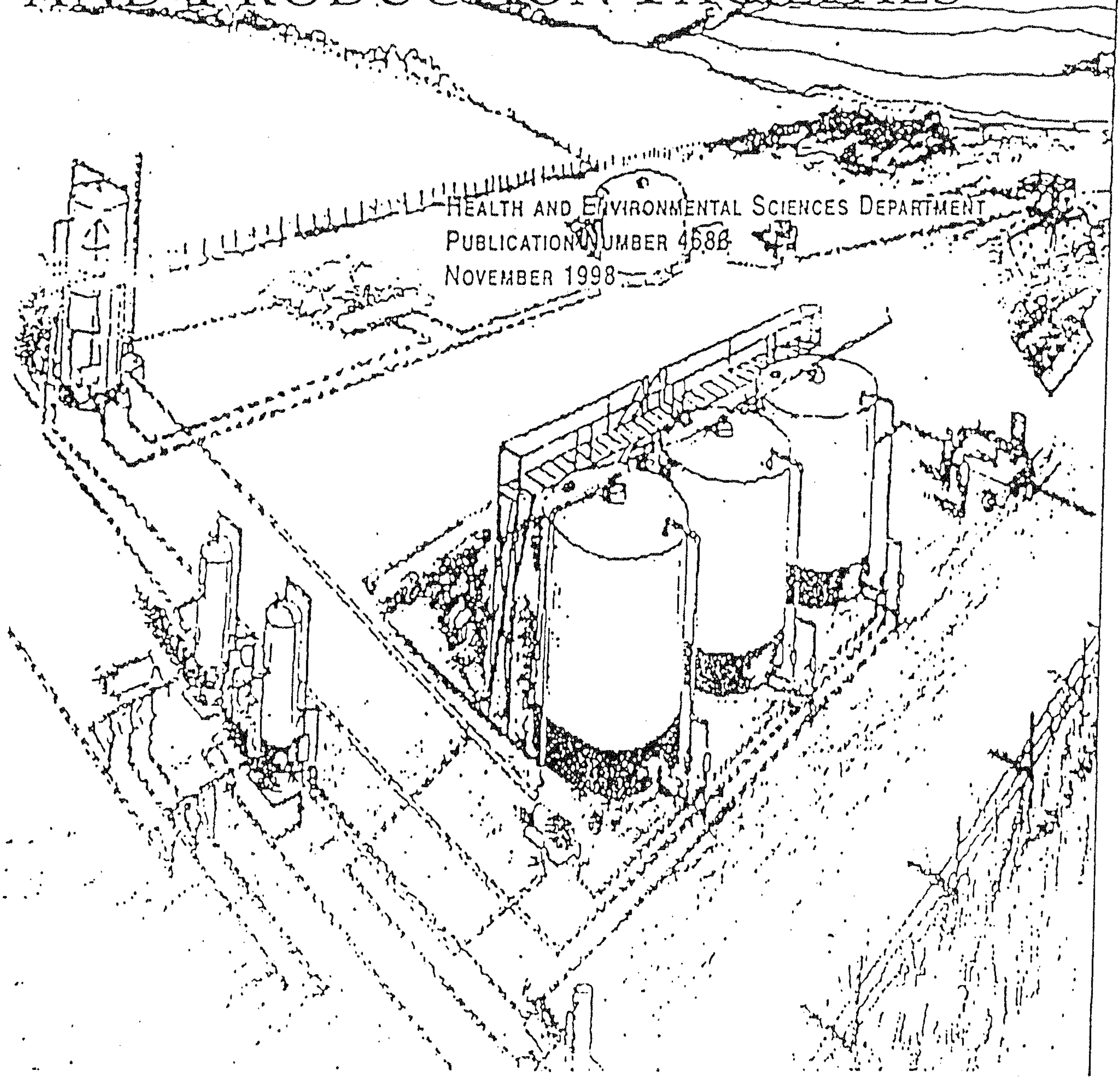
[d] References 1, 4 through 8, and 11.

[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.

Institute

Correlation Equations to Predict Reid Vapor Pressure and Properties of Gaseous Emissions for Exploration and Production Facilities



Health and Environmental Sciences Department

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Table 3-2 summarizes Pearson correlation coefficients (r) calculated for the sales oil RVP relative to the other variables. Better correlations are indicated as $|r|$ approaches 1. Table 3-2 shows that sales oil APIG is the best predictor of RVP. (Note that the sales oil bubble point is an equally good predictor, $r = 0.78$.)

Table 3-2. Single-parameter correlation coefficients for RVP.

Variable	Pearson Correlation With RVP
SP	0.52
ln(SP)	0.51
ST	-0.37
APIG	0.79

REGRESSION ANALYSIS

A multivariate linear regression was developed, represented by the equation shown below.

$$RVP = 0.003 + 0.075 \ln(SP) - 0.016\ ST + 0.165\ APIG \qquad \text{(Equation 3-4)}$$

The correlation coefficient for Equation 3-4 ($r = 0.80$) is not significantly better than the single-parameter coefficient for sales oil APIG shown in Table 3-2. Therefore, the single-parameter fit based on sales oil APIG is recommended for use (see Figure 3-2).

$$RVP = -1.699 + 0.179\ APIG \qquad \text{(Equation 3-5)}$$

The error of the estimate (E) is one measure of the performance of a model or assumption, where the error equals the observed value (Obs) less the estimated value (Est), E = Obs - Est. In Figure 3-2, it is obvious that the error associated with the regression line is much less than the error associated with the default assumption, RVP = 5 psia.

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

Where:

P = stock true vapor pressure, in pounds per square inch absolute.
T = stock temperature, in degrees Fahrenheit.
RVP = Reid vapor pressure, in pounds per square inch.

Note: This equation was derived from a regression analysis of points read off Figure 7.1-13a over the full range of Reid vapor pressures, slopes of the ASTM distillation curve at 10 percent evaporated, and stock temperatures. In general, the equation yields *P* values that are within +0.05 pound per square inch absolute of the values obtained directly from the nomograph.

Figure 7.1-13b. Equation for true vapor pressure of crude oils with a Reid vapor pressure of 2 to 15 pounds per square inch.[4] See note at Figure 7.1-13a.

$$P = \exp\left\{\left[0.7553 - \left(\frac{413.0}{T+459.6}\right)\right]S^{0.5}\log_{10}(RVP) - \left[1.854 - \left(\frac{1{,}042}{T+459.6}\right)\right]S^{0.5}\right.$$

$$\left. + \left[\left(\frac{2{,}416}{T+459.6}\right) - 2.013\right]\log_{10}(RVP) - \left(\frac{8{,}742}{T+459.6}\right) + 15.64\right\}$$

Where:

P = stock true vapor pressure, in pounds per square inch absolute.
T = stock temperature, in degrees Fahrenheit.
RVP = Reid vapor pressure, in pounds per square inch.
S = slope of the ASTM distillation curve at 10 percent evaporated, in degrees Fahrenheit per percent.

Note: This equation was derived from a regression analysis of points read off Figure 7.1-14a over the full range of Reid vapor pressures, slopes of the ASTM distillation curve at 10 percent evaporated, and stock temperatures. In general, the equation yields *P* values that are within +0.05 pound per square inch absolute of the values obtained directly from the nomograph.

Figure 7.1-14b. Equation for true vapor pressure of refined petroleum stocks with a Reid vapor pressure of 1 to 20 pounds per square inch.[4] See note at Figure 7.1-14a.

$A = 15.64 - 1.854\ S^{0.5} - (0.8742-0.3280\ S^{0.5})\ln(RVP)$
$B = 8{,}742 - 1{,}042\ S^{0.5} - (1{,}049-179.4\ S^{0.5})\ln(RVP)$
where:
RVP = stock Reid vapor pressure, in pounds per square inch
ln = natural logarithm function
S = stock ASTM-D86 distillation slope at 10 volume percent evaporation (°F/vol %)

Figure 7.1-15. Equations to determine vapor pressure constants A and B for refined petroleum stocks.[22]

Table 7.1-2. PROPERTIES (M_V, M_L, P_{VA}, W_L) OF SELECTED PETROLEUM LIQUIDS[a, e]

Petroleum Liquid Mixture	Vapor Molecular Weight[a]	Liquid Molecular Weight[b]	Liquid Density [a]	ASTM D86 Distillation Slope[c]	Vapor Pressure Equation Constant[d]	Vapor Pressure Equation Constant[d]	True Vapor Pressure (at 60 °F)
	M_V	M_L	W_L	S	A	B	P_{VA}
	lb/lb-mole	lb/lb-mole	lb/gal	ºF/vol %	dimensionless	ºR	psia
Midcontinent Crude Oil	50	207	7.1	–	Figure 7.1-16	Figure 7.1-16	–
Refined Petroleum Stocks	–	–	–	–	Figure 7.1-15	Figure 7.1-15	–
Motor Gasoline RVP 13	62	92	5.6	3.0	11.644	5043.6	7.0
Motor Gasoline RVP 10	66 [e]	92	5.6	3.0	11.724	5237.3	5.2
Motor Gasoline RVP 7	68	92	5.6	3.0	11.833	5500.6	3.5
Light Naphtha RVP 9-14	–	–	–	3.5	–	–	–
Naphtha RVP 2-8	–	–	–	2.5	–	–	–
Aviation Gasoline	–	–	–	2.0	–	–	–
Jet Naphtha (JP-4)	80	120	6.4	–	11.368	5784.3	1.3
Jet Kerosene (Jet A)	130	162	7.0	–	12.390	8933.0	0.008
No. 2 Fuel Oil (Diesel)	130	188	7.1	–	12.101	8907.0	0.006
No. 6 Fuel Oil [f]	130	387	7.9	–	10.781	8933.0	0.002
Vacuum Residual Oil[g]	190	387	7.9	–	10.104	10,475.5	0.00004

[a] References 10 and 11

[b] Liquid molecular weights from “Memorandum from Patrick B. Murphy, Radian/RTP to James F. Durham, EPA/CPB Concerning Petroleum Refinery Liquid HAP and Properties Data, August 10, 1993,” as adopted in versions 3.1 and 4.0 of EPA’s TANKS software.

[c] Reference 4.

[d] For motor gasolines, see Figure 7.1-15;

for crude oil, see Figure 7.1-16;

for Jet Naphtha, Jet Kerosene, and No. 2 Fuel Oil, see Barnett and Hibbard[10];

for No. 6 Fuel Oil.[22]

[e] Alternatively, in the absence of measured data, a value of 66 lb/lb-mole may be assumed for all gasolines, in that the variability shown as a function of RVP is speculative.

[f] This is for a blend of Vacuum Residual Oil with a light distillate cutter stock, or similar mixture. Vapor pressure constants given will result in higher vapor pressure values than shown previously in AP-42 for Residual Oil No. 6.

[g] This is the straight residue from the bottom of the vacuum distillation column, prior to any further processing or blending. Properties given for Vacuum Residual Oil are those given for Residual Oil No. 6 previously in AP-42.

5.2 Transportation And Marketing Of Petroleum Liquids[1-3]

5.2.1 General

The transportation and marketing of petroleum liquids involve many distinct operations, each of which represents a potential source of evaporation loss. Crude oil is transported from production operations to a refinery by tankers, barges, rail tank cars, tank trucks, and pipelines. Refined petroleum products are conveyed to fuel marketing terminals and petrochemical industries by these same modes. From the fuel marketing terminals, the fuels are delivered by tank trucks to service stations, commercial accounts, and local bulk storage plants. The final destination for gasoline is usually a motor vehicle gasoline tank. Similar distribution paths exist for fuel oils and other petroleum products. A general depiction of these activities is shown in Figure 5.2-1.

5.2.2 Emissions And Controls

Evaporative emissions from the transportation and marketing of petroleum liquids may be considered, by storage equipment and mode of transportation used, in four categories:

1. Rail tank cars, tank trucks, and marine vessels: loading, transit, and ballasting losses.
2. Service stations: bulk fuel drop losses and underground tank breathing losses.
3. Motor vehicle tanks: refueling losses.
4. Large storage tanks: breathing, working, and standing storage losses. (See Chapter 7, "Liquid Storage Tanks".)

Evaporative and exhaust emissions are also associated with motor vehicle operation, and these topics are discussed in AP-42 *Volume II: Mobile Sources*.

5.2.2.1 Rail Tank Cars, Tank Trucks, And Marine Vessels -

Emissions from these sources are from loading losses, ballasting losses, and transit losses.

5.2.2.1.1 Loading Losses -

Loading losses are the primary source of evaporative emissions from rail tank car, tank truck, and marine vessel operations. Loading losses occur as organic vapors in "empty" cargo tanks are displaced to the atmosphere by the liquid being loaded into the tanks. These vapors are a composite of (1) vapors formed in the empty tank by evaporation of residual product from previous loads, (2) vapors transferred to the tank in vapor balance systems as product is being unloaded, and (3) vapors generated in the tank as the new product is being loaded. The quantity of evaporative losses from loading operations is, therefore, a function of the following parameters:

- Physical and chemical characteristics of the previous cargo;
- Method of unloading the previous cargo;
- Operations to transport the empty carrier to a loading terminal;
- Method of loading the new cargo; and
- Physical and chemical characteristics of the new cargo.

The principal methods of cargo carrier loading are illustrated in Figure 5.2-2, Figure 5.2-3, and Figure 5.2-4. In the splash loading method, the fill pipe dispensing the cargo is lowered only part way into the cargo tank. Significant turbulence and vapor/liquid contact occur during the splash

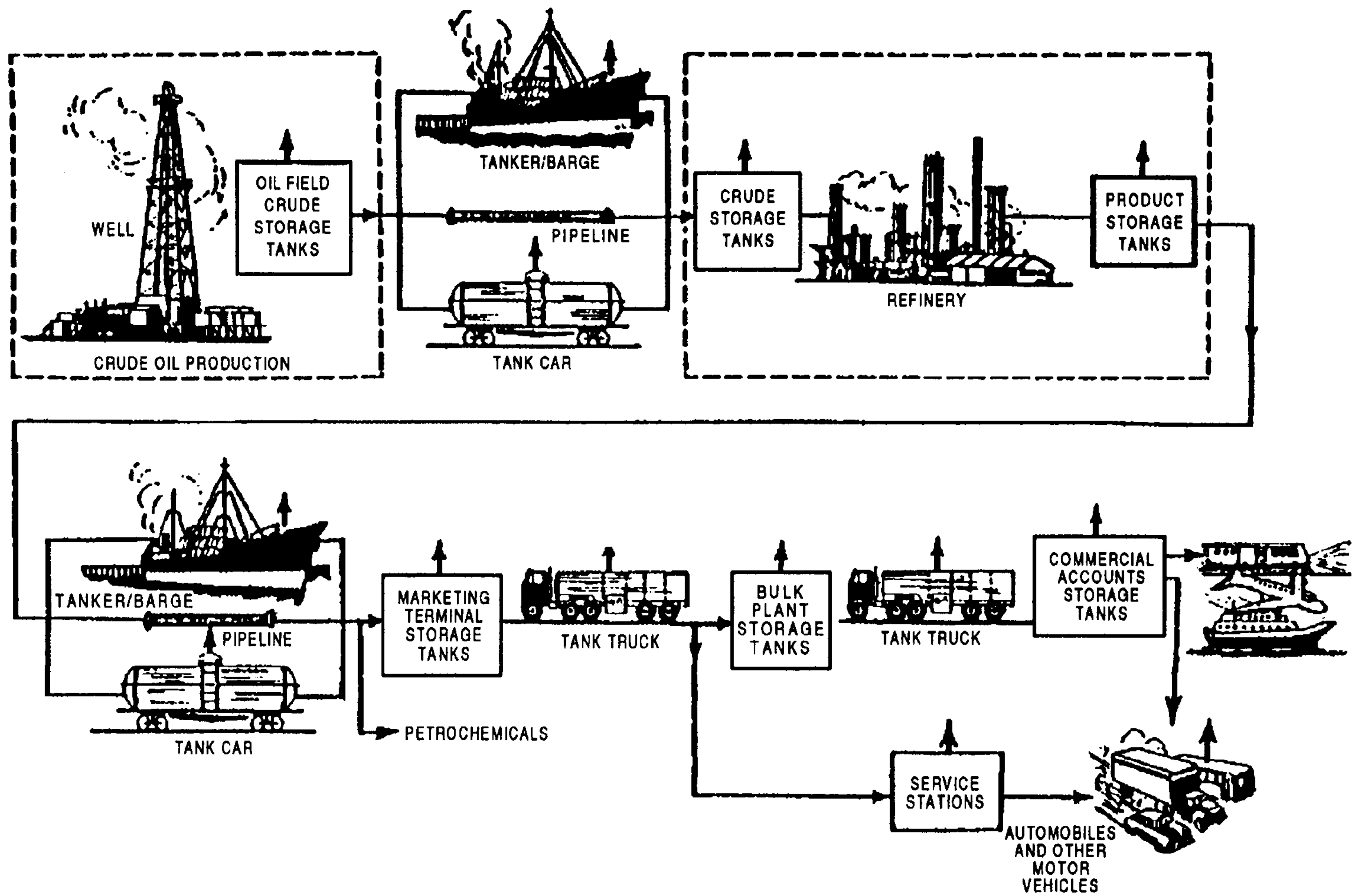

Figure 5.2-1. Flow sheet of petroleum production, refining, and distribution systems.
(Points of organic emissions are indicated by vertical arrows.)

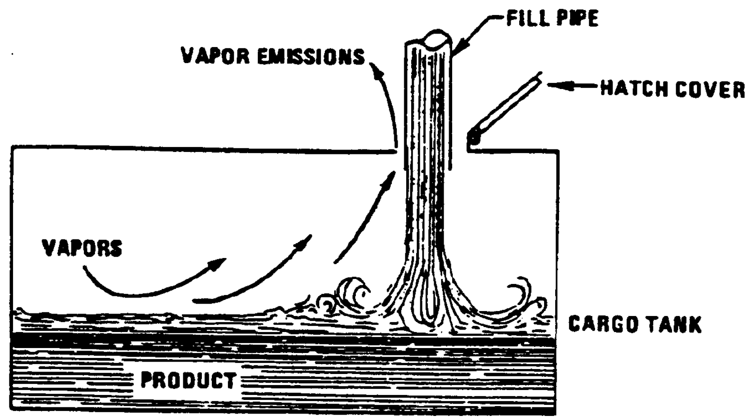

Figure 5.2-2. Splash loading method.

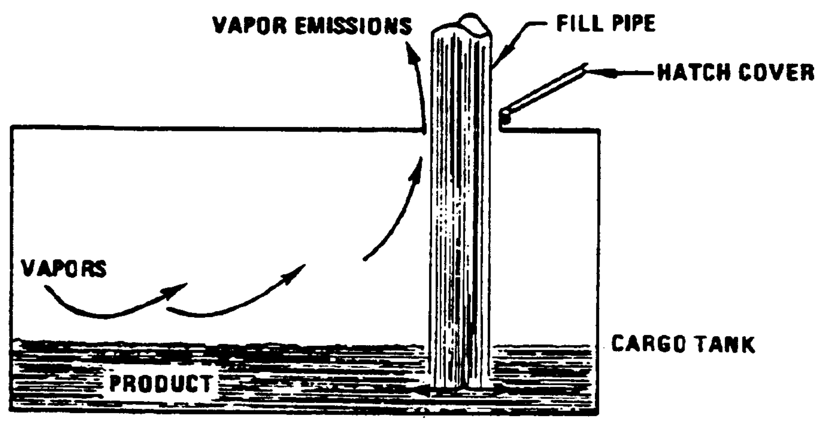

Figure 5.2-3. Submerged fill pipe.

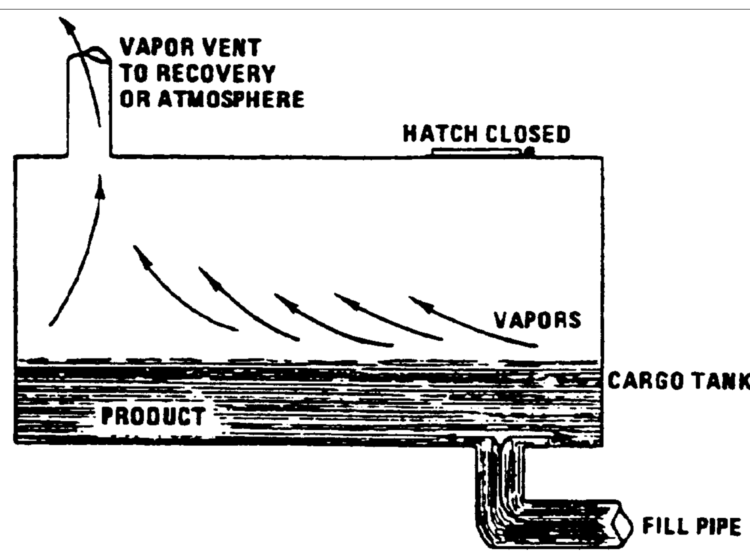

Figure 5.2-4. Bottom loading.

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)

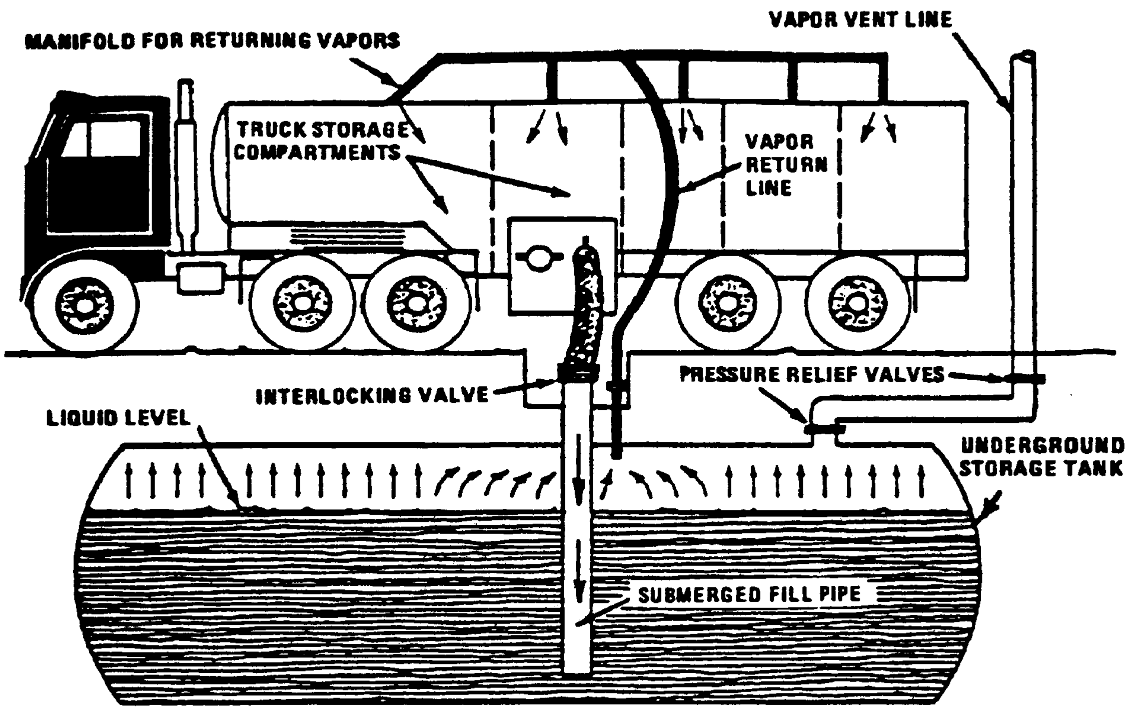

Figure 5.2-5. Tank truck unloading into a service station underground storage tank and practicing "vapor balance" form of emission control.

Table 5.2-1. SATURATION (S) FACTORS FOR CALCULATING PETROLEUM LIQUID LOADING LOSSES

Cargo Carrier	Mode Of Operation	S Factor
Tank trucks and rail tank cars	Submerged loading of a clean cargo tank	0.50
	Submerged loading: dedicated normal service	0.60
	Submerged loading: dedicated vapor balance service	1.00
	Splash loading of a clean cargo tank	1.45
	Splash loading: dedicated normal service	1.45
	Splash loading: dedicated vapor balance service	1.00
Marine vessels[a]	Submerged loading: ships	0.2
	Submerged loading: barges	0.5

[a] For products other than gasoline and crude oil. For marine loading of gasoline, use factors from Table 5.2-2. For marine loading of crude oil, use Equations 2 and 3 and Table 5.2-3.

The saturation factor, S, represents the expelled vapor's fractional approach to saturation, and it accounts for the variations observed in emission rates from the different unloading and loading methods. Table 5.2-1 lists suggested saturation factors.

Emissions from controlled loading operations can be calculated by multiplying the uncontrolled emission rate calculated in Equation 1 by an overall reduction efficiency term:

$$\left(1 - \frac{\text{eff}}{100}\right)$$

The overall reduction efficiency should account for the capture efficiency of the collection system as well as both the control efficiency and any downtime of the control device. Measures to reduce loading emissions include selection of alternate loading methods and application of vapor recovery equipment. The latter captures organic vapors displaced during loading operations and recovers the vapors by the use of refrigeration, absorption, adsorption, and/or compression. The recovered product is piped back to storage. Vapors can also be controlled through combustion in a thermal oxidation unit, with no product recovery. Figure 5.2-6 demonstrates the recovery of gasoline vapors from tank trucks during loading operations at bulk terminals. Control efficiencies for the recovery units range from 90 to over 99 percent, depending on both the nature of the vapors and the type of control equipment used.[5-6] However, not all of the displaced vapors reach the control device, because of leakage from both the tank truck and collection system. The collection efficiency should be assumed to be 99.2 percent for tanker trucks passing the MACT-level annual leak test (not more than 1 inch water column pressure change in 5 minutes after pressurizing to 18 inches water followed by pulling a vacuum of 6 inches water).[7] A collection efficiency of 98.7 percent (a 1.3 percent leakage rate) should be assumed for trucks passing the NSPS-level annual test (3 inches pressure change) A collection efficiency of 70 percent should be assumed for trucks not passing one of these annual leak tests[6].

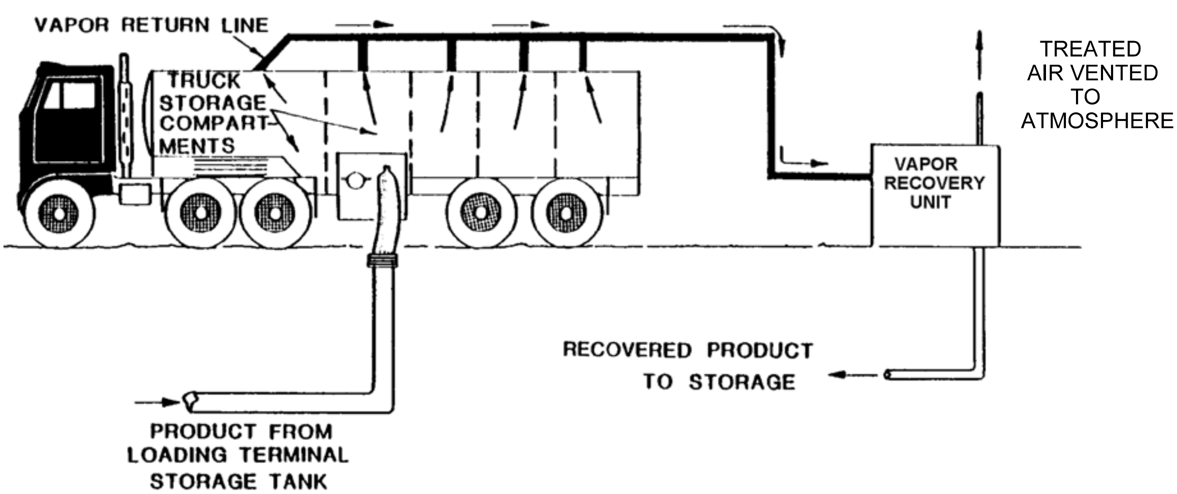

Figure 5.2-6. Tank truck loading with vapor recovery.

Sample Calculation -

Loading losses (L_L) from a gasoline tank truck in dedicated vapor balance service and practicing vapor recovery would be calculated as follows, using Equation 1:

Design basis -

Cargo tank volume is 8000 gal
Gasoline Reid vapor pressure (RVP) is 9 psia
Product temperature is 80°F
Vapor recovery efficiency is 95 percent
Vapor collection efficiency is 98.7 percent (NSPS-level annual leak test)

Loading loss equation -

$$L_L = 12.46 \frac{SPM}{T} \left(1 - \frac{eff}{100}\right)$$

where:

S = saturation factor (see Table 5.2-1) - 1.00
P = true vapor pressure of gasoline = 6.6 psia
M = molecular weight of gasoline vapors = 66
T = temperature of gasoline = 540°R
eff = overall reduction efficiency (95 percent control x 98.7 percent collection) = 94 percent

$$L_L = 12.46 \frac{(1.00)(6.6)(66)}{540} \left(1 - \frac{94}{100}\right)$$

$$= 0.60 \text{ lb}/10^3 \text{ gal}$$

Total loading losses are:

$$(0.60 \text{ lb}/10^3 \text{ gal})(8.0 \times 10^3 \text{ gal}) = 4.8 \text{ pounds (lb)}$$

Measurements of gasoline loading losses from ships and barges have led to the development of emission factors for these specific loading operations.[8] These factors are presented in Table 5.2-2 and should be used instead of Equation 1 for gasoline loading operations at marine terminals. Factors are expressed in units of milligrams per liter (mg/L) and pounds per 1000 gallons (lb/10^3 gal).

Table 5.2-2 (Metric And English Units). VOLATILE ORGANIC COMPOUND (VOC) EMISSION FACTORS FOR GASOLINE LOADING OPERATIONS AT MARINE TERMINALS[a]

Vessel Tank Condition	Previous Cargo	Ships/Ocean Barges[b]		Barges[b]	
		mg/L Transferred	$lb/10^3$ gal Transferred	mg/L Transferred	$lb/10^3$ gal Transferred
Uncleaned	Volatile[c]	315	2.6	465	3.9
Ballasted	Volatile	205	1.7	—[d]	—[d]
Cleaned	Volatile	180	1.5	ND	ND
Gas-freed	Volatile	85	0.7	ND	ND
Any condition	Nonvolatile	85	0.7	ND	ND
Gas-freed	Any cargo	ND	ND	245	2.0
Typical overall situation[e]	Any cargo	215	1.8	410	3.4

[a] References 2,9. Factors are for both VOC emissions (which excludes methane and ethane) and total organic emissions, because methane and ethane have been found to constitute a negligible weight fraction of the evaporative emissions from gasoline. ND = no data.
[b] Ocean barges (tank compartment depth about 12.2 m [40 ft]) exhibit emission levels similar to tank ships. Shallow draft barges (compartment depth 3.0 to 3.7 m [10 to 12 ft]) exhibit higher emission levels.
[c] Volatile cargoes are those with a true vapor pressure greater than 10 kilopascals (kPa) (1.5 psia).
[d] Barges are usually not ballasted.
[e] Based on observation that 41% of tested ship compartments were uncleaned, 11% ballasted, 24% cleaned, and 24% gas-freed. For barges, 76% were uncleaned.

In addition to Equation 1, which estimates emissions from the loading of petroleum liquids, Equation 2 has been developed specifically for estimating emissions from the loading of crude oil into ships and ocean barges:

$$C_L = C_A + C_G \tag{2}$$

where:

C_L = total loading loss, $lb/10^3$ gal of crude oil loaded
C_A = arrival emission factor, contributed by vapors in the empty tank compartment before loading, $lb/10^3$ gal loaded (see Note below)
C_G = generated emission factor, contributed by evaporation during loading, $lb/10^3$ gal loaded

Note: Values of C_A for various cargo tank conditions are listed in Table 5.2-3.

5.2-3 (English Units). AVERAGE ARRIVAL EMISSION FACTORS, C_A, FOR CRUDE OIL LOADING EMISSION EQUATION[a]

Ship/Ocean Barge Tank Condition	Previous Cargo	Arrival Emission Factor, $lb/10^3$ gal
Uncleaned	Volatile[b]	0.86
Ballasted	Volatile	0.46
Cleaned or gas-freed	Volatile	0.33
Any condition	Nonvolatile	0.33

[a] Arrival emission factors (C_A) to be added to generated emission factors (C_G) calculated in Equation 3 to produce total crude oil loading loss (C_L). Factors are for total organic compounds; VOC emission factors average about 15% lower, because VOC does not include methane or ethane.
[b] Volatile cargoes are those with a true vapor pressure greater than 10 kPa (1.5 psia).

This equation was developed empirically from test measurements of several vessel compartments.[8] The quantity C_G can be calculated using Equation 3:

$$C_G = 1.84 \ (0.44 \ P - 0.42) \ \frac{M G}{T} \qquad (3)$$

where:

P = true vapor pressure of loaded crude oil, psia
M = molecular weight of vapors, lb/lb-mole
G = vapor growth factor = 1.02 (dimensionless)
T = temperature of vapors, °R (°F + 460)

Emission factors derived from Equation 3 and Table 5.2-3 represent total organic compounds. Volatile organic compound (VOC) emission factors (which exclude methane and ethane because they are exempted from the regulatory definition of "VOC") for crude oil vapors have been found to range from approximately 55 to 100 weight percent of these total organic factors. When specific vapor composition information is not available, the VOC emission factor can be estimated by taking 85 percent of the total organic factor.[3]

5.2.2.1.2 Ballasting Losses -

Ballasting operations are a major source of evaporative emissions associated with the unloading of petroleum liquids at marine terminals. It is common practice to load several cargo tank compartments with sea water after the cargo has been unloaded. This water, termed "ballast", improves the stability of the empty tanker during the subsequent voyage. Although ballasting practices vary, individual cargo tanks are ballasted typically about 80 percent, and the total vessel 15 to 40 percent, of capacity. Ballasting emissions occur as vapor-laden air in the "empty" cargo tank is displaced to the atmosphere by ballast water being pumped into the tank. Upon arrival at a loading port, the ballast water is pumped from the cargo tanks before the new cargo is loaded. The ballasting of cargo tanks reduces the quantity of vapors returning in the empty tank, thereby reducing the quantity of vapors emitted during subsequent tanker loading. Regulations administered by the U. S. Coast Guard require that, at marine terminals located in ozone nonattainment areas, large tankers with crude oil washing systems contain the organic vapors from ballasting.[10] This is accomplished principally by displacing the vapors during ballasting into a cargo tank being simultaneously unloaded. In other areas, marine vessels emit organic vapors directly to the atmosphere.

Equation 4 has been developed from test data to calculate the ballasting emissions from crude oil ships and ocean barges[8]:

$$L_B = 0.31 + 0.20 \ P + 0.01 \ PU_A \qquad (4)$$

where:

L_B = ballasting emission factor, lb/10^3 gal of ballast water
P = true vapor pressure of discharged crude oil, psia
U_A = arrival cargo true ullage, before dockside discharge, measured from the deck, feet; (the term "ullage" here refers to the distance between the cargo surface level and the deck level)

Table 5.2-4 lists average total organic emission factors for ballasting into uncleaned crude oil cargo compartments. The first category applies to "full" compartments wherein the crude oil true ullage just before cargo discharge is less than 1.5 meters (m) (5 ft). The second category applies to lightered, or short-loaded, compartments (part of cargo previously discharged, or original load a partial fill), with an arrival true ullage greater than 1.5 m (5 ft). It should be remembered that these tabulated emission factors are examples only, based on average conditions, to be used when crude oil vapor pressure is unknown. Equation 4 should be used when information about crude oil vapor pressure and cargo compartment condition is available. The following sample calculation illustrates the use of Equation 4.

5.2-4 (Metric And English Units). TOTAL ORGANIC EMISSION FACTORS FOR CRUDE OIL BALLASTING[a]

	Average Emission Factors			
	By Category		Typical Overall[b]	
Compartment Condition Before Cargo Discharge	mg/L Ballast Water	lb/10^3 gal Ballast Water	mg/L Ballast Water	lb/10^3 gal Ballast Water
Fully loaded[c]	111	0.9	129	1.1
Lightered or previously short loaded[d]	171	1.4 A		

[a] Assumes crude oil temperature of 16°C (60°F) and RVP of 34 kPa (5 psia). VOC emission factors average about 85% of these total organic factors, because VOCs do not include methane or ethane.
[b] Based on observation that 70% of tested compartments had been fully loaded before ballasting. May not represent average vessel practices.
[c] Assumed typical arrival ullage of 0.6 m (2 ft).
[d] Assumed typical arrival ullage of 6.1 m (20 ft).

AIR REQUIRED TO STROKE VALVE

Act Size	Stem Tvl	Diaph.	AIR REQUIRED TO SWITCH (SCF) @ 15 (psig)	@ 20 (psig)	@ 30 (psig)	Nominal Effective Area
9	0.625	F	0.052	0.065	0.092	35
9	0.750	F	0.079	0.096	0.119	
9	1.000	M	0.050	0.060	0.080	
9	1.250	M	0.091	0.111	0.126	
12	0.625	F	0.116	0.150	0.218	70
12	1.000	F	0.151	0.184	0.254	
12	1.250	M	0.128	0.153	0.202	
12	1.500	M	0.150	0.178	0.234	
12	2.000	M	0.201	0.245	0.311	
14	0.625	M	0.155	0.189	0.257	85
14	1.250	M	0.244	0.270	0.361	
14	1.500	M	0.253	0.303	0.404	
14	2.000	M	0.313	0.374	0.495	
18	1.250	M	0.504	0.620	0.849	180
18	1.500	M	0.556	0.680	0.927	
18	2.000	M	0.696	0.844	1.317	
18	2.750	M	0.838	1.009	1.350	
18	3.000	M	0.922	1.110	1.473	
18	4.000	M	1.057	1.266	1.681	

F = Flat
M = Molded
* SCF = Standard Cubic Feet

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EPA-453/R-95-017
November 1995

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EPA

Protocol for Equipment Leak Emission Estimates

TABLE 2-4. OIL AND GAS PRODUCTION OPERATIONS AVERAGE EMISSION FACTORS (kg/hr/source)

Equipment Type	Service[a]	Emission Factor (kg/hr/source)[b]
Valves	Gas	4.5E-03
	Heavy Oil	8.4E-06
	Light Oil	2.5E-03
	Water/Oil	9.8E-05
Pump seals	Gas	2.4E-03
	Heavy Oil	NA
	Light Oil	1.3E-02
	Water/Oil	2.4E-05
Others[c]	Gas	8.8E-03
	Heavy Oil	3.2E-05
	Light Oil	7.5E-03
	Water/Oil	1.4E-02
Connectors	Gas	2.0E-04
	Heavy Oil	7.5E-06
	Light Oil	2.1E-04
	Water/Oil	1.1E-04
Flanges	Gas	3.9E-04
	Heavy Oil	3.9E-07
	Light Oil	1.1E-04
	Water/Oil	2.9E-06
Open-ended lines	Gas	2.0E-03
	Heavy Oil	1.4E-04
	Light Oil	1.4E-03
	Water/Oil	2.5E-04

[a]Water/Oil emission factors apply to water streams in oil service with a water content greater than 50%, from the point of origin to the point where the water content reaches 99%. For water streams with a water content greater than 99%, the emission rate is considered negligible.
[b]These factors are for total organic compound emission rates (including non-VOC's such as methane and ethane) and apply to light crude, heavy crude, gas plant, gas production, and off shore facilities. "NA" indicates that not enough data were available to develop the indicated emission factor.
[c]The "other" equipment type was derived from compressors, diaphrams, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents. This "other" equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps, or valves.

EPA Average Emission Factors

The EPA emission factors used by GRI-HAPCalc 3.01 to estimate fugitive emissions were developed from data obtained during a joint American Petroleum Institute (API)/GRI fugitive testing program at natural gas production and processing sites [U.S. Environmental Protection Agency, 1995; American Petroleum Institute, 1995]. Over 184,000 components at 20 sites were screened for total hydrocarbon (THC) emissions, and the results were averaged for each component type to develop THC emission factors. Furthermore, a statistical analysis conducted by the EPA found no difference in THC fugitive emissions by industry segment for oil and gas production operation. The average THC emission factors for equipment in gas and light liquid service are shown in Table 20.

Table 20. EPA Average Emission Factors for THC

Component	Emission Factor, lb THC/yr		
	Gas Service	Light Liquids Service	Heavy Liquids Service
Connections	3.9	4.1	0.1
Flanges	7.5	2.1	0.0075
Open-Ended Line	39	27	2.7
Pump Seals	46	250	NA
Valves	87	48	0.16
Other*	170	140	0.62

** The "Other" category includes compressors, diaphragms, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents.*

To calculate speciated fugitive emissions for BTEX, methane, NMHC, and NMEHC, composition data obtained during a joint American Petroleum Institute (API)/GRI fugitive testing program are used with the THC emission factors above. The average compositions of fugitive leaks from production facilities and natural gas plants are shown in Table 21.

Table 21. Fractional Composition of Fugitive Emissions

Compound	Fractional Composition, lb/lb THC			
	Gas Production/ Compressor Station	Gas Plant	Light Liquid Service	Heavy Liquid Service
Benzene	0.00023	0.00123	0.00027	0.00935
Toluene	0.00039	0.00032	0.00075	0.00344
Ethylbenzene	0.000020	0.000010	0.000170	0.00051
Xylenes (m,p,o)	0.00010	0.000040	0.000360	0.00372
Methane	0.920	0.564	0.613	0.942
NMHC	0.080	0.436	0.387	0.058
NMEHC	0.0350	0.253	0.292	0.030

The following equation shows how annual emission rates are calculated from the above emission factors. The user-entered component count of each type of fugitive emission source is multiplied by the emission factor (lb THC/component/year) and the fractional composition (lb compound *i* / lb THC). This is then converted to an annual emission rate. Note that all calculations in GRI-HAPCalc 3.01 are done in U.S. Standard units and converted to metric units when necessary.