HLP
engineering inc
A Professional Environmental Firm

June 26, 2015

State of Wyoming
Department of Environmental Quality
Air Quality Division
122 West 25th Street
Herschler Building, 2-E
Cheyenne, Wyoming 82002

Reviewer HMB
cc:
Modeler
D.E.
File A0001326
IMPACID 2696

RE: Application for Minor Source Air Permit
J.P. Oil Company, Inc.
Buck Creek Commingling Tank Battery
Niobrara County, Wyoming

On behalf of J.P. Oil Company, Inc. and in accordance with the Wyoming Department of Environmental Quality's Chapter 6, Section 2 permitting guidelines, submitted with this are three (3) bound sets of the referenced material. Request is hereby made for a minor source air permit for the proposed facility.

This facility will function as a typical oil & gas production facility. Details of operations emission estimates, and associated emission programs are included herein and verify that the facility should be classified as a minor source under the Federal and State air permitting programs. All measures should be taken in the review process to assure that the minor source classification is federally recognized.

If any other information is required regarding these matters, please do not hesitate to contact me at (337)839-1075. All written correspondence should be directed to: **J.P. Oil Company, Inc., P.O. Box 52584, Lafayette, LA 70505, Attn.: Cal Seneca.** Thank-you in advance for your assistance with this matter.

Sincerely,
HLP ENGINEERING, INC.

Jamie Nease, E.I.

Encl.

xc: Cal Seneca - J.P. Oil Company, Inc.

RECEIVED
JUL 10 2015
AIR QUALITY DIVISION

Revised 5/12/2015

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

Air Quality Division

New Source Review Permit Application Form Cover Sheet

Is this a revision to an existing application?

Yes _____ **No** X

Previous Application #: _____

Date of Application: June 2015

COMPANY INFORMATION:

Company Name: J.P. Oil Company, Inc.
Address: P.O. Box 52584
City: Lafayette State: Louisiana Zip Code: 70505
Country: USA Phone Number: 337-234-1170

FACILITY INFORMATION:

Facility Name: Buck Creek Commingling Tank Battery
New Facility or Existing Facility: New
Facility Description: Oil & Gas Production Site
Facility Class: Minor Operating Status: Not Yet Installed
Facility Type: Production Site

For Oil & Gas Production Sites ONLY:
First Date of Production (FDOP)/Date of Modification: **N/A**
Single well or multiple well facility? **Multiple Well**
Does production at this facility contain H2S?* Yes
If yes, contact the Division.

API Number(s): 49-027-20335, 49-027-20346, 49-027-20344, 49-027-20485, 49-027-20343, 49-027-20400, 49-027-20336

NAICS Code: 211111 Crude Petroleum and Natural Gas Extraction

FACILITY LOCATION:

***Enter the facility location in either the latitude/longitude area or section/township/range area. Both are not required.**

Physical Address: _____
City: _____ Zip Code: _____
State: WY County: _____

OR

Latitude: 43.09697 Longitude: -104.46009 County: Niobrara
Quarter Quarter: SE 1/4 Quarter: NE 1/4
Section: 18 Township: 36N Range: **63W**

For longitude and latitude, use NAD 83/WGS84 datum and 5 digits after the decimal (i.e. 41.12345, -107.56789)

CONTACT INFORMATION:

***Note that an Environmental AND NSR Permitting Contact is required for your application to be deemed complete by the agency.**

Title: Mr. First Name: *Cal
Last Name: Seneca
Company Name: J.P. Oil Company, Inc.
Job Title: Health, Safety, & Environmental Manager
Address: P.O. Box 52584
City: Lafayette State: Louisiana
Zip Code: 70505
Primary Phone No.: 337-234-1170 E-mail: cseneca@jpoil.com
Mobile Phone No.: _____ Fax No.: _____
Contact Type: Environmental contact Start Date: Prior to 2015

***Name of the contact to whom the permit will be issued:** Cal Seneca

Revised 5/12/2015

Additional Contact Type (if needed): NSR Permitting contact

Title: First Name: *Same As Above

Last Name:

Company Name:

Job Title:

Address:

City: State:

Zip Code:

Primary Phone No.: E-mail:

Mobile Phone No.: Fax No.:

Contact Type: Start Date:

FACILITY APPLICATION INFORMATION:

General Info:

Has the facility changed location or is it a new/ greenfield facility?	Yes
Has a Land Use Planning document been included in this application?	No
Is the facility located in a sage grouse core area?*	No
If the facility is in a sage grouse core area, what is the WER number?	

** For questions about sage grouse core area, contact WY Game & Fish Department.*

Federal Rules Applicability - Facility Level:

Prevention of Significant Deterioration (PSD):	No
Non-Attainment New Source Review:	No

Modeling Section:

Has the Air Quality Division been contacted to determine if modeling is required?	Yes
Is a modeling analysis part of this application?	No
Is the proposed project subject to Prevention of Significant Deterioration (PSD) requirements?	No
Has the Air Quality Division been notified to schedule a pre-application meeting? N/A	No
Has a modeling protocol been submitted to and approved by the Air Quality Division?	No
Has the Air Quality Division received a Q/D analysis to submit to the respective FLMs to determine the need for an AQRV analysis?	No

Required Attachments:

- [x] Facility Map
- [x] Process Flow Diagram
- [ ] Modeling Analysis (if applicable)
- [ ] Land Use Planning Document -N/A
- [x] Detailed Project Description
- [x] Emissions Calculations

I, Cal Seneca (Responsible Official (Printed Name)) Health, Safety, & Environmental Manager (Title)

an Official Representative of the Company, state that I have knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief. I further certify that the operational information provided and emission rates listed on this application reflect the anticipated emissions due to the operation of this facility. The facility will operate in compliance with all applicable Wyoming Air Quality Standards and Regulations.

Signature: Cal Seneca (ink) Date: 7/7/15

Specific Emission Unit Attributes:

Separator/Treater

Company Equipment ID: 1-15-HT-BS & 2-15-HT-BS
Company Equipment Description: Heater Treater & Test Heater Treater

Operating Status: Not Yet Installed
Initial Construction Commencement Date: Proposed
Initial Operation Commencement Date: Proposed
Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Type of Vessel: Heater-Treater Is Vessel Heated? Yes
Operating Temperature (F): 175
Operating Pressure (psig): 45

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

3-10-001-28

Potential Operating Schedule: Provide the operating schedule for this emission unit.
Hours/day: 24
Hours/year: 8760

Control Equipment: No

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Storage Tank/Silo

Company Equipment ID/IDs: 3a-15-OST-CV through 3d-15-OST-CV
Company Equipment Description: 400 BBL Oil Storage Tank-Common Vent

Operating Status: Not Yet Installed
Initial Construction Commencement Date: Proposed
Initial Operation Commencement Date: Proposed
Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Material Type: Liquid
Description of Material Stored: Produced Oil

Capacity: 400 Units: barrels
Maximum Throughput: 200* Units: barrels/day
Maximum Hourly Throughput: 8.33 Units: barrels/hr
Operating Pressure (psig): 0
Vapor Pressure of Material Stored (psig): 7.7
Is Tank Heated?: No

*Maximum facility throughput is 200 BBLs/day and annual emissions for each tank are based on an average of 50 BBLs/day.

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

4-04-003-01, 4-04-003-02, & 3-10-001-99

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: 24
Hours/year: 8760

Control Equipment: Yes

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: *Subpart OOOO; If it is determined that the storage tanks were orginally constructed after 8/23/11, the tanks would not be subject to this subpart as VOC emissions are less than 6 TPY.*

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Storage Tank/Silo

Company Equipment ID/IDs: 3e-15-WST-CV through 3j-15-WST-CV
Company Equipment Description: 400 BBL Water Storage Tank-Common Vent

Operating Status: Not Yet Installed
Initial Construction Commencement Date: Proposed
Initial Operation Commencement Date: Proposed
Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Material Type: Liquid
Description of Material Stored: Produced Water

Capacity: 400 Units: barrels
Maximum Throughput: 9000* Units: barrels/day
Maximum Hourly Throughput: 375 Units: barrels/hr
Operating Pressure (psig): 0
Vapor Pressure of Material Stored (psig): 7.7
Is Tank Heated?: No

*Maximum facility throughput is 9000 BBLs/day and annual emissions for each tank are based on an average of 1500 BBLs/day.

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

4-04-003-01, 4-04-003-02, & 3-10-001-99

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: 24
Hours/year: 8760

Control Equipment: Yes

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: *Subpart OOOO; If it is determined that the storage tanks were orginally constructed after 8/23/11, the tanks would not be subject to this subpart as VOC emissions are less than 6 TPY.*

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Flare

Company Equipment ID: 5-15-F
Company Equipment Description: Control Flare

Operating Status: Not Yet Installed
Initial Construction Commencement Date: Proposed
Initial Operation Commencement Date: Proposed
Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Maximum Design Capacity (MMSCF/hr): 0.008578
Minimum Design Capacity (MMSCF/hr): 0.008578
Pilot Gas Volume (scf/min): 0.35
Emergency Flare Only: No
Ignition Device Type: Continuous Spark
Btu Content (Btu/scf): 1363
Smokeless Design: Yes
Assist Gas Utilized? No
Continuously Monitored?* Yes
*If yes, describible continuous monitoring:

Thermocouple

Waste Gas Volume: 8,557
Units: scf/hr
Installation Date: Proposed

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

3-10-002-05

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: 24
Hours/year: 8760

☐ ☑

Control Equipment: No

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes ☐ No ☑

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes ☐ No ☑

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Loading/Unloading/Dump

Company Equipment ID: 6-15-LL
Company Equipment Description: Loading Losses-Oil Transfer to Tank Truck

Operating Status: Not Yet Installed
Initial Construction Commencement Date: Proposed
Initial Operation Commencement Date: Proposed
Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Type of Material: Liquid
Material Description: Produced Oil

Maximum Annual Throughput: 73000 Units: barrels/yr
Maximum Hourly Throughput: 180 Units: barrels/hr
Detailed Description of Loading/Unloading/Dump Source:
Oil Transfer to Tank Truck

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

4-06-001-32

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: N/A
Hours/year: 405.6

Control Equipment: No

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Pneumatic Equipment (Pumps and Controllers)

Company Equipment ID: 7-15-PC

Company Equipment Description: Pneumatic Controllers

Operating Status: Not Yet Installed

Initial Construction Commencement Date: Proposed

Initial Operation Commencement Date: Proposed

Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Type of Equipment: Controller

Bleed/Consumption Rate (cfh): 156

Controller Type: Intermittent

Motive Force: Field Gas

VOC Content (%): 55.41

HAP Content (%): 4.36

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

3-10-002-99

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: 24

Hours/year: 8760

Control Equipment: No

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-
Standards of Performance for New Stationary Sources.

NSPS Subpart: *Subpart OOOO; There are no continous bleed controllers used at this facility.*

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Fugitives

Company Equipment ID: 8-15-FE

Company Equipment Description: Fugitive Emissions

Operating Status: Not Yet Installed

Initial Construction Commencement Date: Proposed

Initial Operation Commencement Date: Proposed

Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Type of Fugitive Emission: Fugitive Leaks at O&G

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

3-10-888-11

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: 24

Hours/year: 8760

Control Equipment: No

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Specific Emission Unit Attributes:

Separator/Treater

Company Equipment ID: N/A

Company Equipment Description: Freewater Knockout & Test Freewater Knockout

Operating Status: Not Yet Installed

Initial Construction Commencement Date: Proposed

Initial Operation Commencement Date: Proposed

Most Recent Construction/ Modification Commencement Date: N/A

Most Recent Operation Commencement Date: N/A

Select reason(s) for this emissions unit being included in this application (must be completed regardless of date of installation or modification):

Reason: Construction (Greenfield/New Facility)

If reason is ***Reconstruction*** or ***Temporary Permit*** or ***Other,*** please explain below:

Type of Vessel: FWKO

Is Vessel Heated? No

Operating Temperature (F): 80

Operating Pressure (psig): 45

SCC Codes: List all Source Classification Code(s) (SCC) that describe the process(es) performed by the emission source (e.g., 1-02-002-04).

3-10-001-07

Potential Operating Schedule: Provide the operating schedule for this emission unit.

Hours/day: 24

Hours/year: 8760

Control Equipment: Yes

If yes, please fill out and attach the appropriate Control Device and Release Point Information worksheets.

Best Available Control Technology (BACT): Was a BACT Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed BACT: _____

*If yes, attach BACT Analysis with this application.

Lowest Achievable Emission Rate (LAER): Was a LAER Analysis completed for this emission unit?

Yes No

Pollutant: _____

Proposed LAER: _____

*If yes, attach LAER Analysis with this application.

Federal and State Rule Applicability:

New Source Performance Standards (NSPS): Not Affected

New Source Performance Standard are listed under 40 CFR 60-Standards of Performance for New Stationary Sources.

NSPS Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 61): Not Affected

National Emissions Standards for Hazardous Air Pollutants (NESHAP Part 61) are listed under 40 CFR 61. (These include asbestos, benzene, beryllium, mercury, and vinyl chloride).

Part 61 NESHAP Subpart: _____

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63): Not Affected

National Emission Standards for Hazardous Air Pollutants (NESHAP Part 63) standards are listed under 40 CFR 63

Part 63 NESHAP Subpart: _____

Prevention of Significant Deterioration (PSD): Not Affected

These rules are found under WAQSR Chapter 6, Section 4.

Non-Attainment New Source Review: Not Affected

These rules are found under WAQSR Chapter 6, Section 13.

Revised 5/12/2015

Pollutant Emissions Form
Facility-Wide Emissions Totals

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	0.09	0.11	0.50
2.)	PM #10 microns in diameter (PE/PM10)	0.09	0.11	0.50
3.)	PM #2.5 microns in diameter (PE/PM2.5)	0.09	0.11	0.50
4.)	Sulfur dioxide (SO2)	19.66	20.46	89.59
5.)	Nitrogen Oxides (NOx)	1.16	1.85	8.10
6.)	Carbon monoxide (CO)	0.98	3.39	14.83
7.)	Volatile organic compounds (VOC)	2262.18	43.27	84.26
8.)	Total Hazardous Air Pollutants (HAPs)	218.08	4.93	8.28
9.)	Hydrogen Sulfide (H2S)	37.74	1.40	1.41

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Revised 5/12/2015

Pollutant Emissions Form
Facility-Wide Emissions Totals

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)
1.)	2,2,4-Trimethylpentane	25.01	0.27	0.91
2.)	Benzene	21.27	0.26	0.77
3.)	Ethylbenzene	1.19	0.01	0.04
4.)	N-Hexane	104.95	2.70	4.14
5.)	Toluene	21.59	0.24	0.79
6.)	Xylenese (mixed isomers)	6.33	0.05	0.22

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)
1.)	CO2e	3615.91	1795.50	7864.31
2.)				
3.)				
4.)				
5.)				
6.)				
7.)				
8.)				

Pollutant Emissions Form
EPN: 1-15-HT-BS

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	0.04	0.01	0.04	AP-42
2.)	PM #10 microns in diameter (PE/PM10)	0.04	0.01	0.04	AP-42
3.)	PM #2.5 microns in diameter (PE/PM2.5)	0.04	0.01	0.04	AP-42
4.)	Sulfur dioxide (SO2)	9.49	2.17	9.49	AP-42
5.)	Nitrogen Oxides (NOx)	0.56	0.13	0.56	AP-42
6.)	Carbon monoxide (CO)	0.47	0.11	0.47	AP-42
7.)	Volatile organic compounds (VOC)	0.03	0.01	0.03	AP-42
8.)	Total Hazardous Air Pollutants (HAPs)	0.01	0.00	0.01	AP-42

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	N-Hexane	0.01	0.00	0.01	AP-42

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	813.04	185.63	813.04	Other

Pollutant Emissions Form
EPN: 2-15-HT-BS

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
Criteria Pollutants:					
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	0.05	0.01	0.05	AP-42
2.)	PM #10 microns in diameter (PE/PM10)	0.05	0.01	0.05	AP-42
3.)	PM #2.5 microns in diameter (PE/PM2.5)	0.05	0.01	0.05	AP-42
4.)	Sulfur dioxide (SO2)	10.17	2.32	10.17	AP-42
5.)	Nitrogen Oxides (NOx)	0.6	0.14	0.60	AP-42
6.)	Carbon monoxide (CO)	0.51	0.12	0.51	AP-42
7.)	Volatile organic compounds (VOC)	0.03	0.01	0.03	AP-42
8.)	Total Hazardous Air Pollutants (HAPs)	0.01	0.00	0.01	AP-42

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	N-Hexane	0.01	0.00	0.01	AP-42

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	871.11	198.88	871.11	Other

Revised 5/12/2015

Pollutant Emissions Form
EPNs: 3a-15-OST-CV through 3d-15-OST-CV
Emissions below are representative for each oil storage tank.

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	1.87	0.43	0.02	Other
8.)	Total Hazardous Air Pollutants (HAPs)	1.01	0.23	0.01	Other
9.)	Hydrogen Sulfide (H2S)	0.89	0.21	0.01	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Revised 5/12/2015

Pollutant Emissions Form
EPNs: 3a-15-OST-CV through 3d-15-OST-CV
Emissions below are representative for each oil storage tank.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.01	0.00	0.00	Other
2.)	Benzene	0.02	0.00	0.00	Other
3.)	Ethylbenzene	0.00	0.00	0.00	Other
4.)	N-Hexane	0.05	0.01	0.00	Other
5.)	Toluene	0.02	0.00	0.00	Other
6.)	Xylenese (mixed isomers)	0.01	0.00	0.00	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	5.79	0.00	0.00	Other

Revised 5/12/2015

Pollutant Emissions Form

EPNs: 3e-15-WST-CV through 3j-15-WST-CV

Emissions below are representative for each water storage tank.

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	8.41	0.96	0.04	Other
8.)	Total Hazardous Air Pollutants (HAPs)	0.82	0.08	0.00	Other
9.)	Hydrogen Sulfide (H2S)	0.13	0.02	0.00	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Revised 5/12/2015

Pollutant Emissions Form
EPNs: 3e-15-WST-CV through 3j-15-WST-CV
Emissions below are representative for each water storage tank.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.09	0.01	0.00	Other
2.)	Benzene	0.08	0.01	0.00	Other
3.)	Ethylbenzene	0.00	0.00	0.00	Other
4.)	N-Hexane	0.39	0.04	0.00	Other
5.)	Toluene	0.08	0.01	0.00	Other
6.)	Xylenese (mixed isomers)	0.03	0.00	0.00	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	5.74	0.00	0.00	Other

Pollutant Emissions Form
EPN: 4-15-WG-RV

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	2162.41	0.00	0.00	Other
8.)	Total Hazardous Air Pollutants (HAPs)	205.32	0.00	0.00	Other
9.)	Hydrogen Sulfide (H2S)	32.77	0.00	0.00	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	24.01	0.00	0.00	Other
2.)	Benzene	20.36	0.00	0.00	Other
3.)	Ethylbenzene	1.17	0.00	0.00	Other
4.)	N-Hexane	100.33	0.00	0.00	Other
5.)	Toluene	20.67	0.00	0.00	Other
6.)	Xylenese (mixed isomers)	6.01	0.00	0.00	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	1506.20	0.00	0.00	Other

Pollutant Emissions Form
EPN: 5-15-F

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	0.41	0.09	0.41	AP-42
2.)	PM #10 microns in diameter (PE/PM10)	0.41	0.09	0.41	AP-42
3.)	PM #2.5 microns in diameter (PE/PM2.5)	0.41	0.09	0.41	AP-42
4.)	Sulfur dioxide (SO2)	69.93	15.97	69.93	Other
5.)	Nitrogen Oxides (NOx)	6.94	1.58	6.94	Other
6.)	Carbon monoxide (CO)	13.85	3.16	13.85	Other
7.)	Volatile organic compounds (VOC)	42.11	9.61	42.11	Other
8.)	Total Hazardous Air Pollutants (HAPs)	4.30	0.98	4.30	Other
9.)	Hydrogen Sulfide (H2S)	0.74	0.17	0.74	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.49	0.11	0.49	Other
2.)	Benzene	0.42	0.10	0.42	Other
3.)	Ethylbenzene	0.02	0.01	0.02	Other
4.)	N-Hexane	2.06	0.47	2.06	Other
5.)	Toluene	0.43	0.10	0.43	Other
6.)	Xylenese (mixed isomers)	0.12	0.03	0.12	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	5417.88	1236.96	5417.88	Other

Pollutant Emissions Form
EPN: 6-15-LL

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
Criteria Pollutants:					
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	3.53	17.44	3.53	Other
8.)	Total Hazardous Air Pollutants (HAPs)	0.34	1.70	0.34	Other
9.)	Hydrogen Sulfide (H2S)	0.03	0.13	0.03	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Benzene	0.00	0.02	0.00	Other
2.)	N-Hexane	0.31	1.55	0.31	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	5.50	1.26	5.50	Other

Pollutant Emissions Form
EPN: 7-15-PC

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	33.99	7.76	33.99	Other
8.)	Total Hazardous Air Pollutants (HAPs)	3.23	0.74	3.23	Other
9.)	Hydrogen Sulfide (H2S)	0.52	0.12	0.52	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.38	0.09	0.38	Other
2.)	Benzene	0.32	0.07	0.32	Other
3.)	Ethylbenzene	0.02	0.00	0.02	Other
4.)	N-Hexane	1.58	0.36	1.58	Other
5.)	Toluene	0.32	0.07	0.32	Other
6.)	Xylenese (mixed isomers)	0.09	0.02	0.09	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	23.74	5.42	23.74	Other

Pollutant Emissions Form
EPN: 8-15-FE

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	4.19	0.95	4.19	Other
8.)	Total Hazardous Air Pollutants (HAPs)	0.38	0.09	0.38	Other
9.)	Hydrogen Sulfide (H2S)	0.08	0.02	0.08	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.04	0.01	0.04	Other
2.)	Benzene	0.03	0.01	0.03	Other
3.)	Ethylbenzene	0.00	0.00	0.00	Other
4.)	N-Hexane	0.17	0.04	0.17	Other
5.)	Toluene	0.04	0.01	0.04	Other
6.)	Xylenese (mixed isomers)	0.08	0.02	0.08	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	2.61	0.60	2.61	Other

Pollutant Emissions Form
EPN: 9-15-LOT

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	0.00	0.00	0.00	Tanks Program
8.)	Total Hazardous Air Pollutants (HAPs)	0.00	0.00	0.00	Other
9.)	Hydrogen Sulfide (H2S)	0.00	0.00	0.00	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.00	0.00	0.00	Other
2.)	Benzene	0.00	0.00	0.00	Other
3.)	Ethylbenzene	0.00	0.00	0.00	Other
4.)	N-Hexane	0.00	0.00	0.00	Other
5.)	Toluene	0.00	0.00	0.00	Other
6.)	Xylenese (mixed isomers)	0.00	0.00	0.00	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	0.00	0.00	0.00	Other

Pollutant Emissions Form
EPN: 10-15-LOT

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	0.02	0.00	0.02	Tanks Program
8.)	Total Hazardous Air Pollutants (HAPs)	0.00	0.00	0.00	Other
9.)	Hydrogen Sulfide (H2S)	0.00	0.00	0.00	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.00	0.00	0.00	Other
2.)	Benzene	0.00	0.00	0.00	Other
3.)	Ethylbenzene	0.00	0.00	0.00	Other
4.)	N-Hexane	0.00	0.00	0.00	Other
5.)	Toluene	0.00	0.00	0.00	Other
6.)	Xylenese (mixed isomers)	0.00	0.00	0.00	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	0.00	0.00	0.00	Other

Pollutant Emissions Form
EPN: 11-15-CST

Criteria Pollutants:

		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	Particulate emissions (PE/PM) (formerly particulate matter, PM)	N/A	N/A	N/A	
2.)	PM #10 microns in diameter (PE/PM10)	N/A	N/A	N/A	
3.)	PM #2.5 microns in diameter (PE/PM2.5)	N/A	N/A	N/A	
4.)	Sulfur dioxide (SO2)	N/A	N/A	N/A	
5.)	Nitrogen Oxides (NOx)	N/A	N/A	N/A	
6.)	Carbon monoxide (CO)	N/A	N/A	N/A	
7.)	Volatile organic compounds (VOC)	0.04	0.01	0.04	Tanks Program
8.)	Total Hazardous Air Pollutants (HAPs)	0.00	0.00	0.00	Other
9.)	Hydrogen Sulfide (H2S)	0.00	0.00	0.00	Other

Provide your calculations as an attachment and explain how all process variables and emissions factors were selected.

Hazardous Air Pollutants (HAPs) and Toxic Air Contaminents

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	2,2,4-Trimethylpentane	0.00	0.00	0.00	Other
2.)	Benzene	0.00	0.00	0.00	Other
3.)	Ethylbenzene	0.00	0.00	0.00	Other
4.)	N-Hexane	0.00	0.00	0.00	Other
5.)	Toluene	0.00	0.00	0.00	Other
6.)	Xylenese (mixed isomers)	0.00	0.00	0.00	Other

Greenhouse Gases (GHGs)

Pollutants:		Pre-Controlled Potential Emissions (tons/yr)	Potential to Emit (lbs/hr)	Potential to Emit (tons/yr)	Basis for Determination
1.)	CO2e	0.00	0.00	0.00	Other

Release Point Information:

Complete the table below for ***each*** release point. Please include release point information for each emission unit. Multiple attachments may be necessary. A release point is a point at which emissions from an emission unit are released into the ambient (outside)air. List each individual release point on a separate pair of lines (release point ID and description). ***For longitude and latitude, use NAD 83/WGS84 datum and 5 digits after the decimal (i.e. 41.12345, -107.56789)***

Stack Release Point Information		
Company Release Point ID/IDs:	Release Point Type:	Vertical
1-15-HT-BS	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
1.4 MMBTU/Hr Heater Treater-Burner Stack	Stack Height (ft):	25
	Stack Diameter (ft):	0.5
	Exit Gas Velocity (ft/s):	52
	Exit Gas Temp (F):	500
	Exit Gas Flow Rate (acfm):	616
Company Release Point ID:	Release Point Type:	Vertical
2-15-HT-BS	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
1.5 MMBTU/Hr Heater Treater-Burner Stack	Stack Height (ft):	25
	Stack Diameter (ft):	0.5
	Exit Gas Velocity (ft/s):	56
	Exit Gas Temp (F):	500
	Exit Gas Flow Rate (acfm):	660
Company Release Point ID:	Release Point Type:	Vertical
3a-15-OST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Oil Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.003
Company Release Point ID:	Release Point Type:	Vertical
3b-15-OST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Oil Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.003

Release Point Information:

Complete the table below for ***each*** release point. Please include release point information for each emission unit. Multiple attachments may be necessary. A release point is a point at which emissions from an emission unit are released into the ambient (outside)air. List each individual release point on a separate pair of lines (release point ID and description). ***For longitude and latitude, use NAD 83/WGS84 datum and 5 digits after the decimal (i.e. 41.12345, -107.56789)***

Stack Release Point Information		
Company Release Point ID/IDs:	Release Point Type:	Vertical
3c-15-OST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Oil Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.003
Company Release Point ID:	Release Point Type:	Vertical
3d-15-OST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Oil Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.003
Company Release Point ID:	Release Point Type:	Vertical
3e-15-WST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Water Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.01
Company Release Point ID:	Release Point Type:	Vertical
3f-15-WST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Water Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.01

Release Point Information:

Complete the table below for ***each*** release point. Please include release point information for each emission unit. Multiple attachments may be necessary. A release point is a point at which emissions from an emission unit are released into the ambient (outside)air. List each individual release point on a separate pair of lines (release point ID and description). ***For longitude and latitude, use NAD 83/WGS84 datum and 5 digits after the decimal (i.e. 41.12345, -107.56789)***

Stack Release Point Information		
Company Release Point ID/IDs:	Release Point Type:	Vertical
3g-15-WST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Water Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.01
Company Release Point ID:	Release Point Type:	Vertical
3h-15-WST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Water Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.01
Company Release Point ID:	Release Point Type:	Vertical
3i-15-WST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Water Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.01
Company Release Point ID:	Release Point Type:	Vertical
3j-15-WST-CV	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
400 BBL Water Storage Tank-Common Vent	Stack Height (ft):	20
	Stack Diameter (ft):	1
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	0.01

Release Point Information:

Complete the table below for ***each*** release point. Please include release point information for each emission unit. Multiple attachments may be necessary. A release point is a point at which emissions from an emission unit are released into the ambient (outside)air. List each individual release point on a separate pair of lines (release point ID and description). ***For longitude and latitude, use NAD 83/WGS84 datum and 5 digits after the decimal (i.e. 41.12345, -107.56789)***

Stack Release Point Information		
Company Release Point ID/IDs:	Release Point Type:	Vertical
5-15-F	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
Control Flare	Stack Height (ft):	15
	Stack Diameter (ft):	0.5
	Exit Gas Velocity (ft/s):	646
	Exit Gas Temp (F):	1500
	Exit Gas Flow Rate (acfm):	7613
Company Release Point ID:	Release Point Type:	Vertical
6-15-LL	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
Loading Losses-Oil Transfer to Tank Truck	Stack Height (ft):	5
	Stack Diameter (ft):	0.3
	Exit Gas Velocity (ft/s):	0.58
	Exit Gas Temp (F):	80
	Exit Gas Flow Rate (acfm):	2.45
Company Release Point ID:	Release Point Type:	Horizontal
9-15-LOT	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
265 Gallon Lube Oil Storage Tank	Stack Height (ft):	7
	Stack Diameter (ft):	0.2
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	<0.01
Company Release Point ID:	Release Point Type:	Horizontal
10-15-LOT	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
55 Gallon Lube Oil Storage Tank	Stack Height (ft):	7
	Stack Diameter (ft):	0.2
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	<0.01

Release Point Information:

Complete the table below for ***each*** release point. Please include release point information for each emission unit. Multiple attachments may be necessary. A release point is a point at which emissions from an emission unit are released into the ambient (outside)air. List each individual release point on a separate pair of lines (release point ID and description). ***For longitude and latitude, use NAD 83/WGS84 datum and 5 digits after the decimal (i.e. 41.12345, -107.56789)***

Stack Release Point Information		
Company Release Point ID/IDs:	Release Point Type:	Horizontal
11-15-CST	Release Point Latitude:	43.09697
	Release Point Longitude:	-104.46009
Company Release Point Description:	Base Elevation (ft):	4500
2-110 Gallon Chemical Storage Tanks	Stack Height (ft):	7
	Stack Diameter (ft):	0.2
	Exit Gas Velocity (ft/s):	<0.01
	Exit Gas Temp (F):	70
	Exit Gas Flow Rate (acfm):	<0.01
Company Release Point ID:	Release Point Type:	
	Release Point Latitude:	
	Release Point Longitude:	
Company Release Point Description:	Base Elevation (ft):	
	Stack Height (ft):	
	Stack Diameter (ft):	
	Exit Gas Velocity (ft/s):	
	Exit Gas Temp (F):	
	Exit Gas Flow Rate (acfm):	
Company Release Point ID:	Release Point Type:	
	Release Point Latitude:	
	Release Point Longitude:	
Company Release Point Description:	Base Elevation (ft):	
	Stack Height (ft):	
	Stack Diameter (ft):	
	Exit Gas Velocity (ft/s):	
	Exit Gas Temp (F):	
	Exit Gas Flow Rate (acfm):	
Company Release Point ID:	Release Point Type:	
	Release Point Latitude:	
	Release Point Longitude:	
Company Release Point Description:	Base Elevation (ft):	
	Stack Height (ft):	
	Stack Diameter (ft):	
	Exit Gas Velocity (ft/s):	
	Exit Gas Temp (F):	
	Exit Gas Flow Rate (acfm):	

Complete the table below for each fugitive (area, volume, line) release point. List each individual release point on a separate line.

Fugitive Release Point Information		
Company Release Point ID:	Release Point Latitude:	43.09697
7-15-PC	Release Point Longitude:	-104.46009
	Release Height (ft):	N/A
Company Release Point Description:		
Pneumatic Controllers		
Company Release Point ID:	Release Point Latitude:	43.09697
8-15-FE	Release Point Longitude:	-104.46009
	Release Height (ft):	N/A
Company Release Point Description:		
Fugitive Emissions		
Company Release Point ID:	Release Point Latitude:	
	Release Point Longitude:	
	Release Height (ft):	
Company Release Point Description:		
Company Release Point ID:	Release Point Latitude:	
	Release Point Longitude:	
	Release Height (ft):	
Company Release Point Description:		

Control Equipment:

Flare/Combustor

Manufacturer: N/A

Date Installed: Proposed

Model Name and Number: N/A

Company Control Equipment ID: 5-15-F

Company Control Equipment Description: Control Flare

Pollutant(s) Controlled:

	CO	NOx	Pb	SO2	VOC	PM4
PM (FIL)	PM Condensible	PM 10 (FIL)	PM 2.5 (FIL)	PM 10	PM 2.5	
Other (H2S)						

NOTE: The following fields require numeric values unless otherwise denoted with an asterisk*

Maximum Design Capacity (MMSCF/hr): 0.008578

Minimum Design Capacity (MMSCF/hr): 0.008578

Design Control Efficiency (%): 98

Capture Efficiency (%): 98

Operating Control Efficiency (%): 98

Flare Type:* Elevated- Open

Elevated Flare Type:* Non-Assisted

Ignition Device:* Yes

Flame Presence Sensor:* Yes

Inlet Gas Temp (F): 80

Flame Presence Type:* Thermocouple

Gas Flow Rate (acfm): 7613

Outlet Gas Temp (F): 1500

This is the only control equipment on this air contaminant source

If not, this control equipment is: Primary Secondary Parallel

List all other emission units that are also vented to this control equipment:* Storage Tanks & Process Vent

List all release point IDs associated with this control equipment:* 3a-15-OST-CV through 3j-15-WST-CV & 4-15-WG-RV

Emission Calculations

POINT SOURCE I.D. NUMBER: *1-15-HT-BS*

EMISSION SOURCE DESCRIPTION: *1.4 MMBTU/Hr Heater Treater-Burner Stack*

DATA:

Emission Source:	*External Combustion Burner*
Annual Hours of Operation:	*8760*
Maximum Burner Rating (MMBTU/Hr):	*1.4*
Fuel Gas Heat of Combustion (BTU/scf): *(based on a representative wet gas analysis)**	*1363*
Sulfur Concentration of Fuel Gas (ppmv): *(conservative estimate provided by operator)*	*10000*
Fuel Source:	*Natural Gas*

**Gas analysis was normalized to add 10,000 ppm H_2S.*

Max. Hourly Fuel Consumption (SCFH): = burner rating/fuel gas heat of combustion/80% efficiency = *1,283.93*

Max. Annual Fuel Consumption (MSCF/Yr): = hourly fuel consumption x annual hours = *11,247.23*

EMISSION FACTORS:

Unless otherwise noted, emission factors taken from EPA Publication AP-42, "Compilation of Air Pollution Emission Factors" - Natural Gas Combustion (Small Boilers). SO2 emission factor based on 100% conversion of sulfur compounds in fuel gas, using H2S 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	0.0098	0.0427
Sulfur Dioxide	1687.913	2.1672	9.4922
Nitrogen Oxides	100	0.1284	0.5624
Carbon Monoxide	84	0.1079	0.4724
Methane (excluded from VOC total)	2.3	0.0030	0.0129
VOC	5.5	0.0071	0.0309
TOC	11	0.0141	0.0619
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

POLLUTANT:	EMISSION FACTOR ($LBS/10^6$ SCF)	CALCULATED EMISSION RATES:	
		Hourly (lb/hr)	Annual (TPY)
Benzene (TAP)	0.0021000	0.0000	0.0000
Benzo(a)pyrene (TAP)	0.0000012	0.0000	0.0000
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	0.0001	0.0004
Hexane (TAP)	1.8000000	0.0023	0.0101
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	0.01
	Total VOC-TAPs	0.00	0.01
	Total Non VOC & Non TAP-HC	0.00	0.01
	Total VOC	**0.01**	**0.03**

Emission Calculations

POINT SOURCE I.D. NUMBER: *2-15-HT-BS*

EMISSION SOURCE DESCRIPTION: *1.5 MMBTU/Hr Heater Treater-Burner Stack*

DATA:

Emission Source:	*External Combustion Burner*
Annual Hours of Operation:	*8760*
Maximum Burner Rating (MMBTU/Hr):	*1.5*
Fuel Gas Heat of Combustion (BTU/scf): *(based on a representative wet gas analysis)**	*1363*
Sulfur Concentration of Fuel Gas (ppmv): *(conservative estimate provided by operator)*	*10000*
Fuel Source:	*Natural Gas*

**Gas analysis was normalized to add 10,000 ppm H2S.*

Max. Hourly Fuel Consumption (SCFH): = burner rating/fuel gas heat of combustion/80% efficiency = ***1,375.64***

Max. Annual Fuel Consumption (MSCF/Yr): = hourly fuel consumption x annual hours = ***12,050.61***

EMISSION FACTORS:

Unless otherwise noted, emission factors taken from EPA Publication AP-42, "Compilation of Air Pollution Emission Factors" - Natural Gas Combustion (Small Boilers). SO2 emission factor based on 100% conversion of sulfur compounds in fuel gas, using H2S 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	0.0105	0.0458
Sulfur Dioxide	1687.913	2.3220	10.1702
Nitrogen Oxides	100	0.1376	0.6025
Carbon Monoxide	84	0.1156	0.5061
Methane (excluded from VOC total)	2.3	0.0032	0.0139
VOC	5.5	0.0076	0.0331
TOC	11	0.0151	0.0663
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

POLLUTANT:	EMISSION FACTOR ($LBS/10^6$ SCF)	CALCULATED EMISSION RATES:	
		Hourly (lb/hr)	Annual (TPY)
Benzene (TAP)	0.0021000	0.0000	0.0000
Benzo(a)pyrene (TAP)	0.0000012	0.0000	0.0000
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	0.0001	0.0005
Hexane (TAP)	1.8000000	0.0025	0.0108
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	0.01
	Total VOC-TAPs	0.00	0.01
	Total Non VOC & Non TAP-HC	0.00	0.01
	Total VOC	**0.01**	**0.03**

Emission Calculations

Emission calculations shown below are presented for informational purposes only as vapors from the oil storage tanks will be routed to the control flare (EPN: 5-15-F) for combustion, except during brief intervals when thief hatches are opened for purposes of sampling, gauging, etc.

This is a sample calculation for EPNs: 3a-15-OST-CV through 3d-15-OST-CV.

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 & Breathing) and Flash Gas***
Average Daily Oil Throughput: (Annual Average (BBLD/Tank))	***50***
Maximum Daily Oil Throughput: (BBLD/Tank)	***200***
Anticipated H2S Concentration in Emission Stream: (ppmv)	***10000***
Basis of Estimates:	***E&P Tanks V2.0 Program; Actual LP Oil Analysis***

Avg. Vapor Volume (SCF/Hr):*	=	**8.460**
Avg. Hourly Uncontrolled Emissions (lb/hr):	=	**0.591**
Max. Hourly Uncontrolled Emissions (lb/hr):	=	**2.364**
Avg. Annual Uncontrolled Emissions (TPY):	=	**2.590**

**Taken from E&P Tanks V2.0; Copies included in ensuing pages.*

SPECIATION FACTORS:

Component breakdown taken from the referenced E&P Tanks V2.0 run; reference ensuing pages.

UNCONTROLLED EMISSIONS SUMMARY:

POLLUTANT:	CALCULATED EMISSION RATES		
	Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Hydrogen Sulfide (excluded from VOC total)	0.204	0.816	0.892
Carbon Dioxide (excluded from VOC total)	0.073	0.292	0.321
Nitrogen (excluded from VOC total)	0.010	0.040	0.045
Methane (excluded from VOC total)	0.056	0.224	0.247
Ethane (excluded from VOC total)	0.109	0.436	0.477
Propane	0.136	0.544	0.597
Iso-Butane	0.025	0.100	0.108
N-Butane	0.087	0.348	0.380
Iso-Pentane	0.045	0.180	0.197
N-Pentane	0.041	0.164	0.179
C6	0.022	0.088	0.096
C7	0.030	0.120	0.131
C8	0.007	0.028	0.032

C9	0.003	0.012	0.013
C10+	0.003	0.012	0.014
Benzene (HAP)	0.005	0.020	0.020
Toluene (HAP)	0.004	0.016	0.019
Ethylbenzene (HAP)	0.000	0.000	0.000
Xylenes (HAP)	0.003	0.012	0.013
N-Hexane (HAP)	0.012	0.048	0.053
2,2,4-Trimethylpentane (HAP)	0.003	0.012	0.013
Total TAP Emissions	0.231	0.92	1.01
Total VOC Emissions	**0.43**	**1.70**	**1.87**
Total Non VOC & Non TAP-HC	0.17	0.66	0.72
Total Emissions	0.88	3.51	3.85

Uncontrolled VOC Emission Total (TPY)	Storage Vapors + Oil Flash	=	**1.87**

DATA:

Emission Source:	***Losses When Opening Thief Hatches***
Maximum Thief Hatch Venting (Hrs/Yr) **(Under Normal/Routine Operating Conditions)**	*98*
Number of Tanks in Vent System:	*4*
Max. Minutes a Hatch is Opened in a Single Hour:	*15*
Maximum Hourly Emission Rate (lb/hr): **(from preceding tank emission estimates)**	*0.88*

Avg. Hourly Emissions (lb/hr)	=	Annual Total/8760 (hrs/yr)	=	**0.01**
Maximum Hourly Emissions (lb/hr)	=	Max. Emission Rate * Max. Minutes/Hr Hatch is Open	=	**0.88**
Maximum Annual Emissions (TPY)	=	Max. Hourly THC Rate * Hours/Yr Hatch is Open	=	**0.04**

EMISSION SUMMARY (based on the above referenced E&P Tanks composition breakdown):

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	1.1507	0.000	0.010	0.000
Carbon Dioxide (excluded from VOC total)	8.2794	0.001	0.073	0.004
Methane (excluded from VOC total)	6.3745	0.001	0.056	0.003
Ethane (excluded from VOC total)	12.3208	0.001	0.108	0.005
Hydrogen Sulfide (excluded from VOC total)	23.5143	0.002	0.207	0.010
Propane	15.4047	0.001	0.136	0.007
Iso-Butane	2.7895	0.000	0.025	0.001
N-Butane	9.8205	0.001	0.086	0.004
Iso-Pentane	5.0782	0.000	0.045	0.002
N-Pentane	4.6152	0.000	0.041	0.002
Other Hexanes	2.5361	0.000	0.022	0.001
N-Hexane (TAP)	1.3803	0.000	0.012	0.001
Methylcyclopentane	0.0000	0.000	0.000	0.000

Benzene (TAP)	0.5186	0.000	0.005	0.000
Cyclohexane	0.0000	0.000	0.000	0.000
Heptanes	3.5011	0.000	0.031	0.002
Methylcyclohexane	0.0000	0.000	0.000	0.000
Toluene (TAP)	0.4989	0.000	0.004	0.000
2,2,4-Trimethylpentane (TAP)	0.3310	0.000	0.003	0.000
Octanes	0.8449	0.000	0.007	0.000
Ethylbenzene (TAP)	0.0096	0.000	0.000	0.000
Xylenes (TAP)	0.3285	0.000	0.003	0.000
Nonanes	0.3457	0.000	0.003	0.000
Decanes Plus	0.3574	0.000	0.003	0.000
Other NM/NE HC	0.0000	0.000	0.000	0.000
Total Weight Percent:	100.0000			
Total TAP Emissions		0.00	0.23	0.01
Total VOC Emissions		**0.00**	**0.43**	**0.02**
Total Non VOC & Non TAP-HC		0.00	0.16	0.01
Total Emissions		0.01	0.88	0.04

Emission Calculations

Emission calculations shown below are presented for informational purposes only as vapors from the water storage tanks will be routed to the control flare (EPN: 5-15-F) for combustion, except during brief intervals when thief hatches are opened for purposes of sampling, gauging, etc.

This is a sample calculation for EPNs: 3e-15-WST-CV through 3j-15-WST-CV.

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

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

DATA:

Emission Source:	***Crude Oil Storage Vapors (Working & Breathing) and Flash Gas***
Average Daily Oil Throughput: (Annual Average (BBLD/Tank)	***1.5***
Maximum Daily Oil Throughput: (BBLD/Tank)	***9***
Anticipated H2S Concentration in Emission Stream: (ppmv)	***10000***
Basis of Estimates:	***E&P Tanks V2.0 Program; Actual LP Oil Analysis***

Avg. Vapor Volume (SCF/Hr):*	=	**0.435**
Avg. Hourly Uncontrolled Emissions (lb/hr):	=	**0.073**
Max. Hourly Uncontrolled Emissions (lb/hr):	=	**0.438**
Avg. Annual Uncontrolled Emissions (TPY):	=	**0.319**

**Taken from E&P Tanks V2.0; Copies included in ensuing pages.*

SPECIATION FACTORS:

Component breakdown taken from the referenced E&P Tanks V2.0 run; reference ensuing pages.

UNCONTROLLED EMISSIONS SUMMARY:

POLLUTANT:	CALCULATED EMISSION RATES		
	Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Hydrogen Sulfide (excluded from VOC total)	0.002	0.012	0.009
Carbon Dioxide (excluded from VOC total)	0.001	0.006	0.004
Nitrogen (excluded from VOC total)	0.000	0.000	0.001
Methane (excluded from VOC total)	0.001	0.006	0.004
Ethane (excluded from VOC total)	0.001	0.006	0.005
Propane	0.003	0.018	0.014
Iso-Butane	0.003	0.018	0.011
N-Butane	0.013	0.078	0.056
Iso-Pentane	0.011	0.066	0.049
N-Pentane	0.011	0.066	0.048
C6	0.007	0.042	0.030
C7	0.010	0.060	0.044

C8	0.003	0.018	0.011
C9	0.001	0.006	0.004
C10+	0.001	0.006	0.005
Benzene (HAP)	0.001	0.006	0.006
Toluene (HAP)	0.001	0.006	0.006
Ethylbenzene (HAP)	0.000	0.000	0.000
Xylenes (HAP)	0.001	0.006	0.004
N-Hexane (HAP)	0.004	0.024	0.017
2,2,4-Trimethylpentane (HAP)	0.001	0.006	0.004
Total TAP Emissions	0.010	0.06	0.05
Total VOC Emissions	**0.07**	**0.43**	**0.31**
Total Non-VOC & Non TAP-HC	0.00	0.01	0.01
Total Emissions	0.08	0.46	0.33

DATA:

Emission Source:	***Flash Gas from Brine Solution***
Approx. Pressure Drop of Brine Solution: (psig)	***45***
Approx. Temperature of Brine Solution: (^{0}F)	***80***
Flash Gas Specific Gravity: *(based on a representative wet gas analysis)*	***1.4207***
Avg. Brine Throughput: (BBLD)	***1500***
Max. Brine Throughput: (BBLD)	***9000***
Gas to Water Ratio: (SCF/BBL of Brine; GWR)	***0.5***
Basis of Emission Estimates:	***API Documentation & Representative Wet Gas Analysis***

Avg. Hourly Uncontrolled Flash Rate (SCF/Hr)	=	Brine Rate * GWR	=	**31.25**
Avg. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Flash Gas Gravity * Density of Air * Flash Rate	=	**3.39**
Max. Hourly Uncontrolled Total Flash Emissions (lb/hr)	=	Avg. Emissions * Ratio of Max. Water Rate to Avg. Water Rate	=	**20.35**
Annual Potential Uncontrolled Flash Emissions (TPY)	=	.Hourly * 8760/2000	=	**14.85**

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" (refer to ensuing pages). 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 a representative wet gas analysis and normalized to account for the presence of H2S; refer to Energy Laboratories Report in ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	38.5802	1.3086	7.8517	5.7285
Carbon Dioxide (excluded from VOC total)	1.7515	0.0594	0.3565	0.2601
Methane (excluded from VOC total)	1.6062	0.0545	0.3269	0.2385
Ethane (excluded from VOC total)	2.6529	0.0900	0.5399	0.3939

Hydrogen Sulfide (excluded from VOC total)	0.8271	0.0281	0.1683	0.1228
Propane	5.8520	0.1985	1.1910	0.8689
Iso-Butane	2.2140	0.0751	0.4506	0.3287
N-Butane	8.7708	0.2975	1.7850	1.3023
Iso-Pentane	8.3975	0.2848	1.7090	1.2469
N-Pentane	11.6018	0.3935	2.3611	1.7227
Iso-Hexane	10.9333	0.3708	2.2251	1.6234
N-Hexane (TAP)	2.5325	0.0859	0.5154	0.3760
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.5138	0.0174	0.1046	0.0763
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	1.3678	0.0464	0.2784	0.2031
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.5217	0.0177	0.1062	0.0775
2,2,4-Trimethylpentane (TAP)	0.6061	0.0206	0.1233	0.0900
Octanes	1.0895	0.0370	0.2217	0.1618
Ethylbenzene (TAP)	0.0296	0.0010	0.0060	0.0044
Xylenes (TAP)	0.1518	0.0051	0.0309	0.0225
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		0.18	1.05	0.77
Total VOC Emissions		**1.85**	**11.11**	**8.10**
Total Non VOC & Non TAP-HC		0.14	0.87	0.63
Total Emissions		3.39	20.35	14.85

Uncontrolled VOC Emission Total (TPY)	Storage Vapors + Oil Flash + Brine Flash	=	**8.41**

DATA:

Emission Source:	***Losses When Opening Thief Hatches***
Maximum Thief Hatch Venting (Hrs/Yr) **(Under Normal/Routine Operating Conditions)**	*30*
Number of Tanks in Vent System:	*4*
Max. Minutes a Hatch is Opened in a Single Hour:	*5*
Maximum Hourly Emission Rate (lb/hr): **(from preceding tank emission estimates)**	*1.73*

Avg. Hourly Emissions (lb/hr)	=	Annual Total/8760 (hrs/yr)	=	**0.02**
Maximum Hourly Emissions (lb/hr)	=	Max. Emission Rate * Max. Minutes/Hr Hatch is Open	=	**1.73**
Maximum Annual Emissions (TPY)	=	Max. Hourly THC Rate * Hours/Yr Hatch is Open	=	**0.08**

EMISSION SUMMARY (based on weighted average of all streams contributing to tank emissions):

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	37.744	0.007	0.653	0.029
Carbon Dioxide (excluded from VOC total)	1.737	0.000	0.030	0.001
Methane (excluded from VOC total)	1.599	0.000	0.028	0.001
Ethane (excluded from VOC total)	2.626	0.000	0.045	0.002
Hydrogen Sulfide (excluded from VOC total)	0.866	0.000	0.015	0.001
Propane	5.813	0.001	0.101	0.005
Iso-Butane	2.240	0.000	0.039	0.002
N-Butane	8.946	0.002	0.155	0.007
Iso-Pentane	8.531	0.002	0.148	0.007
N-Pentane	11.660	0.002	0.202	0.009
Other/Iso- Hexanes	10.895	0.002	0.188	0.009
N-Hexane (TAP)	2.589	0.000	0.045	0.002
Methylcyclopentane	0.000	0.000	0.000	0.000
Benzene (TAP)	0.545	0.000	0.009	0.000
Cyclohexane	0.000	0.000	0.000	0.000
Heptanes	1.633	0.000	0.028	0.001
Methylcyclohexane	0.000	0.000	0.000	0.000
Toluene (TAP)	0.553	0.000	0.010	0.000
2,2,4-Trimethylpentane (TAP)	0.621	0.000	0.011	0.000
Octanes	1.138	0.000	0.020	0.001
Ethylbenzene (TAP)	0.030	0.000	0.001	0.000
Xylenes (TAP)	0.177	0.000	0.003	0.000
Nonanes	0.030	0.000	0.001	0.000
Decanes Plus	0.027	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	0.09	0.00
Total VOC Emissions		**0.01**	**0.96**	**0.04**
Total Non VOC & Non TAP-HC		0.00	0.07	0.00
Total Emissions		0.02	1.73	0.08

Emission Calculations

Emission calculations shown below are presented for informational purposes only as produced well gas will be used as facility fuel with any relief routed to a control flare (EPN: 5-15-F) for combustion.

POINT SOURCE I.D. NUMBER: *4-15-WG-RV*

EMISSION SOURCE DESCRIPTION: *Well Gas-Relief Vent*

DATA:

Emission Source:	*Well Gas Relief*
Wet Gas Specific Gravity:	*1.4207*
Maximum Relief Gas Rate (MSCFD): (conservative estimate provided by operator)	*200*
Basis of Emission Estimates:	*Conservative Estimate Provided by Operator & Representative Wet Gas Analysis*

Avg. Hourly Uncontrolled Gas Rate (SCF/Hr)	=	Max Relief Gas Rate *1000/24	=	**8333.33**
Avg. Hourly Uncontrolled Total Gas Emissions (lb/hr)	=	Gas Gravity * Density of Air * Gas Rate	=	**904.51**
Max. Hourly Uncontrolled Total Gas Emissions (lb/hr)	=	Avg. Emissions	=	**904.51**
Annual Potential Uncontrolled Gas Emissions (TPY)	=	Hourly * 8760/2000	=	**3961.75**

SPECIATION FACTORS:

Speciation of the relief gas is based on a representative wet gas analysis and normalized to account for the presence of H2S; refer to Energy Laboratories Report in ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	38.5802	348.9626	348.9626	1528.4527
Carbon Dioxide (excluded from VOC total)	1.7515	15.8425	15.8425	69.3901
Methane (excluded from VOC total)	1.6062	14.5284	14.5284	63.6342
Ethane (excluded from VOC total)	2.6529	23.9956	23.9956	105.1003
Hydrogen Sulfide (excluded from VOC total)	0.8271	7.4811	7.4811	32.7671
Propane	5.8520	52.9320	52.9320	231.8417
Iso-Butane	2.2140	20.0258	20.0258	87.7129
N-Butane	8.7708	79.3326	79.3326	347.4758
Iso-Pentane	8.3975	75.9563	75.9563	332.6878
N-Pentane	11.6018	104.9398	104.9398	459.6354
Iso-Hexane	10.9333	98.8927	98.8927	433.1490
N-Hexane (TAP)	2.5325	22.9066	22.9066	100.3305
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.5138	4.6475	4.6475	20.3559
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	1.3678	12.3722	12.3722	54.1900
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000

Toluene (TAP)	0.5217	4.7189	4.7189	20.6688
2,2,4-Trimethylpentane (TAP)	0.6061	5.4822	5.4822	24.0119
Octanes	1.0895	9.8545	9.8545	43.1628
Ethylbenzene (TAP)	0.0296	0.2677	0.2677	1.1726
Xylenes (TAP)	0.1518	1.3732	1.3732	6.0144
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	46.88	46.88	205.32
	Total VOC Emissions	**493.70**	**493.70**	**2162.41**
	Total Non VOC & Non TAP-HC	38.52	38.52	168.73
	Total Emissions	904.51	904.51	3961.75

VOC Emission Total (TPY)	=	Well Gas Relief	=	**2162.41**

Emission Calculations

POINT SOURCE I.D. NUMBER: *5-15-F*

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):	*1435*
Low Pressure Gas Streams:	
Gas Stream #2:	***Well Gas Relief Vent***
Gas Heat of Combustion (BTU/Ft^3-representative analysis):	*1363*
Pilot Feed:	***Yes***
Gas Heat of Combustion (BTU/Ft^3-representative analysis):	*1363*
Combustion Efficiency:	***99% for C_3 HC and lighter; 98% for other HC***

Gas Stream #1 - Storage Tank Vapors

Gas volume estimates are supported by the calculations associated with EPNs: 3a-15-OST-CV through 3j-15-WST-CV 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*
224	*8760*	*98*	*1435*	*1.4217*

CALCULATIONS

Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*224*	*x*	*0.98*	*x*	*8,760*
	=	***1,922,566 scf/yr***		=	***219 SCF/hr***	
Heat Content (annual hourly average)	=	gas rate (scf/yr)	x	gas heat of combustion (BTU/scf)		
	=	*1,922,566*	*x*	*1435*		
	=	***0.3150 MMBTU/Hr***				
Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*1.4217*	*x*	*0.0764*	*x*	*224*
	=	***24.33 lbs/hr***				
Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*1.4217*	*x*	*0.0000382*	*x*	*1,961,802*
	=	***106.55 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 ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	32.459	7.8958	7.8958	34.5838
Carbon Dioxide (excluded from VOC total)	2.689	0.6540	0.6540	2.8646
Methane (excluded from VOC total)	2.294	0.0056	0.0056	0.0244
Ethane (excluded from VOC total)	4.036	0.0098	0.0098	0.0430
Hydrogen Sulfide (TAP; excluded from VOC total)	4.085	0.0199	0.0199	0.0870
Propane	7.210	0.0175	0.0175	0.0768
Iso-Butane	2.322	0.0113	0.0113	0.0495
N-Butane	9.080	0.0442	0.0442	0.1935
Iso-Pentane	8.036	0.0391	0.0391	0.1712
N-Pentane	10.646	0.0518	0.0518	0.2269
Iso-Hexanes	9.690	0.0471	0.0471	0.2065
N-Hexane (TAP)	2.416	0.0118	0.0118	0.0515
Methylcyclopentane	0.000	0.0000	0.0000	0.0000
Benzene (TAP)	0.542	0.0026	0.0026	0.0115
Cyclohexane	0.000	0.0000	0.0000	0.0000
Heptanes	1.906	0.0093	0.0093	0.0406
Methylcyclohexane	0.000	0.0000	0.0000	0.0000
Toluene (TAP)	0.545	0.0027	0.0027	0.0116
2,2,4-Trimethylpentane (TAP)	0.579	0.0028	0.0028	0.0123
Octanes	1.096	0.0053	0.0053	0.0234
Ethylbenzene (TAP)	0.027	0.0001	0.0001	0.0006
Xylenes (TAP)	0.199	0.0010	0.0010	0.0042
Nonanes	0.076	0.0004	0.0004	0.0016
Decanes Plus	0.069	0.0003	0.0003	0.0015
Other NM/NE HC	0.000	0.0000	0.0000	0.0000
TOTAL WEIGHT PERCENT:	100.000			
TOTAL TAP EMISSIONS:		0.04	0.04	0.18
TOTAL VOC EMISSIONS:		**0.25**	**0.25**	**1.08**
TOTAL Non-VOC & Non-TAP HC:		0.02	0.02	0.07
TOTAL EMISSIONS:		8.83	8.83	38.69

Gas Stream #2 - Well Gas Relief Vent

DATA:

Emission Source:	***Well Gas Relief***
Flash Gas Specific Gravity:	***1.4207***
Maximum Gas Throughput (MSCFD): (conservative estimate provided by operator)	***200***
Basis of Emission Estimates:	***Conservative Estimate Provided by Operator & Representative Wet Gas Analysis***

Gas volume estimates are supported by the calculations provided above:

INPUT				
Maximum Gas Flowrate (scf/hr)	*Operating Time (hrs/year)*	*Burn Efficiency (%)*	*Gas Heat of Combustion (BTU/FT^3)*	*Specific Gravity of Gas*
8,333	*8760*	*98*	*1363*	*1.4207*

CALCULATIONS						
Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*8,333*	*x*	*0.98*	*x*	*8,760*
	=	***71,539,971 scf/yr***		=	***8,167 SCF/hr***	
Heat Content (annual hourly average)	=	gas rate (scf/yr)	x	gas heat of combustion (BTU/scf)		
	=	*71,539,971*	*x*	*1363*		
	=	***11.1345 MMBTU/Hr***				
Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*1.4207*	*x*	*0.0764*	*x*	*8,333*
	=	***904.50 lbs/hr***				
Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*1.4207*	*x*	*0.0000382*	*x*	*72,999,971*
	=	***3,961.70 TPY***				

SPECIATION FACTORS:

Speciation of the relief gas is based on a representative wet gas analysis; refer to Energy Laboratories Report in ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	38.5802	348.9571	348.9571	1528.4322
Carbon Dioxide (excluded from VOC total)	1.7515	15.8423	15.8423	69.3892
Methane (excluded from VOC total)	1.6062	0.1453	0.1453	0.6363
Ethane (excluded from VOC total)	2.6529	0.2400	0.2400	1.0510
Hydrogen Sulfide (TAP; excluded from VOC total)	0.8271	0.1496	0.1496	0.6553
Propane	5.8520	0.5293	0.5293	2.3184
Iso-Butane	2.2140	0.4005	0.4005	1.7542
N-Butane	8.7708	1.5866	1.5866	6.9494
Iso-Pentane	8.3975	1.5191	1.5191	6.6537
N-Pentane	11.6018	2.0988	2.0988	9.1926
Iso-Hexanes	10.9333	1.9778	1.9778	8.6629

N-Hexane (TAP)	2.5325	0.4581	0.4581	2.0066
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.5138	0.0929	0.0929	0.4071
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	1.3678	0.2474	0.2474	1.0838
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.5217	0.0944	0.0944	0.4134
2,2,4-Trimethylpentane (TAP)	0.6061	0.1096	0.1096	0.4802
Octanes	1.0895	0.1971	0.1971	0.8632
Ethylbenzene (TAP)	0.0296	0.0054	0.0054	0.0235
Xylenes (TAP)	0.1518	0.0275	0.0275	0.1203
Nonanes	0.0000	0.0000	0.0000	0.0000
Decanes Plus	0.0000	0.0000	0.0000	0.0000
Other Nm/NE HC	0.0000	0.0000	0.0000	0.0000
TOTAL WEIGHT PERCENT:	100.0000			
TOTAL TAP EMISSIONS:		0.94	0.94	4.11
TOTAL VOC EMISSIONS:		**9.34**	**9.34**	**40.93**
TOTAL Non-VOC & Non-TAP HC:		0.39	0.39	1.69
TOTAL EMISSIONS:		374.68	374.68	1641.09

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	*8760*	*98*	*1363*	*1.4207*

CALCULATIONS						
Gas Combusted (annual hourly average)	=	*gas rate (scf/hr)*	*x*	*efficiency*	*x*	*usage (hrs/yr)*
	=	*21*	*x*	*0.98*	*x*	*8,760*
	=	***180,281 scf/yr***		=	***21 SCF/hr***	
Heat Content (annual hourly average)	=	gas rate (scf/yr)	x	gas heat of combustion (BTU/scf)		
	=	*180,281*	*x*	*1363.407696*		
	=	***0.0281 MMBTU/Hr***				
Uncontrolled Max. Hourly Emissions (lbs/hr)	=	*gas specific gravity*	*x*	*density of air (lb/SCF)*	*x*	*Maximum Gas Rate (SCF/Hr)*
	=	*1.4207*	*x*	*0.0764*	*x*	*21*
	=	***2.28 lbs/hr***				
Uncontrolled Annual Emissions (TPY)	=	*gas specific gravity*	*x*	*density of air (tons/SCF)*	*x*	*Total Gas Rate (SCF/Yr)*
	=	*1.4207*	*x*	*0.0000382*	*x*	*183,960*
	=	***9.98 TPY***				

SPECIATION FACTORS:

Speciation of the pilot gas is based on a representative wet gas analysis and normalized to account for the presence of H2S; refer to Energy Laboratories Report in ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	38.5802	0.8794	0.8794	3.8517
Carbon Dioxide (excluded from VOC total)	1.7515	0.0399	0.0399	0.1749
Methane (excluded from VOC total)	1.6062	0.0004	0.0004	0.0016
Ethane (excluded from VOC total)	2.6529	0.0006	0.0006	0.0026
Hydrogen Sulfide (TAP; excluded from VOC total)	0.8271	0.0004	0.0004	0.0017
Propane	5.8520	0.0013	0.0013	0.0058
Iso-Butane	2.2140	0.0010	0.0010	0.0044
N-Butane	8.7708	0.0040	0.0040	0.0175
Iso-Pentane	8.3975	0.0038	0.0038	0.0168
N-Pentane	11.6018	0.0053	0.0053	0.0232
Iso-Hexanes	10.9333	0.0050	0.0050	0.0218
N-Hexane (TAP)	2.5325	0.0012	0.0012	0.0051
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.5138	0.0002	0.0002	0.0010
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	1.3678	0.0006	0.0006	0.0027
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.5217	0.0002	0.0002	0.0010
2,2,4-Trimethylpentane (TAP)	0.6061	0.0003	0.0003	0.0012
Octanes	1.0895	0.0005	0.0005	0.0022
Ethylbenzene (TAP)	0.0296	0.0000	0.0000	0.0001
Xylenes (TAP)	0.1518	0.0001	0.0001	0.0003
Nonanes	0.0000	0.0000	0.0000	0.0000
Decanes Plus	0.0000	0.0000	0.0000	0.0000
Other Nm/NE HC	0.0000	0.0000	0.0000	0.0000
TOTAL WEIGHT PERCENT:	100.0000			
TOTAL TAP EMISSIONS:		0.00	0.00	0.01
TOTAL VOC EMISSIONS:		**0.02**	**0.02**	**0.10**
TOTAL Non-VOC & Non-TAP HC:		0.00	0.00	0.00
TOTAL EMISSIONS:		0.94	0.94	4.14

Total of Average Hourly VOC emissions estimated for this source:	**9.61 Lbs/Hr**
Total of Maximum Hourly VOC emissions estimated for this source:	**9.61 Lbs/Hr**
Total of Maximum Annual VOC emissions estimated for this source:	**42.11 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	224	224	0.3150	0.3150
2. Welle Gas Relief Vent	8760	8333	8333	11.1345	11.1345
Pilot Feed	8760	21	21	0.0281	0.0281
	Totals:	***8,578***	***8,578***	***11.48***	***11.48***

Emission factor for soot is from AP-42 "Compilation of Air Pollution Emission Factors" for an industrial burn flare stack (refer to ensuing pages for copies of supporting documentation).
SO2 emissions based on the composite H2S 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	0.09	0.09	0.41
Soot (expressed as $PM_{2.5}$)	0.000011	0.09	0.09	0.41
SO_2	N/A	15.97	15.97	69.93

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 ensuing pages for copies of supporting documentation).

POLLUTANT:	**Emission Factor (lb/10^6 BTU)**	**CALCULATED EMISSION RATES**		
		Average Hourly (lb/hr)	**Maximum Hourly (lb/hr)**	**Annual (TPY)**
Nitrogen Oxides	0.1380	1.58	1.58	6.94
CO	0.2755	3.16	3.16	13.85

Emission Calculations

POINT SOURCE I.D. NUMBER: *6-15-LL*

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

DATA:

Emission Source:	*Vapors from Oil Truck Loading*
Maximum Annual Loading Volume-Barrels (Q):	*73,000*
Average Oil Temperature - °R (T):	*540*
API Oil Gravity@ Average Oil Temperature	*35*
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; refer to ensuing pages)	*4.6*
True Vapor Pressure (P): (from Fig. 7.1-13b of AP-42; refer to ensuing pages)	*3.8*
Loading Rate-Barrels/Hr (R): (conservative estimate)	*180*
Basis of Loading Loss Estimates:	*AP-42; January 1995 edition; refer to Ensuing Pages*

Annual Uncontrolled THC Emissions (TPY)	=	12.46 * S * P * M/T*Q*42/2000/1000 gallons loaded	=	**4.03**
Hourly Uncontrolled THC Emissions (lb/hr)	=	12.46 * S * P * M/T*R*42/1000 gallons loaded	=	**19.89**
Max. Hourly Uncontrolled THC Emissions (lb/hr)	=	12.46 * S * P * M/T*R*42/1000 gallons loaded	=	**19.89**

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; concentrations normalized to account for the presence of H_2S, reference ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Hydrogen Sulfide (excluded from VOC total)	0.6621	0.1317	0.1317	0.0267
Methane (excluded from VOC total)	6.1155	1.2164	1.2164	0.2465
Ethane (excluded from VOC total)	5.5236	1.0986	1.0986	0.2226
Propane	17.3607	3.4530	3.4530	0.6996
Iso-Butane	1.4800	0.2944	0.2944	0.0596
N-Butane	26.7314	5.3169	5.3169	1.0773
Iso-Pentane	1.4792	0.2942	0.2942	0.0596
N-Pentane	14.4009	2.8643	2.8643	0.5804
Heptane	9.0751	1.8050	1.8050	0.3657

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Octane	6.8055	1.3536	1.3536	0.2743
Other NM/NE Hydrocarbons	2.4737	0.4920	0.4920	0.0997
N-Hexane (TAP)	7.7932	1.5501	1.5501	0.3141
Benzene (TAP)	0.0992	0.0197	0.0197	0.0040
Total Weight Percent	100.0000			
Total TAP Emissions		1.57	1.89	0.32
Total VOC Emissions		**17.44**	**17.44**	**3.53**
Total Non VOC & Non TAP-HC		2.32	2.32	0.47
Total Hydrocarbon Emissions		19.89	19.89	4.03

Calculated Max. Gas Flowrate (SCFH) = **147**

Emission Calculations

POINT SOURCE I.D. NUMBERS: *7-15-PC*

EMISSION SOURCE DESCRIPTION: *Pneumatic Controllers*

DATA:

Emission Source:	***Natural Gas Supplied to Controllers & Transmitters***
Specific Gravity of Natural Gas Supply: *(based on a representative wet gas analysis)*	*1.4207*
Basis of Emission Estimates:	***Manufacturers' Specifications or EPA Publication***

"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 Air Rate Required (SCFH)
Level Controllers (Process Separators)	*30*	*9200*	*9*	*24*	*8*	*1028*	*129*
Pressure Controllers (Process Vessels)	*30*	*N/A*	*4"*	*N/A*	*N/A*	*2800*	*22*
Pressure Controllers (Fired Equipment)	*30*	*N/A*	*4"*	*N/A*	*N/A*	*600*	*5*
						TOTAL AIR CONSUMPTION:	*156*
						TOTAL GAS CONSUMPTION:	*131*

Avg. Hourly Uncontrolled Supply Gas Emissions (lb/hr)	=	Hourly Gas Rate * Gas Density	=	**14.22**
Max. Hourly Uncontrolled Supply Gas Emissions (lb/hr)	=	Hourly Gas Rate * Gas Density	=	**14.22**
Annual Potential Uncontrolled Supply Gas Emissions (TPY)	=	Hourly Rate * 8760 hrs/yr/2000 lbs/ton	=	**62.28**

SPECIATION FACTORS:

Speciation of the supply gas is based on a representative wet gas analysis and normalized to account for the presence of H2S; refer to Energy Laboratories Report in ensuing pages.

EMISSIONS SUMMARY:

POLLUTANT:	Weight Percent	CALCULATED EMISSION RATES		
		Average Hourly (lb/hr)	Maximum Hourly (lb/hr)	Annual (TPY)
Nitrogen (excluded from VOC total)	38.5802	5.4861	5.4861	24.0278
Carbon Dioxide (excluded from VOC total)	1.7515	0.2491	0.2491	1.0908
Methane (excluded from VOC total)	1.6062	0.2284	0.2284	1.0004
Ethane (excluded from VOC total)	2.6529	0.3772	0.3772	1.6522
Hydrogen Sulfide (TAP; excluded from VOC total)	0.8271	0.1176	0.1176	0.5151
Propane	5.8520	0.8322	0.8322	3.6446
Iso-Butane	2.2140	0.3148	0.3148	1.3789
N-Butane	8.7708	1.2472	1.2472	5.4624
Iso-Pentane	8.3975	1.1941	1.1941	5.2300
N-Pentane	11.6018	1.6498	1.6498	7.2256
Iso-Hexanes	10.9333	1.5547	1.5547	6.8092
N-Hexane (TAP)	2.5325	0.3601	0.3601	1.5772
Methylcyclopentane	0.0000	0.0000	0.0000	0.0000
Benzene (TAP)	0.5138	0.0731	0.0731	0.3200
Cyclohexane	0.0000	0.0000	0.0000	0.0000
Heptanes	1.3678	0.1945	0.1945	0.8519
Methylcyclohexane	0.0000	0.0000	0.0000	0.0000
Toluene (TAP)	0.5217	0.0742	0.0742	0.3249
2,2,4-Trimethylpentane (TAP)	0.6061	0.0862	0.0862	0.3775
Octanes	1.0895	0.1549	0.1549	0.6785
Ethylbenzene (TAP)	0.0296	0.0042	0.0042	0.0184
Xylenes (TAP)	0.1518	0.0216	0.0216	0.0945
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:		0.74	0.74	3.23
TOTAL VOC EMISSIONS:		**7.76**	**7.76**	**33.99**
TOTAL Non-VOC & Non-TAP HC		0.61	0.61	2.65
TOTAL Emissions		14.22	14.22	62.28

Emission Calculations

POINT SOURCE I.D. NUMBERS: *8-15-FE*

EMISSION SOURCE DESCRIPTION: *Fugitive Emissions*

DATA:

Emission Source:	***Fugitive from Light Liquid & Gas-Service Components***
Light Liquid Service Valves (conservative estimate):	*50*
Gas Service Valves (conservative estimate):	*100*
Number of Pumps [a] (per operator):	*0*
Basis of Emission Estimates:	***U.S. EPA & API Studies***

COMPONENT CALCULATIONS:

	Light Liquid (LL) Service [d]					Gas Service [d]				
Total # of Components [b]	*50*	÷	18.5%	=	*270*	*100*	÷	*15.0%*	=	*667*
# of Valves:					*50*					*100*
# of Connections (Other):	*270*	x	55.7%	=	*151*	*667*	x	*69.7%*	=	*465*
# of Flanges:	*270*	x	22.8%	=	*62*	*667*	x	*11.3%*	=	*75*
# of Open Ends:	*270*	x	2.0%	=	*5*	*667*	x	*2.5%*	=	*17*
# of "Others" [c]	*270*	x	1.0%	=	*3*	*667*	x	*1.5%*	=	*10*

EMISSION CALCULATIONS:

	Count - by Service			THC Emission Factors [e] (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
Connections (Others)	151	465	616	2.1E-04	2.0E-04	0.070	0.205	0.31	0.90
Flanges	62	75	137	1.1E-04	3.9E-04	0.015	0.065	0.07	0.28
Open Ends	5	17	22	1.4E-03	2.0E-03	0.017	0.073	0.07	0.32
Pumps	0		0	1.3E-02	2.4E-03	0.000	N/A	0.00	N/A
Valves	50	100	150	2.5E-03	4.5E-03	0.276	0.992	1.21	4.35
"Others"	3	10	13	7.5E-03	8.8E-03	0.045	0.194	0.20	0.85
TOTALS:	**270**	**667**	**938**			**0.42**	**1.53**	**1.85**	**6.70**

[a] Process Pumps Only

[b] Assumes that pumps are not considered within the "total components by type" factors

[c] "Others" equipment derived from compressors, diaphragms, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents

[d] Refer to Table 4 (API Publication 4589) & Table 5 (API Publication 4615), copy included in ensuing pages

[e] Refer to EPA Publication No. 453/R-95-017, "Protocol for Equipment Leak Emission Estimates", copy included in ensuing pages

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" and normalized to account for the presence of H2S.

EMISSIONS SUMMARY:

Component	Weight Percent	Calculated Emission Rate	
		Avg. Hourly (lb/hr)	Avg. Annual (TPY)
Hydrogen Sulfide (TAP; excluded from VOC total)	1.4998	0.006	0.028
NMEHC (expressed as VOC)	28.5990	0.121	0.528
Benzene (TAP)	0.0265	0.000	0.000
Ethylbenzene (TAP)	0.0167	0.000	0.000
Toluene (TAP)	0.0739	0.000	0.001
Xylenes (m,p,o) (TAP)	0.0356	0.000	0.001
	TOTAL TAP EMISSIONS:	0.01	0.03
	TOTAL VOC EMISSIONS:	**0.12**	**0.53**

GAS SERVICE SPECIATION FACTORS:

Speciation of the emission stream from components in gas service is based on a representative wet gas analysis and normalized to account for the presence of H2S; refer to Energy Laboratories Report in ensuing pages.

EMISSIONS SUMMARY:

Component	Weight Percent	Calculated Emission Rate	
		Avg. Hourly (lb/hr)	Avg. Annual (TPY)
Nitrogen (excluded from VOC total)	38.5802	0.590	2.584
Carbon Dioxide (excluded from VOC total)	1.7515	0.027	0.117
Methane (excluded from VOC total)	1.6062	0.025	0.108
Ethane (excluded from VOC total)	2.6529	0.041	0.178
Hydrogen Sulfide (TAP; excluded from VOC total)	0.8271	0.013	0.055
Propane	5.8520	0.089	0.392
Iso-Butane	2.2140	0.034	0.148
N-Butane	8.7708	0.134	0.587
Iso-Pentane	8.3975	0.128	0.562
N-Pentane	11.6018	0.177	0.777
Iso-Hexanes	10.9333	0.167	0.732
N-Hexane (TAP)	2.5325	0.039	0.170
Methylcyclopentane	0.0000	0.000	0.000
Benzene (TAP)	0.5138	0.008	0.034
Cyclohexane	0.0000	0.000	0.000
Heptanes	1.3678	0.021	0.092
Methylcyclohexane	0.0000	0.000	0.000

Toluene (TAP)	0.5217	0.008	0.035
2,2,4-Trimethylpentane (TAP)	0.6061	0.009	0.041
Octanes	1.0895	0.017	0.073
Ethylbenzene (TAP)	0.0296	0.000	0.002
Xylenes (TAP)	0.1518	0.002	0.010
Nonanes	0.0000	0.000	0.000
Decanes Plus	0.0000	0.000	0.000
TOTAL WEIGHT PERCENT:	100.0000		
TOTAL TAP EMISSIONS:		0.08	0.35
TOTAL VOC EMISSIONS:		**0.83**	**3.66**
TOTAL Non-VOC & Non-TAP HC		0.07	0.29
TOTAL Emissions		1.53	6.70

Facility-Wide VOC Fugitive Totals	=	**0.95 lb/hr**	**4.19 TPY**

Emission Calculations

POINT SOURCE I.D. NUMBER: *9-15-LOT*

EMISSION SOURCE DESCRIPTION: *265 Gallon Lube Oil Storage Tank*

DATA:

Emission Source:	***"Working" & "Breathing" Losses***
Maximum Annual Throughput: **(Gallons/Yr)**	*2,650*
Average VOC Working Losses - L_w (lb/yr): ***(from EPA Tanks 4.0; report in ensuing pages)***	*1.63*
Average VOC Breathing Losses - L_B (lb/yr): ***(from EPA Tanks 4.0; report in ensuing pages)***	*3.92*

Avg. Hourly Uncontrolled THC Losses (lb/hr)	=	$(L_W + L_B)$	=	**0.00**
Annual Potential Uncontrolled THC Losses (TPY)	=	Hourly * 8760/2000	=	**0.00**

For purposes of permitting and/or providing conservative emission estimates, the EPA Tanks 4.0 Program was run using Toluene as the stored material for this tank. A throughput of approximately 2,650 gallons was used in the emissions model in an effort to demonstrate a conservative potential emissions estimate.

Emission Calculations

POINT SOURCE I.D. NUMBER: *10-15-LOT*

EMISSION SOURCE DESCRIPTION: *55 Gallon Lube Oil Storage Tank*

DATA:

Emission Source:	*"Working" & "Breathing" Losses*
Maximum Annual Throughput: (Gallons/Yr)	*550*
Average VOC Working Losses - L_W (lb/yr): *(from EPA Tanks 4.0; report in ensuing pages)*	*1.89*
Average VOC Breathing Losses - L_B (lb/yr): *(from EPA Tanks 4.0; report in ensuing pages)*	*35.11*

Avg. Hourly Uncontrolled THC Losses (lb/hr)	=	$(L_W + L_B)$	=	**0.00**
Annual Potential Uncontrolled THC Losses (TPY)	=	Hourly * 8760/2000	=	**0.02**

For purposes of permitting and/or providing conservative emission estimates, the EPA Tanks 4.0 Program was run using n-Hexane as the stored material for this tank. A throughput of approximately 550 gallons was used in the emissions model in an effort to demonstrate a conservative potential emissions estimate.

Emission Calculations

POINT SOURCE I.D. NUMBER: *11-15-CST*

EMISSION SOURCE DESCRIPTION: *2-110 Gallon Chemical Storage Tanks*

DATA:

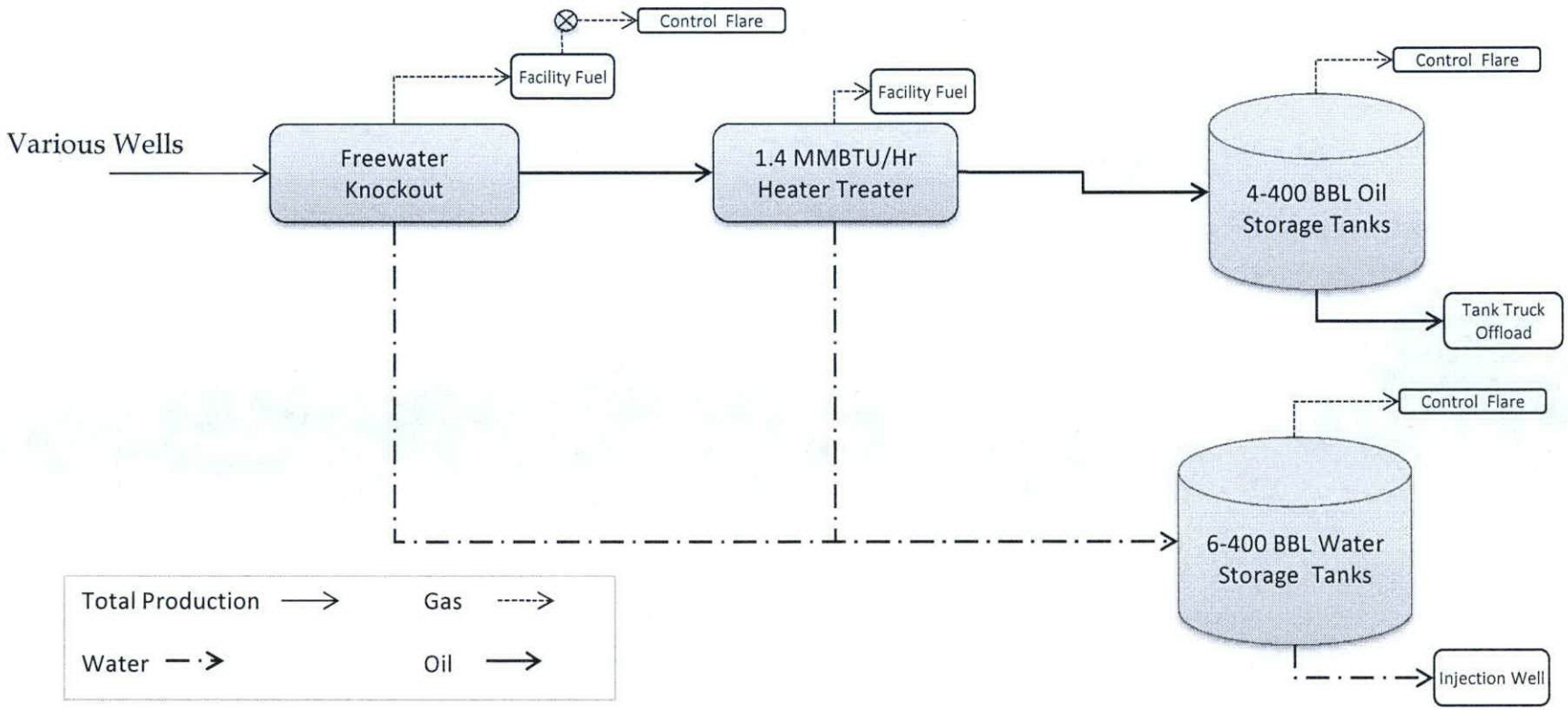
Emission Source:	*"Working" & "Breathing" Losses*
Maximum Annual Throughput: (Gallons/Yr)	*1,100*
Average VOC Working Losses - L_w (lb/yr): *(from EPA Tanks 4.0; report in ensuing pages)*	*7.54*
Average VOC Breathing Losses - L_B (lb/yr): *(from EPA Tanks 4.0; report in ensuing pages)*	*70.22*

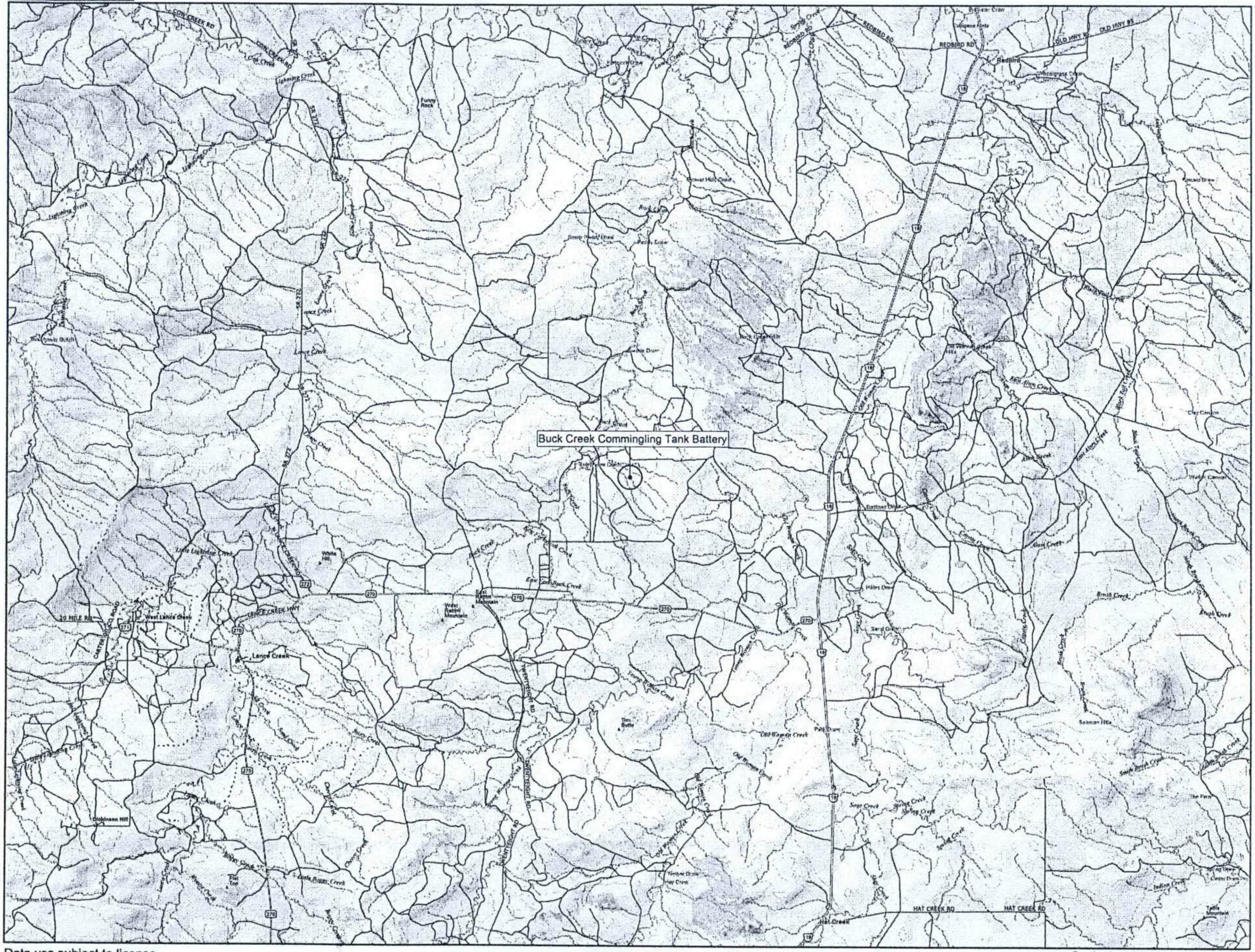
Avg. Hourly Uncontrolled THC Losses (lb/hr)	=	$(L_W + L_B)$	=	**0.01**
Annual Potential Uncontrolled THC Losses (TPY)	=	Hourly * 8760/2000	=	**0.04**

For purposes of permitting and/or providing conservative emission estimates, the EPA Tanks 4.0 Program was run using n-Hexane as the stored material for this tank. A throughput of approximately 1,100 gallons for each tank was used in the emissions model in an effort to demonstrate a conservative potential emissions estimate.

Simplified Process Flow Diagram

J.P. Oil Company, Inc.
Buck Creek Commingling Tank Battery
Niobrara County, WY





Scale 1 : 200,000

TN

MN (8.4°E)

1" = 3.16 mi

Data Zoom 11-0

Data use subject to license.

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33.2% wet gas

LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

Client: JP Oil Co
Project: Buck Creek
Client Sample ID: Federal 13-18
Location:
Samp FRQ/Type:
Lab ID: G14110292-001

Report Date: 12/03/14
Collection Date: 11/18/14 11:30
Date Received: 11/19/14
Matrix: Gas
Sampled By: David Bowles

Analyses	Result	Units	Qualifier	Method	Analysis Date / By
SAMPLE INFORMATION PROVIDED BY CLIENT					
Field	Buck Creek			NGField	11/18/14 11:30 / ***
County	Niobrara			NGField	11/18/14 11:30 / ***
State	WY			NGField	11/18/14 11:30 / ***
Location	Well Head			NGField	11/18/14 11:30 / ***
Source Pressure	1.5	psi		NGField	11/18/14 11:30 / ***
ELI Container #	617			NGField	11/18/14 11:30 / ***
HYDROGEN SULFIDE IN GAS					
Hydrogen Sulfide	130	ppm		GPA 2377	11/18/14 11:30 / djb
NATURAL GAS CHROMATOGRAPHIC ANALYSIS REPORT					
Oxygen	< 0.001	Mol %		GPA 2261	11/21/14 11:43 / dem
Nitrogen	57.306	Mol %		GPA 2261	11/21/14 11:43 / dem
Carbon Dioxide	1.656	Mol %		GPA 2261	11/21/14 11:43 / dem
Methane	4.166	Mol %		GPA 2261	11/21/14 11:43 / dem
Ethane	3.671	Mol %		GPA 2261	11/21/14 11:43 / dem
Propane	5.522	Mol %		GPA 2261	11/21/14 11:43 / dem
Isobutane	1.585	Mol %		GPA 2261	11/21/14 11:43 / dem
n-Butane	6.279	Mol %		GPA 2261	11/21/14 11:43 / dem
Isopentane	4.843	Mol %		GPA 2261	11/21/14 11:43 / dem
n-Pentane	6.691	Mol %		GPA 2261	11/21/14 11:43 / dem
Hexanes plus	8.268	Mol %		GPA 2261	11/21/14 11:43 / dem
GPM @ STD COND/1000 CU.FT., MOISTURE FREE GAS					
GPM Ethane	0.9815	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM Propane	1.5209	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM Isobutane	0.5185	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM n-Butane	1.9791	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM Isopentane	1.7707	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM n-Pentane	2.4248	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM Hexanes plus	3.6071	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM Pentanes plus	7.8026	gal/MCF		GPA 2261	11/21/14 11:43 / dem
GPM Total	12.803	gal/MCF		GPA 2261	11/21/14 11:43 / dem
CALCULATED PROPERTIES					
Calculation Pressure Base	14.730	psia		GPA 2261	11/21/14 11:43 / dem
Calculation Temperature Base	60	°F		GPA 2261	11/21/14 11:43 / dem
Compressibility Factor, Z	0.99176	unitless		GPA 2261	11/21/14 11:43 / dem
Molecular Weight	41.59	unitless		GPA 2261	11/21/14 11:43 / dem
Pseudo-critical Pressure, psia	522	psia		GPA 2261	11/21/14 11:43 / dem
Pseudo-critical Temperature, deg R	445	deg R		GPA 2261	11/21/14 11:43 / dem
Specific Gravity (air=1.000)	1.436	unitless		GPA 2261	11/21/14 11:43 / dem

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Prepared by Gillette, WY Branch

Client: JP Oil Co
Project: Buck Creek
Client Sample ID: Federal 13-18
Location:
Samp FRQ/Type:
Lab ID: G14110292-001

Report Date: 12/03/14
Collection Date: 11/18/14 11:30
Date Received: 11/19/14
Matrix: Gas
Sampled By: David Bowles

Analyses	Result	Units	Qualifier	Method	Analysis Date / By
CALCULATED PROPERTIES					
Gross BTU per cu ft @ std cond, dry	1398.57	BTU/cu ft		GPA 2261	11/21/14 11:43 / dem
Gross BTU per cu ft @ std cond, wet	1374.23	BTU/cu ft		GPA 2261	11/21/14 11:43 / dem

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

Name: Buck Creek Commingling Tank Battery

COMPONENT	mole %	MOLE FRACTION	MW	fuel weight	WT frac	Wt %	dh*	Heat Value (BTU/SCF)	Carbon Weight %
Nitrogen	57.3060	0.573	28.0134	16.05	0.3879	38.7858	0	0.00	0.0000
Hydrogen Sulfide	0.0130	0.000	34.08	0.00	0.0001	0.0107	637.1	0.08	0.0000
Carbon Dioxide	1.6560	0.017	44.01	0.73	0.0176	1.7608	0	0.00	0.1990
Methane	4.1660	0.042	16.043	0.67	0.0161	1.6148	1010	42.08	0.4999
Ethane	3.6710	0.037	30.07	1.10	0.0267	2.6670	1770	64.96	0.8809
Propane	5.5220	0.055	44.097	2.44	0.0588	5.8832	2516	138.94	1.9882
I-Butane	1.5850	0.016	58.123	0.92	0.0223	2.2258	3252	51.54	0.7609
N-Butane	6.2790	0.063	58.123	3.65	0.0882	8.8175	3262	204.84	3.0142
I-Pentane	4.8430	0.048	72.15	3.49	0.0844	8.4422	4001	193.76	2.9058
N-Pentane	6.6910	0.067	72.15	4.83	0.1166	11.6637	4009	268.24	4.0146
Other hexanes	5.2791	0.053	86.177	4.55	0.1099	10.9916	4750	250.77	3.8010
N-hexane	1.2228	0.012	86.177	1.05	0.0255	2.5461	4756	58.16	0.8805
heptane	0.5680	0.006	100.204	0.57	0.0138	1.3751	5503	31.25	0.4771
iso-octane	0.2208	0.002	114.231	0.25	0.0061	0.6093	6232	13.76	0.2119
octanes+	0.3969	0.004	144.231	0.57	0.0138	1.3830	6500	25.80	0.4751
benzene	0.2737	0.003	78.114	0.21	0.0052	0.5165	3742	10.24	0.1970
toluene	0.2356	0.002	92.141	0.22	0.0052	0.5246	4475	10.54	0.1981
ethylbenzene	0.0116	0.000	106.167	0.01	0.0003	0.0297	5222	0.60	0.0111
xylene	0.0595	0.001	106.167	0.06	0.0015	0.1527	5209	3.10	0.0571
TOTALS	**100.0**	**1.000**		**41.39**	**1.0000**	**100.0000**		***1369***	***20.5724***

		sg	**1.4272**		
hexanes+	8.2680	**VOC wt%**	**55.1608**	Carbon wt%	49.70419
		Toxic wt%	**4.3788**		

Normalized Wet Gas Analysis Calculation

COMPONENT	mole %	mole % w/extra component	COMPONENT MW	fuel weight	Normalized WT %	component BTU/scf	partial Heating values
Water		0.000	18	0.00	0.0000	0	0
Nitrogen	57.3060	56.740	28.0134	15.89	38.5802	0	0
Methane	4.1660	4.125	16.043	0.66	1.6062	1010	42
Carbon Dioxide	1.6560	1.640	44.01	0.72	1.7515	0	0
Ethane	3.6710	3.635	30.07	1.09	2.6529	1770	64
Hydrogen Sulfide	0.0130	0.013	34.08	0.00	0.0106	637	0
Propane	5.5220	5.467	44.097	2.41	5.8520	2516	138
I-Butane	1.5850	1.569	58.123	0.91	2.2140	3252	51
N-Butane	6.2790	6.217	58.123	3.61	8.7708	3262	203
I-Pentane	4.8430	4.795	72.15	3.46	8.3975	4001	192
N-Pentane	6.6910	6.625	72.15	4.78	11.6018	4009	266
Other hexanes	5.2791	5.227	86.177	4.50	10.9333	4750	248
N-hexane	1.2228	1.211	86.177	1.04	2.5325	4756	58
Methylcyclopentane	0.0000	0.000	84.1608	0.00	0.0000	4501	0
benzene	0.2737	0.271	78.114	0.21	0.5138	3742	10
cyclohexane	0.0000	0.000	84.1608	0.00	0.0000	4482	0
heptane	0.5680	0.562	100.204	0.56	1.3678	5503	31
Methylcyclohexane	0.0000	0.000	98.18	0.00	0.0000	5216	0
toluene	0.2356	0.233	92.141	0.21	0.5217	4475	10
iso-octane	0.2208	0.219	114.22	0.25	0.6061	6232	14
octanes	0.3969	0.393	114.22	0.45	1.0895	7000	28
ethylbenzene	0.0116	0.011	106.167	0.01	0.0296	5222	1
xylene	0.0595	0.059	106.167	0.06	0.1518	5208	3
nonanes	0.0000	0.000	128.25	0.00	0.0000	6997	0
Decanes Plus	0.0000	0.000	142.28	0.00	0.0000	7743	0
Max H2S	0.9870	0.9870	34.08	0.34	0.8164	637	6
TOTALS	101.0	100.000	MW=	41.20	100.0000	total btu/scf	1363.4077

sg	1.421
VOC wt%	54.5821
Toxic wt%	4.355

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 $lb/10^6$ 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 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. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6 \text{ scf}] = (3.67)(CON)(C)(D)$, where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, 4.2×10^4 $lb/10^6$ 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
205-82-3	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

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
74-98-6	Propane	1.6E+00	E
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 16. To convert from $lb/10^6$ scf to lb/MMBtu, divide by 1,020.

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

References For Section 1.4

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10. J. P. Kesselring and W. V. Krill, "A Low-NO_x Burner For Gas-Fired Firetube Boilers", *Proceedings: 1985 Symposium On Stationary Combustion NO_x Control, Volume 2*, EPRI CS-4360, Electric Power Research Institute, Palo Alto, CA, January 1986.

11. *Emission Factor Documentation for AP-42 Section 1.4—Natural Gas Combustion*, Technical Support Division, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC, 1997.

12. *Alternate Control Techniques Document - NO_x Emissions from Utility Boilers*, EPA-453/R-94-023, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1994.

OSTs


```
*****************************************************************************************
*     Project Setup Information                                                         *
*****************************************************************************************
Project File                : O:\E&P Tanks\JP_Buck Creek Commingling TB_OSTs.ept
Flowsheet Selection         : Oil Tank with Separator
Calculation Method          : AP42
Control Efficiency          : 100.0%
Known Separator Stream      : Low Pressure Oil
Entering Air Composition    : No

Filed Name                  : JP Oil - Buck Creek Commingling Tank Battery
Date                        : 2015.05.29


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

Separator Pressure          : 45.00[psig]
Separator Temperature       : 175.00[F]
Ambient Pressure            : 14.70[psia]
Ambient Temperature         : 80.00[F]
C10+ SG                     : 0.7455
C10+ MW                     : 159.828

-- Low Pressure Oil ----------------------------------------------------------------------
   No.    Component              wt %
   1      H2S                    0.2726
   2      O2                     0.0000
   3      CO2                    0.0434
   4      N2                     0.0031
   5      C1                     0.0211
   6      C2                     0.1005
   7      C3                     0.3606
   8      i-C4                   0.1595
   9      n-C4                   0.7859
   10     i-C5                   1.0412
   11     n-C5                   1.2619
   12     C6                     2.2159
   13     C7                     8.9530
   14     C8                     6.6634
   15     C9                     7.6886
   16     C10+                  60.4148
   17     Benzene                0.6186
   18     Toluene                2.0608
   19     E-Benzene              0.1182
   20     Xylenes                4.6102
   21     n-C6                   1.5349
   22     224Trimethylp          1.0718

-- Sales Oil -----------------------------------------------------------------------------
Production Rate             : 50[bbl/day]
Days of Annual Operation    : 365 [days/year]
API Gravity                 : 33.0
Reid Vapor Pressure         : 7.70[psia]
Bulk Temperature            : 80.00[F]

-- Tank and Shell Data -------------------------------------------------------------------
Diameter                    : 12.00[ft]
Shell Height                : 20.00[ft]
Cone Roof Slope             : 0.06
Average Liquid Height       : 9.50[ft]
Vent Pressure Range         : 0.06[psi]
Solar Absorbance            : 0.68

-- Meteorological Data -------------------------------------------------------------------
```

City	: Cheyenne, WY
Ambient Pressure	: 14.70[psia]
Ambient Temperature	: 80.00[F]
Min Ambient Temperature	: 33.10[F]
Max Ambient Temperature	: 58.30[F]
Total Solar Insolation	: 1491.00[Btu/ft^2*day]

****
* Calculation Results *
****

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

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
Total HAPs	0.120	0.027
Total HC	2.590	0.591
VOCs, C2+	2.343	0.535
VOCs, C3+	1.865	0.426

Uncontrolled Recovery Info.

Vapor	203.0300 x1E-3	[MSCFD]
HC Vapor	130.2300 x1E-3	[MSCFD]
GOR	4.06	[SCF/bbl]

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

No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
1	H2S	0.892	0.204
2	O2	0.000	0.000
3	CO2	0.321	0.073
4	N2	0.045	0.010
5	C1	0.247	0.056
6	C2	0.477	0.109
7	C3	0.597	0.136
8	i-C4	0.108	0.025
9	n-C4	0.380	0.087
10	i-C5	0.197	0.045
11	n-C5	0.179	0.041
12	C6	0.096	0.022
13	C7	0.131	0.030
14	C8	0.032	0.007
15	C9	0.013	0.003
16	C10+	0.014	0.003
17	Benzene	0.020	0.005
18	Toluene	0.019	0.004
19	E-Benzene	0.000	0.000
20	Xylenes	0.013	0.003
21	n-C6	0.053	0.012
22	224Trimethylp	0.013	0.003
	Total	3.847	0.878

-- Stream Data ----------

No.	Component	MW	LP Oil wt %	Flash Oil wt %	Sale Oil wt %	Flash Gas wt %	W&S Gas wt %	Total Emissions wt %
1	H2S	34.80	0.2726	0.2617	0.2176	22.2237	24.2131	23.5143
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.0434	0.0388	0.0230	9.3220	7.7149	8.2794
4	N2	28.01	0.0031	0.0015	0.0000	3.2759	0.0002	1.1507
5	C1	16.04	0.0211	0.0158	0.0034	10.7476	4.0069	6.3745
6	C2	30.07	0.1005	0.0945	0.0713	12.2772	12.3444	12.3208
7	C3	44.10	0.3606	0.3540	0.3256	13.7812	16.2837	15.4047
8	i-C4	58.12	0.1595	0.1584	0.1534	2.4257	2.9866	2.7895
9	n-C4	58.12	0.7859	0.7821	0.7651	8.4944	10.5384	9.8205
10	i-C5	72.15	1.0412	1.0396	1.0320	4.3608	5.4666	5.0782
11	n-C5	72.15	1.2619	1.2605	1.2542	3.9593	4.9703	4.6152
12	C6	86.16	2.2159	2.2159	2.2153	2.1731	2.7326	2.5361
13	C7	100.20	8.9530	8.9559	8.9663	3.0014	3.7715	3.5011

14	C8	114.23	6.6634	6.6664	6.6774	0.7251	0.9098	0.8449
15	C9	128.28	7.6886	7.6922	7.7061	0.2970	0.3721	0.3457
16	C10+	159.83	60.4148	60.4447	60.5579	0.3079	0.3839	0.3574
17	Benzene	78.11	0.6186	0.6187	0.6189	0.4440	0.5590	0.5186
18	Toluene	92.13	2.0608	2.0617	2.0646	0.4274	0.5376	0.4989
19	E-Benzene	106.17	0.1182	0.1182	0.1184	0.0082	0.0104	0.0096
20	Xylenes	106.17	4.6102	4.6123	4.6204	0.2818	0.3538	0.3285
21	n-C6	86.18	1.5349	1.5350	1.5353	1.1825	1.4874	1.3803
22	224Trimethylp	114.24	1.0718	1.0721	1.0736	0.2837	0.3566	0.3310
	MW		126.66	126.82	127.11	36.05	41.41	39.35
	Stream Mole Ratio		1.0000	0.9983	0.9954	0.0017	0.0028	0.0046
	Heating Value	[BTU/SCF]				1505.22	1791.12	1681.43
	Gas Gravity	[Gas/Air]				1.24	1.43	1.36
	Bubble Pt. @ 100F	[psia]	19.95	17.46	11.81			
	RVP @ 100F	[psia]	64.06	60.09	50.35			
	Spec. Gravity @ 100F		0.696	0.696	0.696			

Oil Flash

QUESTAR APPLIED TECHNOLOGY

1210 D. Street, Rock Springs, Wyoming 82901

(307) 352-7292

LIMS ID:	N/A	Description:	Buck Creek 12-17A
Analysis Date/Time:	7/3/2006	Field:	Buck Creek
Analyst Initials:	PRP	ML#:	Nance
Sample Temperature:	150	GC Method:	Quesliq1.M
Sample Pressure:	35	Data File:	QPC39.D
Date Sampled:	6/29/2006	Instrument ID:	1

Component	Mol%	Wt%	LV%
Methane	0.1695	0.0212	0.0521
Ethane	0.4312	0.1011	0.2096
Propane	1.0545	0.3625	0.5269
Isobutane	0.3539	0.1604	0.21
n-Butane	1.7437	0.79	0.9969
Neopentane	0.2575] 1.8612	0.1448	0.1788
Isopentane	1.6035	0.9018	1.0643
n-Pentane	2.2553	1.2684	1.4812
2,2-Dimethylbutane	0.0173	0.0116	0.0131
2,3-Dimethylbutane	0.4989	0.3351	0.3707
2-Methylpentane	1.5938	1.0706	1.1993
3-Methylpentane	1.2065	0.8104	0.8926
n-Hexane	2.2967	1.5428	1.7121
Heptanes	12.5434	9.3951	9.4514
Octanes	11.6166	9.8289	9.7329
Nonanes	13.4719	12.4797	11.9112
Decanes plus	48.7441	60.7288	59.9546
Nitrogen	0.0144	0.0031	0.0029
Carbon Dioxide	0.1273	0.0437	0.0394
Total	100.0000	100.0000	100.0000

Global Properties		Units
Avg Molecular Weight	128.2917	gm/mole
Pseudocritical Pressure	368.99	psia
Pseudocritical Temperatu	605.76	degF
Specific Gravity	0.7369	gm/ml
Liquid Density	6.1435	lb/gal
Liquid Density	258.03	lb/bbl
Specific Gravity	2.8254	air=1
SCF/bbl	764.25	SCF/bbl
SCF/gal	18.1964	SCF/gal
MCF/gal	0.0182	MCF/gal
gal/MCF	54.974	gal/MCF
Net Heating Value	5918.1	BTU/SCF at 60°F
Net Heating Value	17409.3	BTU/lb at 60°F
Gross Heating Value	6389.7	BTU/SCF at 60°F
Gross Heating Value	18726	BTU/lb at 60°F
Gross Heating Value	115064.8	BTU/gal at 60°F
API Gravity	60.5	
MON	34.1	
RON	36.1	
RVP	18.909	psia

Component	Mol%	Wt%	LV%
Benzene	1.0213	0.6219	0.5181
Toluene	2.8845	2.0717	1.751
Ethylbenzene	0.1435	0.1187	0.1004
M&P Xylene	4.4405	3.6748	3.117
O-Xylene	1.159	0.9591	0.7989
2,2,4-Trimethylpentane	1.2098	1.0773	1.1022

Data File: Buck Creek 12-17A

Page #2

CRTE&P TANK INFORMATION

Component	Mol%	Wt%	LV%
H2S			
O2			
CO2	0.1273	0.0437	0.0394
N2	0.0144	0.0031	0.0029
C1	0.1695	0.0212	0.0521
C2	0.4312	0.1011	0.2096
C3	1.0545	0.3625	0.5269
IC4	0.3539	0.1604	0.21
NC4	1.7437	0.79	0.9969
IC5	1.8610	1.0466	1.2431
NC5	2.2553	1.2684	1.4812
Hexanes	3.3165	2.2277	2.4757
Heptanes	11.5221	8.7732	8.9333
Octanes	7.5223	6.6799	6.8797
Nonanes	7.7289	7.7271	7.8949
Benzene	1.0213	0.6219	0.5181
Toluene	2.8845	2.0717	1.751
E-Benzene	0.1435	0.1187	0.1004
Xylene	5.5995	4.6339	3.9159
n-C6	2.2967	1.5428	1.7121
2,2,4-Trimethylpentane	1.2098	1.0773	1.1022
C10 Plus			
C10 Mole %	48.7441	60.7288	59.9546
Molecular Wt.	159.8279		
Specific Gravity	0.7455		
Total	100.0000	100.000	100.000

WSTs


```
*****************************************************************************************
*     Project Setup Information                                                         *
*****************************************************************************************
Project File                : O:\E&P Tanks\JP_Buck Creek Commingling TB_OSTs.ept
Flowsheet Selection         : Oil Tank with Separator
Calculation Method          : AP42
Control Efficiency          : 100.0%
Known Separator Stream      : Low Pressure Oil
Entering Air Composition    : No

Filed Name                  : JP Oil - Buck Creek Commingling Tank Battery
Date                        : 2015.05.29


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

Separator Pressure          : 45.00[psig]
Separator Temperature       : 80.00[F]
Ambient Pressure            : 14.70[psia]
Ambient Temperature         : 80.00[F]
C10+ SG                     : 0.7455
C10+ MW                     : 159.828

-- Low Pressure Oil ----------------------------------------------------------------
   No.    Component            mol %
   1      H2S                  0.9999
   2      O2                   0.0000
   3      CO2                  0.1260
   4      N2                   0.0143
   5      C1                   0.1678
   6      C2                   0.4269
   7      C3                   1.0440
   8      i-C4                 0.3504
   9      n-C4                 1.7263
   10     i-C5                 1.8424
   11     n-C5                 2.2327
   12     C6                   3.2833
   13     C7                  11.4069
   14     C8                   7.4471
   15     C9                   7.6516
   16     C10+                48.2567
   17     Benzene              1.0111
   18     Toluene              2.8557
   19     E-Benzene            0.1421
   20     Xylenes              5.5435
   21     n-C6                 2.2737
   22     224Trimethylp        1.1977

-- Sales Oil -----------------------------------------------------------------------
Production Rate             : 1.5[bbl/day]
Days of Annual Operation    : 365 [days/year]
API Gravity                 : 33.0
Reid Vapor Pressure         : 7.70[psia]
Bulk Temperature            : 80.00[F]

-- Tank and Shell Data -------------------------------------------------------------
Diameter                    : 12.00[ft]
Shell Height                : 20.00[ft]
Cone Roof Slope             : 0.06
Average Liquid Height       : 9.50[ft]
Vent Pressure Range         : 0.06[psi]
Solar Absorbance            : 0.68

-- Meteorological Data -------------------------------------------------------------
```

City	: Cheyenne, WY
Ambient Pressure	: 14.70[psia]
Ambient Temperature	: 80.00[F]
Min Ambient Temperature	: 33.10[F]
Max Ambient Temperature	: 58.30[F]
Total Solar Insolation	: 1491.00[Btu/ft^2*day]

****
* Calculation Results *
****

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

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
Total HAPs	0.040	0.009
Total HC	0.319	0.073
VOCs, C2+	0.315	0.072
VOCs, C3+	0.310	0.071

Uncontrolled Recovery Info.

Vapor	10.4500 x1E-3	[MSCFD]
HC Vapor	9.6500 x1E-3	[MSCFD]
GOR	6.97	[SCF/bbl]

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

No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
1	H2S	0.009	0.002
2	O2	0.000	0.000
3	CO2	0.004	0.001
4	N2	0.001	0.000
5	C1	0.004	0.001
6	C2	0.005	0.001
7	C3	0.014	0.003
8	i-C4	0.011	0.003
9	n-C4	0.056	0.013
10	i-C5	0.049	0.011
11	n-C5	0.048	0.011
12	C6	0.030	0.007
13	C7	0.044	0.010
14	C8	0.011	0.003
15	C9	0.004	0.001
16	C10+	0.005	0.001
17	Benzene	0.006	0.001
18	Toluene	0.006	0.001
19	E-Benzene	0.000	0.000
20	Xylenes	0.004	0.001
21	n-C6	0.017	0.004
22	224Trimethylp	0.004	0.001
	Total	0.332	0.076

-- Stream Data ----------

No.	Component	MW	LP Oil mol %	Flash Oil mol %	Sale Oil mol %	Flash Gas mol %	W&S Gas mol %	Total Emissions mol %
1	H2S	34.80	0.9999	0.9611	0.0000	23.1679	0.0001	5.0531
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.1260	0.1128	0.0000	7.6844	0.0001	1.6761
4	N2	28.01	0.0143	0.0069	0.0000	4.2430	0.0002	0.9255
5	C1	16.04	0.1678	0.1256	0.0000	24.3085	0.0001	5.3019
6	C2	30.07	0.4269	0.4017	0.0000	14.8121	0.0001	3.2307
7	C3	44.10	1.0440	1.0260	0.0437	11.3370	4.7399	6.1787
8	i-C4	58.12	0.3504	0.3484	0.1067	1.5141	4.5910	3.9199
9	n-C4	58.12	1.7263	1.7200	0.7569	5.3022	23.1268	19.2392
10	i-C5	72.15	1.8424	1.8418	1.4024	2.1927	16.5169	13.3927
11	n-C5	72.15	2.2327	2.2331	1.8557	1.9908	16.3552	13.2223
12	C6	86.16	3.2833	3.2874	3.2718	0.9150	8.9093	7.1657
13	C7	100.20	11.4069	11.4249	11.9979	1.0867	11.1068	8.9214

14	C8	114.23	7.4471	7.4597	7.9824	0.2303	2.3852	1.9152
15	C9	128.28	7.6516	7.6648	8.2496	0.0840	0.8704	0.6989
16	C10+	159.83	48.2567	48.3410	52.1728	0.0699	0.7074	0.5684
17	Benzene	78.11	1.0111	1.0125	1.0298	0.2062	2.0561	1.6526
18	Toluene	92.13	2.8557	2.8604	3.0357	0.1683	1.7407	1.3977
19	E-Benzene	106.17	0.1421	0.1423	0.1528	0.0028	0.0294	0.0236
20	Xylenes	106.17	5.5435	5.5530	5.9655	0.0963	1.0017	0.8043
21	n-C6	86.18	2.2737	2.2768	2.3057	0.4978	4.9357	3.9678
22	224Trimethylp	114.24	1.1977	1.1996	1.2672	0.0901	0.9267	0.7442
	MW		126.66	126.82	130.83	36.05	74.64	66.22
	Stream Mole Ratio		1.0000	0.9983	0.9920	0.0017	0.0063	0.0080
	Heating Value	[BTU/SCF]				1505.22	4090.85	3526.91
	Gas Gravity	[Gas/Air]				1.24	2.58	2.29
	Bubble Pt. @ 100F	[psia]	19.95	17.46	2.10			
	RVP @ 100F	[psia]	64.06	60.09	13.74			
	Spec. Gravity @ 100F		0.696	0.696	0.699			

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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

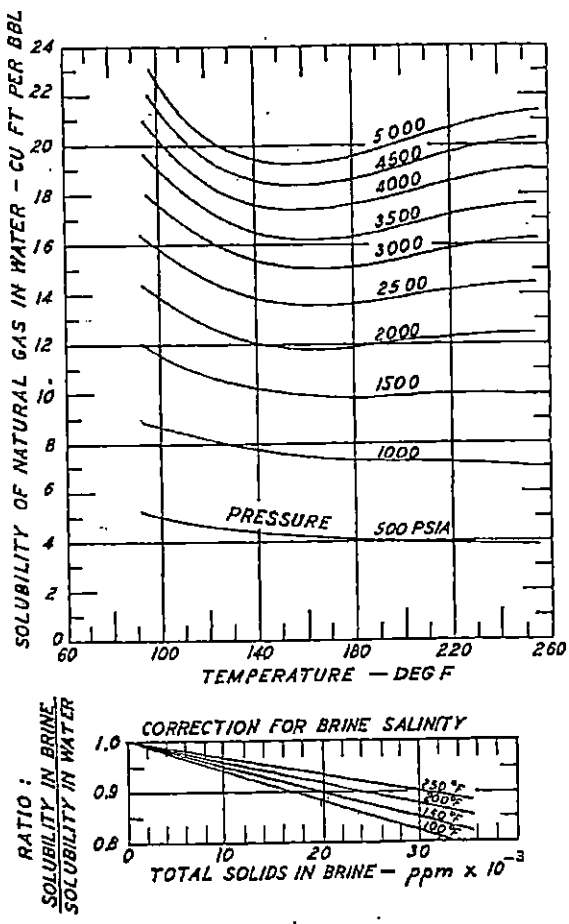
Formation Volumes of Pure Water and Mixtures of Natural Gas and Water

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 Water Storage Tank Thief Hatch Emissions

storage vapors/oil flash for 1-WST	**0.435**	**SCFH**
brine flash for 1-WST	**31.25**	**SCFH**

	0.435	scfh	31.25	scfh	Weighted Avg.					
Compound	**Vol % Storage Vapors/Oil Flash-WST**	**SCFH Storage Vapors/Oil Flash-WST**	**Vol % brine flash vapors**	**SCFH brine flash vapors**	**total vol%**	**MW**	**wt of gas**	**wt%**	**dH**	**heating value**
Nitrogen	0.9255	0.004	56.740	17.731	55.974	28.020	15.684	**37.744**	0	0.00
Hydrogen Sulfide	5.0531	0.022	1.000	0.312	1.0555	34.080	0.360	**0.866**	637.1	6.72
Water	0.0000	0.000	0.000	0.000	0.000	18.000	0.000	**0.000**	0	0.00
CO2	1.6761	0.007	1.640	0.512	1.640	44.010	0.722	**1.737**	0	0.00
Meth	5.3019	0.023	4.125	1.289	4.141	16.043	0.664	**1.599**	1010	41.82
Eth	3.2307	0.014	3.635	1.136	3.629	30.070	1.091	**2.626**	1770	64.22
Propane	6.1787	0.027	5.467	1.709	5.477	44.097	2.415	**5.813**	2516	137.81
Iso-B	3.9199	0.017	1.569	0.490	1.602	58.123	0.931	**2.240**	3252	52.08
N-But	19.2392	0.084	6.217	1.943	6.396	58.123	3.717	**8.946**	3262	208.65
Iso-Pent	13.3927	0.058	4.795	1.498	4.913	72.150	3.545	**8.531**	4001	196.57
N-Pent	13.2223	0.058	6.625	2.070	6.716	72.150	4.845	**11.660**	4009	269.22
methylcyclopent	0.0000	0.000	0.000	0.000	0.000	70.134	0.000	**0.000**	3764	0.00
Other/Iso Hex	7.1657	0.031	5.227	1.633	5.254	86.177	4.527	**10.895**	4750	249.56
N-Hex	3.9678	0.017	1.211	0.378	1.249	86.177	1.076	**2.589**	4756	59.38
Benz	1.6526	0.007	0.271	0.085	0.290	78.114	0.227	**0.545**	3742	10.85
CycloHex	0.0000	0.000	0.000	0.000	0.000	84.161	0.000	**0.000**	4482	0.00
Hept	8.9214	0.039	0.562	0.176	0.677	100.204	0.679	**1.633**	5503	37.26
Methylcyclohex	0.0000	0.000	0.000	0.000	0.000	98.188	0.000	**0.000**	5216	0.00
Tol	1.3977	0.006	0.233	0.073	0.249	92.141	0.230	**0.553**	4475	11.15
2,2,4-Tri	0.7442	0.003	0.219	0.068	0.226	114.231	0.258	**0.621**	6232	14.07
EB	0.0236	0.000	0.011	0.004	0.012	106.167	0.012	**0.030**	5222	0.61
Xyle	0.8043	0.003	0.059	0.018	0.069	106.167	0.073	**0.177**	5209	3.60
octanes	1.9152	0.008	0.393	0.123	0.414	114.231	0.473	**1.138**	6249	25.86
nonanes	0.6989	0.003	0.000	0.000	0.010	128.258	0.012	**0.030**	6997	0.67
decanes	0.5684	0.002	0.000	0.000	0.008	142.285	0.011	**0.027**	7743	0.60
other NM/NE HC	0.0000	0.000	0.000	0.000	0.000	102.090	0.000	**0.000**	5200	0.00
Totals	100.0000	0.43	100.000	31.25	100		41.553	**100**		**1390.74**

total stream flowrate: 31.68 scfh **SG 1.4329**

Weighted Average for Tank Vapors to Control Flare

storage vapors/oil flash for 1-WST:	**0.435**	**SCFH**
brine flash for 1-WST:	**31.25**	**SCFH**
total number of WSTs:	**6**	
storage vapors/oil flash for 1-OST:	**8.46**	**SCFH**
total number of OSTs:	**4**	

	2.61	scfh	187.50	scfh	33.84	scfh	Weighted Avg.					
Compound	Vol % Storage Vapors/Oil Flash-WST	SCFH Storage Vapors/Oil Flash-WST	Vol % Brine Flash Vapors	SCFH Brine Flash Vapors	vol% Storage Vapors/Oil Flash-OST	SCFH Storage Vapors/Oil Flash-OST	total vol%	MW	wt of gas	wt%	dH	heating value
Nitrogen	0.9255	0.024	56.740	106.388	1.6280	0.551	47.762	28.020	13.383	**32.459**	0	0.00
Hydrogen Sulfide	5.0531	0.132	1.000	1.875	26.7758	9.061	4.9420	34.080	1.684	**4.085**	637.1	31.49
Water	0.0000	0.000	0.000	0.000	0.0000	0.000	0.000	18.000	0.000	**0.000**	0	0.00
CO2	1.6761	0.044	1.640	3.074	7.4548	2.523	2.519	44.010	1.109	**2.689**	0	0.00
Meth	5.3019	0.138	4.125	7.734	15.7482	5.329	5.895	16.043	0.946	**2.294**	1010	59.54
Eth	3.2307	0.084	3.635	6.815	16.2366	5.494	5.534	30.070	1.664	**4.036**	1770	97.93
Propane	6.1787	0.161	5.467	10.252	13.8422	4.684	6.741	44.097	2.973	**7.210**	2516	169.62
Iso-B	3.9199	0.102	1.569	2.943	1.9019	0.644	1.647	58.123	0.957	**2.322**	3252	53.56
N-But	19.2392	0.502	6.217	11.657	6.6957	2.266	6.441	58.123	3.744	**9.080**	3262	210.13
Iso-Pent	13.3927	0.350	4.795	8.991	2.7891	0.944	4.592	72.150	3.313	**8.036**	4001	183.73
N-Pent	13.2223	0.345	6.625	12.422	2.5348	0.858	6.084	72.150	4.389	**10.646**	4009	243.89
methylcyclopent	0.0000	0.000	0.000	0.000	0.0000	0.000	0.000	70.134	0.000	**0.000**	3764	0.00
Other/Iso Hex	7.1657	0.187	5.227	9.801	1.1664	0.395	4.636	86.177	3.995	**9.690**	4750	220.22
N-Hex	3.9678	0.104	1.211	2.270	0.6347	0.215	1.156	86.177	0.996	**2.416**	4756	54.97
Benz	1.6526	0.043	0.271	0.508	0.2631	0.089	0.286	78.114	0.223	**0.542**	3742	10.70
CycloHex	0.0000	0.000	0.000	0.000	0.0000	0.000	0.000	84.161	0.000	**0.000**	4482	0.00
Hept	8.9214	0.233	0.562	1.054	1.3846	0.469	0.784	100.204	0.786	**1.906**	5503	43.14
Methylcyclohex	0.0000	0.000	0.000	0.000	0.0000	0.000	0.000	98.188	0.000	**0.000**	5216	0.00
Tol	1.3977	0.036	0.233	0.437	0.2146	0.073	0.244	92.141	0.225	**0.545**	4475	10.92
2,2,4-Tri	0.7442	0.019	0.219	0.410	0.1148	0.039	0.209	114.231	0.239	**0.579**	6232	13.03
EB	0.0236	0.001	0.011	0.022	0.0036	0.001	0.010	106.167	0.011	**0.027**	5222	0.54
Xyle	0.8043	0.021	0.059	0.110	0.1226	0.041	0.077	106.167	0.082	**0.199**	5209	4.02
octanes	1.9152	0.050	0.393	0.737	0.2931	0.099	0.396	114.231	0.452	**1.096**	6249	24.72
nonanes	0.6989	0.018	0.000	0.000	0.1068	0.036	0.024	128.258	0.031	**0.076**	6997	1.70
decanes	0.5684	0.015	0.000	0.000	0.0886	0.030	0.020	142.285	0.028	**0.069**	7743	1.55
other NM/NE HC	0.0000	0.000	0.000	0.000	0.0000	0.000	0.000	102.090	0.000	**0.000**	5200	0.00
Totals	100.0000	2.61	100.000	187.50	100.0000	33.84	100		41.231	**100**		**1435.41**
		total stream flowrate:	**223.95 scfh**					**SG**	**1.4217**			

Specific Gravity of Tank Vapor Stream	1.76854089
Heating Value of Tank Vapor Stream	2891.91111

OSTs

****
* Project Setup Information *
****

Project File	: Untitled.Ept
Flowsheet Selection	: Oil Tank with Separator
Calculation Method	: AP42
Control Efficiency	: 100.0%
Known Separator Stream	: Low Pressure Oil
Entering Air Composition	: No
Filed Name	: JP Oil - Buck Creek Commingling Tank Battery
Date	: 2015.05.29

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

Separator Pressure	: 45.00[psig]
Separator Temperature	: 175.00[F]
Ambient Pressure	: 14.70[psia]
Ambient Temperature	: 80.00[F]
C10+ SG	: 0.7455
C10+ MW	: 159.828

-- Low Pressure Oil ----------

No.	Component	mol %
1	H2S	0.9999
2	O2	0.0000
3	CO2	0.1260
4	N2	0.0143
5	C1	0.1678
6	C2	0.4269
7	C3	1.0440
8	i-C4	0.3504
9	n-C4	1.7263
10	i-C5	1.8424
11	n-C5	2.2327
12	C6	3.2833
13	C7	11.4069
14	C8	7.4471
15	C9	7.6516
16	C10+	48.2567
17	Benzene	1.0111
18	Toluene	2.8557
19	E-Benzene	0.1421
20	Xylenes	5.5435
21	n-C6	2.2737
22	224Trimethylp	1.1977

-- Sales Oil ----------

Production Rate	: 50[bbl/day]
Days of Annual Operation	: 365 [days/year]
API Gravity	: 33.0
Reid Vapor Pressure	: 7.70[psia]
Bulk Temperature	: 80.00[F]

-- Tank and Shell Data ----------

Diameter	: 12.00[ft]
Shell Height	: 20.00[ft]
Cone Roof Slope	: 0.06
Average Liquid Height	: 9.50[ft]
Vent Pressure Range	: 0.06[psi]
Solar Absorbance	: 0.68

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

City	: Cheyenne, WY
Ambient Pressure	: 14.70[psia]
Ambient Temperature	: 80.00[F]
Min Ambient Temperature	: 33.10[F]
Max Ambient Temperature	: 58.30[F]
Total Solar Insolation	: 1491.00[Btu/ft^2*day]

****
* Calculation Results *
****

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

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
Total HAPs	0.120	0.027
Total HC	2.590	0.591
VOCs, C2+	2.343	0.535
VOCs, C3+	1.865	0.426

Uncontrolled Recovery Info.

Vapor	203.0300 x1E-3	[MSCFD]
HC Vapor	130.2300 x1E-3	[MSCFD]
GOR	4.06	[SCF/bbl]

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

No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]
1	H2S	0.892	0.204
2	O2	0.000	0.000
3	CO2	0.321	0.073
4	N2	0.045	0.010
5	C1	0.247	0.056
6	C2	0.477	0.109
7	C3	0.597	0.136
8	i-C4	0.108	0.025
9	n-C4	0.380	0.087
10	i-C5	0.197	0.045
11	n-C5	0.179	0.041
12	C6	0.096	0.022
13	C7	0.131	0.030
14	C8	0.032	0.007
15	C9	0.013	0.003
16	C10+	0.014	0.003
17	Benzene	0.020	0.005
18	Toluene	0.019	0.004
19	E-Benzene	0.000	0.000
20	Xylenes	0.013	0.003
21	n-C6	0.053	0.012
22	224Trimethylp	0.013	0.003
	Total	3.847	0.878

-- Stream Data ----------

No.	Component	MW	LP Oil mol %	Flash Oil mol %	Sale Oil mol %	Flash Gas mol %	W&S Gas mol %	Total Emissions mol %
1	H2S	34.80	0.9999	0.9611	0.8028	23.1679	29.0216	26.7758
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.1260	0.1128	0.0672	7.6844	7.3119	7.4548
4	N2	28.01	0.0143	0.0069	0.0000	4.2430	0.0003	1.6280
5	C1	16.04	0.1678	0.1256	0.0274	24.3085	10.4196	15.7482
6	C2	30.07	0.4269	0.4017	0.3042	14.8121	17.1233	16.2366
7	C3	44.10	1.0440	1.0260	0.9478	11.3370	15.4016	13.8422
8	i-C4	58.12	0.3504	0.3484	0.3389	1.5141	2.1434	1.9019
9	n-C4	58.12	1.7263	1.7200	1.6899	5.3022	7.5631	6.6957
10	i-C5	72.15	1.8424	1.8418	1.8361	2.1927	3.1603	2.7891
11	n-C5	72.15	2.2327	2.2331	2.2314	1.9908	2.8734	2.5348
12	C6	86.16	3.2833	3.2874	3.3005	0.9150	1.3229	1.1664
13	C7	100.20	11.4069	11.4249	11.4866	1.0867	1.5700	1.3846

14	C8	114.23	7.4471	7.4597	7.5037	0.2303	0.3322	0.2931
15	C9	128.28	7.6516	7.6648	7.7112	0.0840	0.1210	0.1068
16	C10+	159.83	48.2567	48.3410	48.6369	0.0699	0.1002	0.0886
17	Benzene	78.11	1.0111	1.0125	1.0171	0.2062	0.2985	0.2631
18	Toluene	92.13	2.8557	2.8604	2.8766	0.1683	0.2434	0.2146
19	E-Benzene	106.17	0.1421	0.1423	0.1432	0.0028	0.0041	0.0036
20	Xylenes	106.17	5.5435	5.5530	5.5863	0.0963	0.1390	0.1226
21	n-C6	86.18	2.2737	2.2768	2.2869	0.4978	0.7199	0.6347
22	224Trimethylp	114.24	1.1977	1.1996	1.2063	0.0901	0.1302	0.1148
	MW		126.66	126.82	127.11	36.05	41.41	39.35
	Stream Mole Ratio		1.0000	0.9983	0.9954	0.0017	0.0028	0.0046
	Heating Value	[BTU/SCF]				1505.22	1791.12	1681.43
	Gas Gravity	[Gas/Air]				1.24	1.43	1.36
	Bubble Pt. @ 100F	[psia]	19.95	17.46	11.81			
	RVP @ 100F	[psia]	64.06	60.09	50.35			
	Spec. Gravity @ 100F		0.696	0.696	0.696			

TNRCC

June 1998
RG-109

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 Conservation Commission

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

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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 lb/MM Btu	CO lb/MM Btu
Steam Assisted	High Btu (>1000/scf)	0.0465	0.3503
Steam Assisted	Low Btu (192-1000/scf)	0.0660	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

Since flares do not lend themselves to conventional emission testing techniques, only a few attempts have been made to characterize flare emissions. Recent EPA tests using propylene as flare gas indicated that efficiencies of 98 percent can be achieved when burning an offgas with at least 11,200 kJ/m^3 (300 Btu/ft^3). The tests conducted on steam-assisted flares at velocities as low as 39.6 meters per minute (m/min) (130 ft/min) to 1140 m/min (3750 ft/min), and on air-assisted flares at velocities of 180 m/min (617 ft/min) to 3960 m/min (13,087 ft/min) indicated that variations in incoming gas flow rates have no effect on the combustion efficiency. Flare gases with less than 16,770 kJ/m^3 (450 Btu/ft^3) do not smoke.

Table 13.5-1 presents flare emission factors, and Table 13.5-2 presents emission composition data obtained from the EPA tests.[1] Crude propylene was used as flare gas during the tests. Methane was a major fraction of hydrocarbons in the flare emissions, and acetylene was the dominant intermediate hydrocarbon species. Many other reports on flares indicate that acetylene is always formed as a stable intermediate product. The acetylene formed in the combustion reactions may react further with hydrocarbon radicals to form polyacetylenes followed by polycyclic hydrocarbons.[2]

In flaring waste gases containing no nitrogen compounds, NO is formed either by the fixation of atmospheric nitrogen (N) with oxygen (O) or by the reaction between the hydrocarbon radicals present in the combustion products and atmospheric nitrogen, by way of the intermediate stages, HCN, CN, and OCN.[2] Sulfur compounds contained in a flare gas stream are converted to SO_2 when burned. The amount of SO_2 emitted depends directly on the quantity of sulfur in the flared gases.

Table 13.5-1 (English Units). EMISSION FACTORS FOR FLARE OPERATIONS[a]

EMISSION FACTOR RATING: B

Component	Emission Factor (lb/10^6 Btu)
Total hydrocarbons[b]	0.14
Carbon monoxide	0.37
Nitrogen oxides	0.068
Soot[c]	0 - 274

[a] Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.
[b] Measured as methane equivalent.
[c] Soot in concentration values: nonsmoking flares, 0 micrograms per liter (μg/L); lightly smoking flares, 40 μg/L; average smoking flares, 177 μg/L; and heavily smoking flares, 274 μg/L.

Table 13.5-2. HYDROCARBON COMPOSITION OF FLARE EMISSION[a]

Composition	Volume %	
	Average	Range
Methane	55	14 - 83
Ethane/Ethylene	8.	1 - 14
Acetylene	5	0.3 - 23
Propane	7	0 - 16
Propylene	25	1 - 65

[a] Reference 1. The composition presented is an average of a number of test results obtained under the following sets of test conditions: steam-assisted flare using high-Btu-content feed; steam-assisted using low-Btu-content feed; air-assisted flare using high-Btu-content feed; and air-assisted flare using low-Btu-content feed. In all tests, "waste" gas was a synthetic gas consisting of a mixture of propylene and propane.

References For Section 13.5

1. *Flare Efficiency Study*, EPA-600/2-83-052, U. S. Environmental Protection Agency, Cincinnati, OH, July 1983.

2. K. D. Siegel, *Degree Of Conversion Of Flare Gas In Refinery High Flares*, Dissertation, University of Karlsruhe, Karlsruhe, Germany, February 1980.

3. *Manual On Disposal Of Refinery Wastes; Volume On Atmospheric Emissions*, API Publication 931, American Petroleum Institute, Washington, DC, June 1977.

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

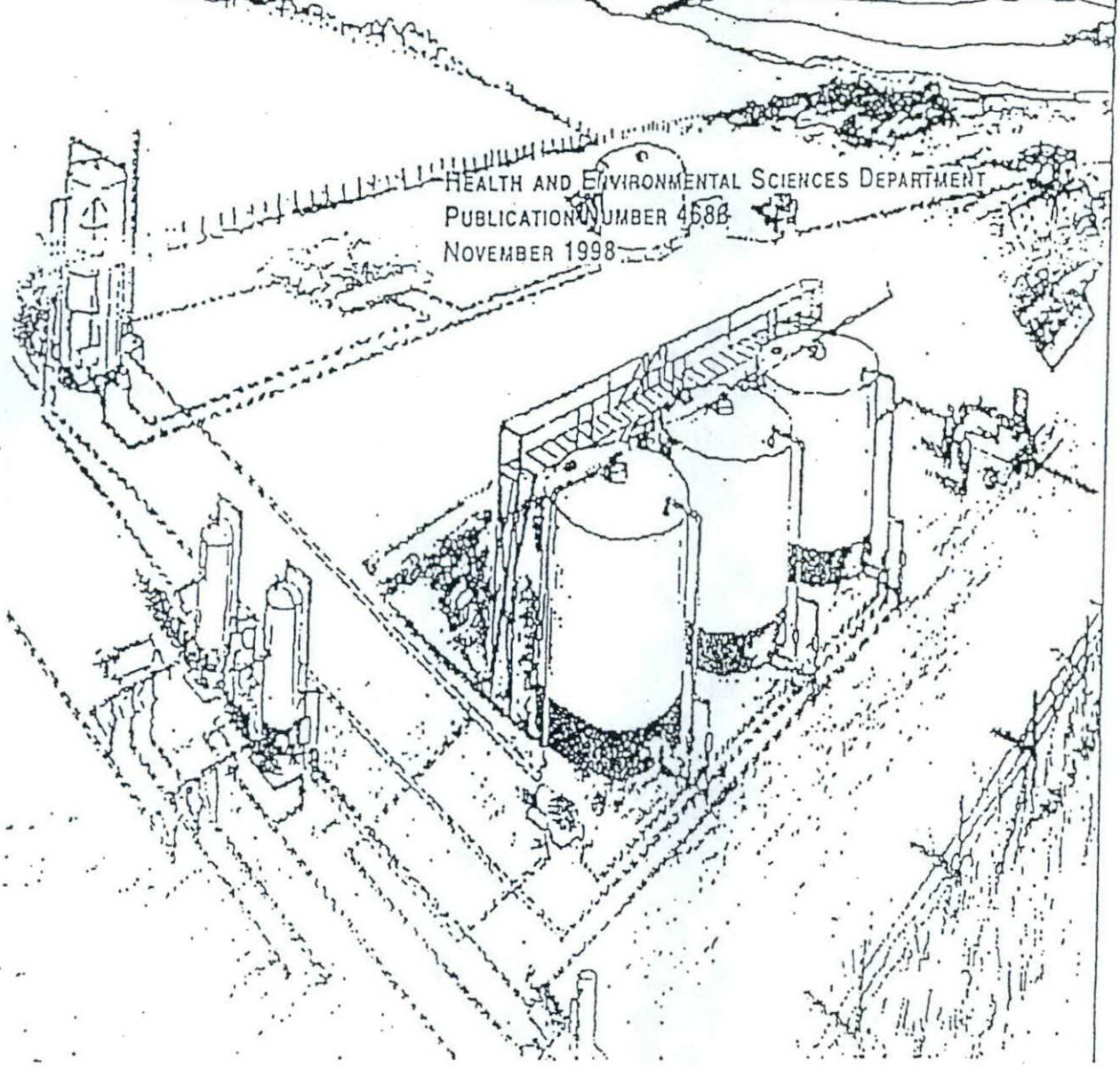

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Table 3-2 summarizes Pearson correlation coefficients (r) calculated for the sales oil RVP relative to the other variables. Better correlations are indicated as |r| approaches 1. Table 3-2 shows that sales oil APIG is the best predictor of RVP. (Note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

$$RVP = 0.003 + 0.075 \ln(SP) - 0.016\ ST + 0.165\ APIG$$

(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).

$$RVP = -1.699 + 0.179\ APIG$$

(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]

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

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

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]

$$A = 15.64 - 1.854\,S^{0.5} - (0.8742 - 0.3280\,S^{0.5})\ln(RVP)$$
$$B = 8{,}742 - 1{,}042\,S^{0.5} - (1{,}049 - 179.4\,S^{0.5})\ln(RVP)$$

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.[8]

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

Petroleum Liquid	Vapor Molecular Weight at 60°F, M_V (lb/lb-mole)	Liquid Density At 60°F, W_L (lb/gal)	True Vapor Pressure, P_{VA} (psi)						
			40°F	50°F	60°F	70°F	80°F	90°F	100°F
Crude oil RVP 5	50	7.1	1.8	2.3	2.8	3.4	4.0	4.8	5.7
Distillate fuel oil No. 2	130	7.1	0.0031	0.0045	0.0065	0.0090	0.012	0.016	0.022
Gasoline RVP 7	68	5.6	2.3	2.9	3.5	4.3	5.2	6.2	7.4
Gasoline RVP 7.8	68	5.6	2.5929	3.2079	3.9363	4.793	5.7937	6.9552	8.2952
Gasoline RVP 8.3	68	5.6	2.7888	3.444	4.2188	5.1284	6.1891	7.4184	8.8344
Gasoline RVP 10	66	5.6	3.4	4.2	5.2	6.2	7.4	8.8	10.5
Gasoline RVP 11.5	65	5.6	4.087	4.9997	6.069	7.3132	8.7519	10.4053	12.2949
Gasoline RVP 13	62	5.6	4.7	5.7	6.9	8.3	9.9	11.7	13.8
Gasoline RVP 13.5	62	5.6	4.932	6.0054	7.2573	8.7076	10.3774	12.2888	14.4646
Gasoline RVP 15.0	60	5.6	5.5802	6.774	8.1621	9.7656	11.6067	13.7085	16.0948
Jet kerosene	130	7.0	0.0041	0.0060	0.0085	0.011	0.015	0.021	0.029
Jet naphtha (JP-4)	80	6.4	0.8	1.0	1.3	1.6	1.9	2.4	2.7
Residual oil No. 6	190	7.9	0.00002	0.00003	0.00004	0.00006	0.00009	0.00013	0.00019

[a] References 10 and 11

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

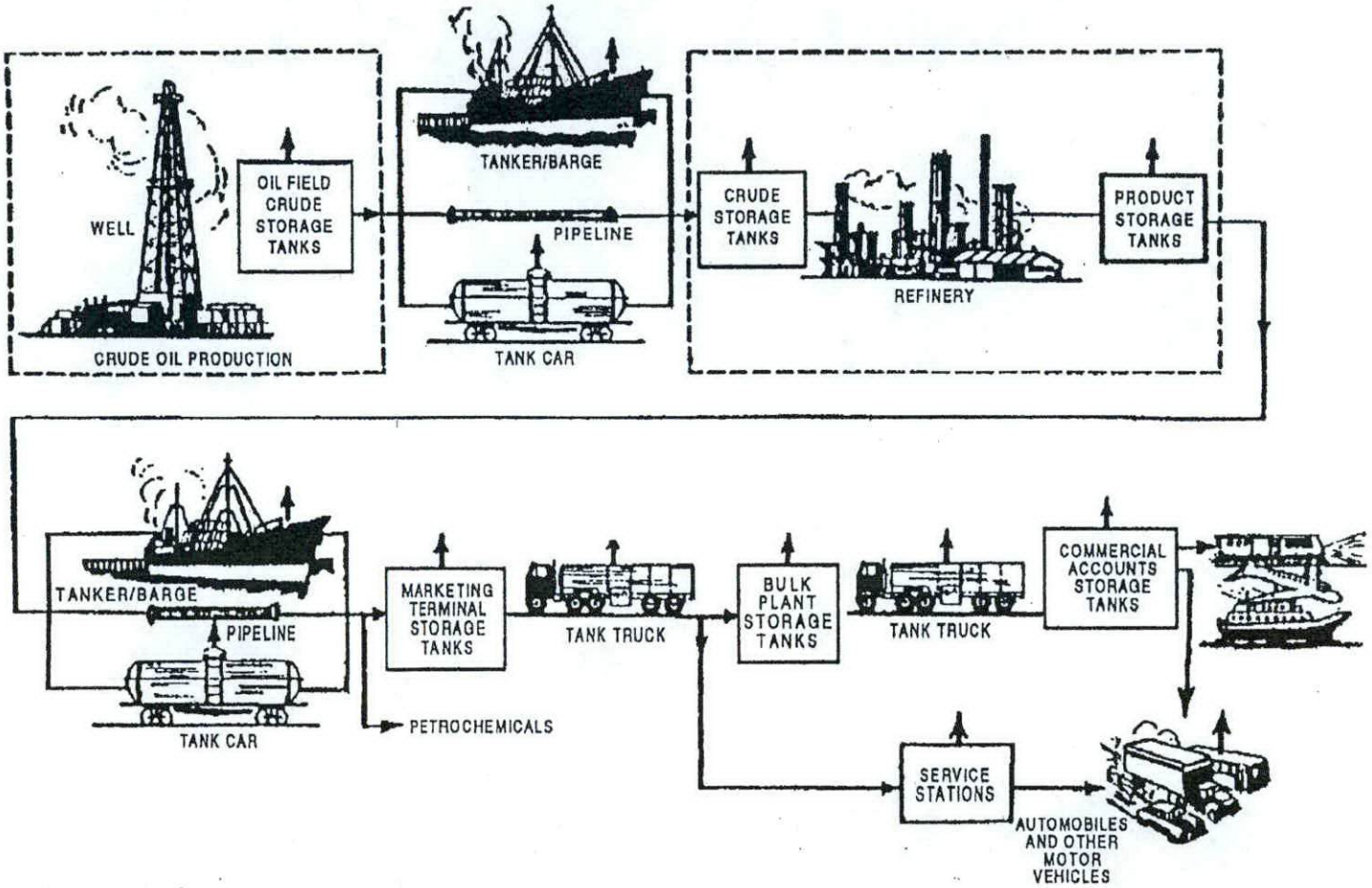

Figure 5.2-1. Flow sheet of petroleum production, refining, and distribution systems. (Points of organic emissions are indicated by vertical arrows.)

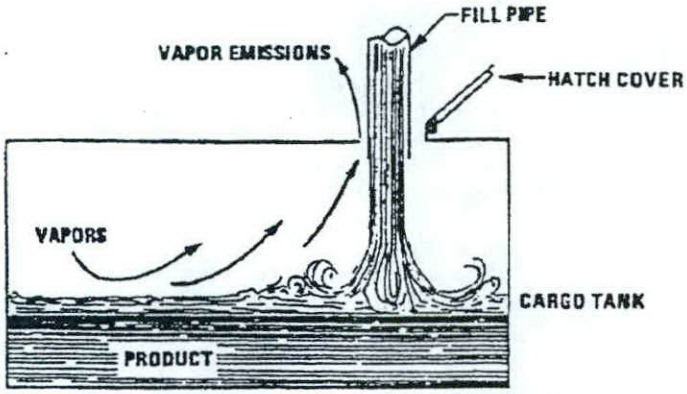

Figure 5.2-2. Splash loading method.

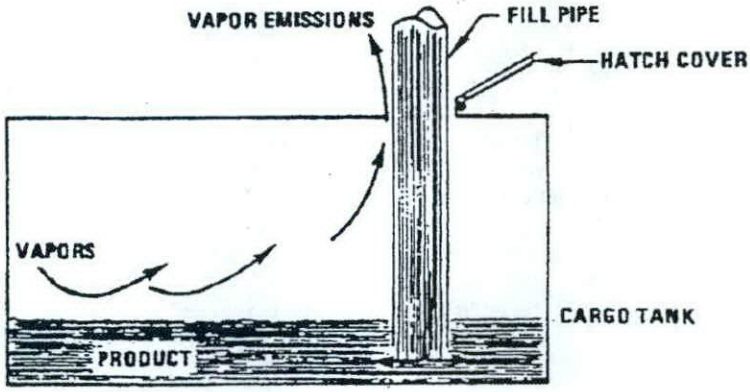

Figure 5.2-3. Submerged fill pipe.

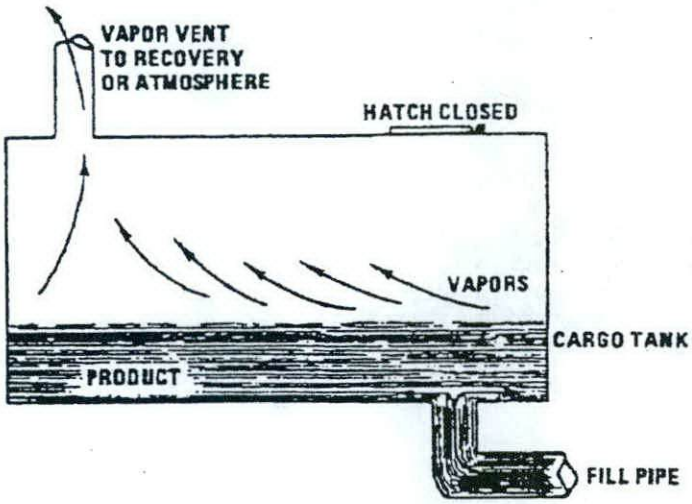

Figure 5.2-4. Bottom loading.

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:

$$L_L = 12.46 \frac{SPM}{T} \qquad (1)$$

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 Figure 7.1-5, Figure 7.1-6, and Table 7.1-2)
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole) (see Table 7.1-2)
T = temperature of bulk liquid loaded, °R (°F + 460)

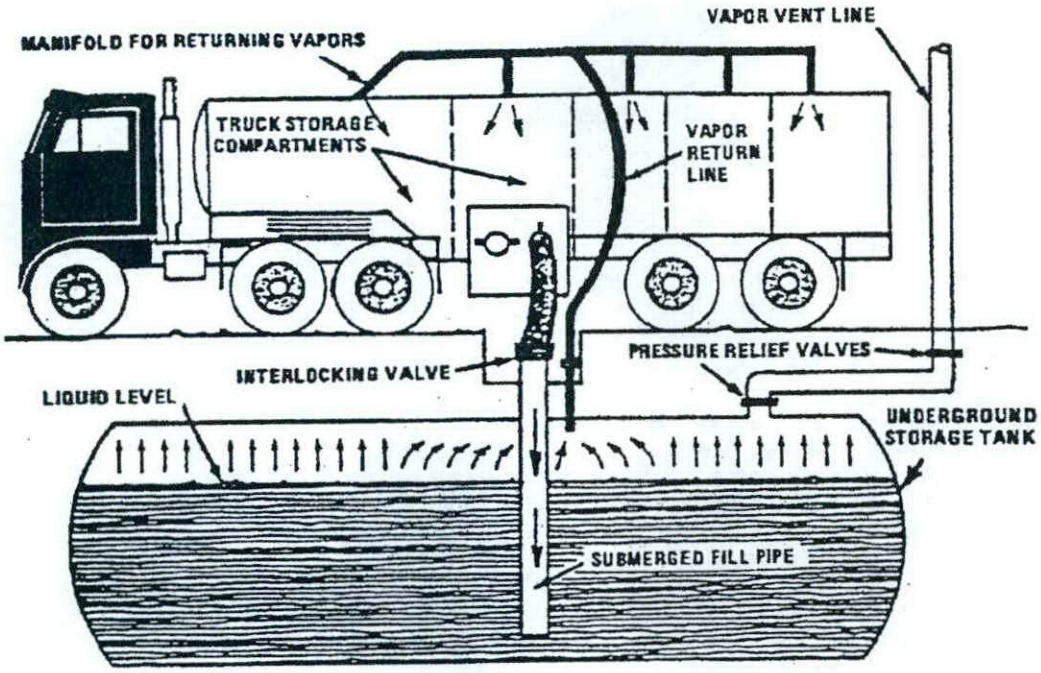

Figure 5.2-5. Tank truck unloading into a service station underground storage tank and practicing "vapor balance" form of emission control.

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].

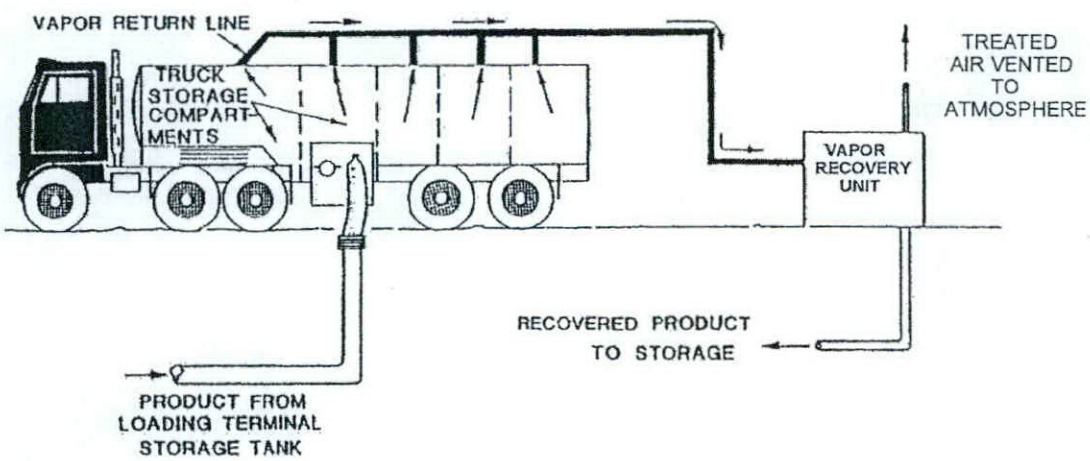

Figure 5.2-6. Tank truck loading with vapor recovery.

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 (see Figure 7.1-6) = 6.6 psia
M = molecular weight of gasoline vapors (see Table 7.1-2) = 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/10³ gal Transferred	mg/L Transferred	lb/10³ 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/10³ gal of crude oil loaded
C_A = arrival emission factor, contributed by vapors in the empty tank compartment before loading, lb/10³ gal loaded (see Note below)
C_G = generated emission factor, contributed by evaporation during loading, lb/10³ 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 (see Figure 7.1-5 and Table 7.1-2)
M = molecular weight of vapors, lb/lb-mole (see Table 7.1-2)
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 (see Figure 7.1-5 and Table 7.1-2)
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]

Compartment Condition Before Cargo Discharge	Average Emission Factors			
	By Category		Typical Overall[b]	
	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] 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).

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	

Normalized Component Calculation
Storage Emissions Speciation

COMPONENT	mole %	mole % w/extra component	COMPONENT MW	fuel weight	Normalized WT %	component BTU/scf	partial Heating values
Water	0.0000	0.000	18	0.00	0.0000	0	0
Nitrogen	0.0000	0.000	28.0134	0.00	0.0000	0	0
Methane	19.8200	19.622	16.043	3.15	6.1155	1010	198
Carbon Dioxide	0.0000	0.000	44.01	0.00	0.0000	0	0
Ethane	9.5510	9.455	30.07	2.84	5.5236	1770	167
Hydrogen Sulfide	0.0000	0.000	34.08	0.00	0.0000	637	0
Propane	20.4700	20.265	44.097	8.94	17.3607	2516	510
I-Butane	1.3240	1.311	58.123	0.76	1.4800	3252	43
N-Butane	23.9130	23.674	58.123	13.76	26.7314	3262	772
I-Pentane	1.0660	1.055	72.15	0.76	1.4792	4001	42
N-Pentane	10.3780	10.274	72.15	7.41	14.4009	4009	412
Other hexanes	0.0000	0.000	86.177	0.00	0.0000	4750	0
N-hexane	4.7020	4.655	86.177	4.01	7.7932	4756	221
Methylcyclopentane	0.0000	0.000	84.1608	0.00	0.0000	4501	0
benzene	0.0660	0.065	78.114	0.05	0.0992	3742	2
cyclohexane	0.0000	0.000	84.1608	0.00	0.0000	4482	0
heptane	4.7090	4.662	100.204	4.67	9.0751	5503	257
Methylcyclohexane	0.0000	0.000	98.18	0.00	0.0000	5216	0
toluene	0.0000	0.000	92.141	0.00	0.0000	4475	0
iso-octane	0.0000	0.000	114.22	0.00	0.0000	6232	0
octanes	3.0980	3.067	114.22	3.50	6.8055	7000	215
ethylbenzene	0.0000	0.000	106.167	0.00	0.0000	5222	0
xylene	0.0000	0.000	106.167	0.00	0.0000	5208	0
nonanes	0.0000	0.000	128.25	0.00	0.0000	6997	0
Decanes Plus	0.9040	0.895	142.28	1.27	2.4737	7743	69
Max H2S	1.0000	1.0000	34.08	0.34	0.6621	637	6
TOTALS	101.001	100.001	MW=	51.47	100.0000	total btu/scf	2915.14142

sg	1.775
VOC wt%	87.6989
Toxic wt%	7.892

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	0.069	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

Solutions through engineered products.
NORRISEAL
A DOVER RESOURCES COMPANY
NORRISEAL CONTROLS
NORRIS VALVES

102B BURGESS DRIVE
BROUSSARD, LA 70518

PHONE 318-837-3223
FAX 318-837-3448

Fugitive Hydrocarbon Emissions from Oil and Gas Production Operations

HEALTH AND ENVIRONMENTAL SCIENCES
API PUBLICATION NUMBER 4589
DECEMBER 1993

STEP
Strategies for Today's Environmental Partnership

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005

Using Table 3:

221 lb/day THC emissions x		=	203 lb/day
	0.920 Methane	=	18 lb/day
	0.080 NMHC	=	8 lb/day
	0.035 VOC	=	0.7 lb/day
	0.00338 C6+	=	0.05 lb/day
	0.00023 Benzene	=	0.09 lb/day
	0.00039 Toluene	=	0.004 lb/day
	0.00002 Ethyl-Benzene	=	0.02 lb/day
	0.00010 Xylenes	=	

Options to Method One

The total number of components at a site can be obtained by counting the number of valves and using Table 4 to estimate the other components. Table 4 was developed from 470,000 components inventoried at a total of 48 sites in three separate studies by API (1980), API/GRI (1993) and the US Minerals Management Service (1989).

Table 4. PERCENTAGE OF TOTAL COMPONENTS BY TYPE

	Connection	Valves	Open-Ends	Others
Light Crude	78.5%	18.5%	2%	1%
Heavy Crude	80%	15%	3.5%	1.5%
Gas Production	81%	15%	2.5%	1.5%
Gas Plant	76.5%	19%	2.5%	2%
Pacific Offshore	81.5%	14%	2.5%	2%
Gulf Offshore	80.5%	15%	2.5%	2%

NOTE: "Gulf" is Gulf of Mexico

Example Calculations

The hypothetical onshore gas production site in the example above had 1425 valves; the estimated total number of components is then:

1425 valves/0.15 = 9,500 total components.

Interpretation of Results

Method One is built on the assumption that the average leak rate of a group of components at one site is the same as the average leak rate of a second group of similar components at another site. A number of factors such as facility age, equipment condition, inspection and maintenance programs, and petroleum product characteristics could cause this assumption to be incorrect.

HEALTH AND
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Emission Factors for Oil and Gas Production Operations

STEP
Strategies for Today's Environmental Partnership

American
Petroleum
Institute

possible in all cases to determine whether the corrected screening values were zero or some number between 1 and 9 ppmv. To be conservative, they were assumed to have screening values of 10 ppmv above background. Emissions from connections and open end lines in this group were calculated using the appropriate EPA default zeros; emission rates for flanges, pumps, valves, and other components in this category were calculated at a screening value of 10 ppmv. Table 4 shows the emission rates used to calculate the emissions of these components.

Table 4. Emission Rates Used for "Non-Emitters" (lb/component-day)

	EPA Default Zero	Equivalent Equation ppmv	Non-Emitter ppmv used	Non-Emitter Emission Rate used
Connection	0.000441	10.25	10.25	0.000441
Flange	0.000528	3.18	10.00	0.001183
Open End	0.000671	12.40	12.40	0.000671
Pump	0.001621	0.48	10.00	0.010348
Valve	0.000644	9.50	10.00	0.000671
Others	0.000209	0.13	10.00	0.002703

"Others" category includes instruments, loading arms, pressure relief valves, stuffing boxes, compressor seals, dump lever arms, and vents.

Adjustment for Flange and Other Connector Designations. The API 1993 database separates components as connection, valve, open-ended line, pump seal, compressor seal, pressure relief valve, instrument, hatch, polished rod stuffing box, dump lever arm, vent, meter, and drain. The database does not differentiate between non-emitting connections and non-emitting flanges; both types of components are included in a single category. Calculations in this report are based on a division of the connections into two categories: flange and other connections. Table 5 shows the assumptions used for assigning components to each category. These assumptions were based on component counts at sites 21 through 24 and additional inventory work at two light crude production sites. The sensitivity of the emission factors to these assumptions is discussed later in this report.

Table 5. Assumptions for Dividing API Connections by Type

Type of Site	Connection	Flange
Onshore Light Crude Production	71%	29%
Onshore Heavy Crude Production	71%	29%
Onshore Gas Production	86%	14%
Onshore Gas Plants	70%	30%
Offshore Oil and Gas Production	79%	21%

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

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Air

EPA

Protocol for Equipment Leak Emission Estimates

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

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

[a]Water/Oil emission factors apply to water streams in oil service with a water content greater than 50%, from the point of origin to the point where the water content reaches 99%. For water streams with a water content greater than 99%, the emission rate is considered negligible.

[b]These factors are for total organic compound emission rates (including non-VOC's such as methane and ethane) and apply to light crude, heavy crude, gas plant, gas production, and off shore facilities. "NA" indicates that not enough data were available to develop the indicated emission factor.

[c]The "other" equipment type was derived from compressors, diaphrams, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents. This "other" equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps, or valves.

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

	Emission Factor, lb THC/yr		
Component	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

	Fractional Composition, lb/lb THC			
Compound	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.

Normalized Component Calculation
Fugitive Emissions Speciation

COMPONENT	mole %	mole % w/extra component	COMPONENT MW	fuel weight	Normalized WT %	component BTU/scf	partial Heating values
Water	0.0000	0.0000	18	0.00	0.0000	0	0
Nitrogen	0.0000	0.0000	28.0134	0.00	0.0000	0	0
Methane	86.3900	85.5261	16.043	13.72	60.3817	1010	864
Carbon Dioxide	0.0000	0.0000	44.01	0.00	0.0000	0	0
Ethane	7.1500	7.0785	30.07	2.13	9.3669	1770	125
Hydrogen Sulfide	0.0000	0.0000	34.08	0.00	0.0000	637	0
Propane	0.0000	0.0000	44.097	0.00	0.0000	2516	0
I-Butane	0.0000	0.0000	58.123	0.00	0.0000	3252	0
N-Butane	0.0000	0.0000	58.123	0.00	0.0000	3262	0
I-Pentane	0.0000	0.0000	72.15	0.00	0.0000	4001	0
N-Pentane	0.0000	0.0000	72.15	0.00	0.0000	4009	0
Other hexanes	0.0000	0.0000	86.177	0.00	0.0000	4750	0
N-hexane	0.0000	0.0000	86.177	0.00	0.0000	4756	0
Methylcyclopentane	0.0000	0.0000	84.1608	0.00	0.0000	4501	0
benzene	0.0078	0.0077	78.114	0.01	0.0265	3742	0
cyclohexane	0.0000	0.0000	84.1608	0.00	0.0000	4482	0
heptane	0.0000	0.0000	100.204	0.00	0.0000	5503	0
Methylcyclohexane	0.0000	0.0000	98.18	0.00	0.0000	5216	0
toluene	0.0184	0.0182	92.141	0.02	0.0739	4475	1
iso-octane	0.0000	0.0000	114.22	0.00	0.0000	6232	0
octanes	0.0000	0.0000	114.22	0.00	0.0000	7000	0
ethylbenzene	0.0036	0.0036	106.167	0.00	0.0167	5222	0
xylene	0.0077	0.0076	106.167	0.01	0.0356	5208	0
nonanes	0.0000	0.0000	128.25	0.00	0.0000	6997	0
Other NM/NE HC	6.4300	6.3657	102.09	6.50	28.5990	5200	331
Max H2S	1.0000	1.0000	34.08	0.34	1.4998	637	6
TOTALS	101.0	100.01	MW=	22.72	100.0000	total btu/scf	1328.1767

sg	0.7836
VOC wt%	28.7516
Toxic wt%	0.153

TANKS 4.0.9d

Emissions Report - Summary Format

Tank Indentification and Physical Characteristics

Identification

User Identification:	9-15-LOT
City:	
State:	Wyoming
Company:	JP Oil Company
Type of Tank:	Horizontal Tank
Description:	265 Gallon Lube Oil Tank

Tank Dimensions

Shell Length (ft):		5.00
Diameter (ft):		3.00
Volume (gallons):		265.00
Turnovers:		10.00
Net Throughput(gal/yr):		2,650.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meterological Data used in Emissions Calculations: Cheyenne, Wyoming (Avg Atmospheric Pressure = 11.76 psia)

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

9-15-LOT - Horizontal Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Toluene	All	54.86	43.72	65.99	48.68	0.2807	0.1949	0.3969	92.1300			92.13	Option 2: A=6.954, B=1344.8, C=219.48

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

Emissions Report for: Annual

9-15-LOT - Horizontal Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Toluene	1.63	3.92	5.55

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

Identification

User Identification:	10-15-LOT
City:	
State:	Wyoming
Company:	JP Oil Company
Type of Tank:	Horizontal Tank
Description:	55 Gallon Lube Oil Tank

Tank Dimensions

Shell Length (ft):		5.00
Diameter (ft):		3.00
Volume (gallons):		55.00
Turnovers:		10.00
Net Throughput(gal/yr):		550.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meterological Data used in Emissions Calculations: Cheyenne, Wyoming (Avg Atmospheric Pressure = 11.76 psia)

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

10-15-LOT - Horizontal Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Hexane (-n)	All	54.86	43.72	65.99	48.68	1.6711	1.2322	2.2316	86.1700			86.17	Option 2: A=6.876, B=1171.17, C=224.41

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

Emissions Report for: Annual

10-15-LOT - Horizontal Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Hexane (-n)	1.89	35.11	37.00

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

Identification

User Identification:	11-15-CST
City:	
State:	Wyoming
Company:	JP Oil Company
Type of Tank:	Horizontal Tank
Description:	2-110 Gallon Chemical Storage Tanks

Tank Dimensions

Shell Length (ft):		5.00
Diameter (ft):		3.00
Volume (gallons):		110.00
Turnovers:		10.00
Net Throughput(gal/yr):		1,100.00
Is Tank Heated (y/n):	N	
Is Tank Underground (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig)	0.00

Meterological Data used in Emissions Calculations: Cheyenne, Wyoming (Avg Atmospheric Pressure = 11.76 psia)

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

11-15-CST - Horizontal Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Hexane (-n)	All	54.86	43.72	65.99	48.68	1.6711	1.2322	2.2316	86.1700			86.17	Option 2: A=6.876, B=1171.17, C=224.41

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

Emissions Report for: Annual

11-15-CST - Horizontal Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Hexane (-n)	3.77	35.11	38.89