16767

Marathon Oil Company
1501 Stampede Avenue
Cody, Wyoming 82414
Telephone: 307-587-4961
Fax: 307-587-2139

Marathon Oil

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DIVISION

July 21, 2014

Mr. Cole Anderson
Wyoming Department of Environmental Quality
Air Quality Division
Herschler Building
122 West 25th Street
Cheyenne, Wyoming 82002

via Certified Mail Number:
(7013 1090 0002 2506 8680)

Re: **Gooseberry Battery A**
Modification to Permit Waiver
AP-8520

Dear Mr. Anderson:

Marathon Oil Company (Marathon) is respectfully submitting this Chapter 6, Section 2 air permit application for the Gooseberry Battery A located in the SE ¼ NE ¼ of Section 28, Township 47 North, Range 100 West, in Park County, Wyoming. We acquired the Gooseberry A and B Batteries (A C6S2 application for Battery B is submitted under separate cover) from Encore Operating, LP on May 1, 2014 and became the operator effective July 7, 2014. Thus, Change of Ownership forms are also included in this application package. The following forms reflect minor updates to the equipment list and requests an increase to the permitted throughput limits.

Table 1, attached, shows the current uncontrolled emissions. These emissions are based on the most recent and representative gas analysis (May 2014). Please note that the VOCs are inflated due to how the Treater is operated. Currently propane is used as makeup gas to keep optimal pressure for proper Treater operation. Propane is also used as fuel for the heaters. Once Marathon takes over operations of these fields/batteries, we plan to control VOCs, HAPs, and H_2S with a flare, as soon as practicable. Table 1 provides the controlled emissions at the current estimated gas, oil, and water throughputs and updated gas analysis. Table 2 shows the flare-controlled emissions (including the propane makeup gas) for proposed throughputs. As shown in these two tables, even with an increase in throughputs, the VOC emissions will be reduced by 80 percent.

The tables below summarize the current emissions and the proposed controlled emissions.

TABLE 1: Uncontrolled Current Gooseberry Battery A Emissions (TPY) - 10 MCFD

Emission Source	VOCs	Total HAPs	NO_X	CO	SO_2	H_2S
Treater Flashing Emissions	74.38	0.41	-	-	-	4.18
Crude Tanks (S/W/B)	0.74	0.00	-	-	-	0.04
Produced Water Tanks (S/W/B)	4.39	0.02	-	-	-	0.20
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners*	4.47	0.00	0.77	0.19	-	-
Fugitives	0.01	0.00	-	-	-	-
TOTALS	**83.99**	**0.44**	**0.77**	**0.19**	**0.00**	**4.41**

Marathon Oil

TABLE 2: Controlled Proposed Gooseberry Battery A Emissions (TPY) - 65 MCFD						
Emission Source	**VOCs**	**Total HAPs**	**NO_X**	**CO**	**SO_2**	**H_2S**
Treater Flashing Emissions	9.67	0.05	1.76	-	45.93	0.54
Crude Tanks (S/W/B)	0.03	0.00	-	-	0.14	0.07
Produced Water Tanks (S/W/B)	0.48	0.00	-	-	2.71	1.36
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners	4.47	0.00	0.77	0.19	-	-
Fugitives	0.01	0.00	-	-	-	-
TOTALS	**14.66**	**0.06**	**2.52**	**0.19**	**48.78**	**1.97**

It is anticipated that once the well gas is captured, propane will not be needed as makeup gas. Once the final operation is known, an updated permit application based on this operation scenario will be submitted, if needed. The number of wells has not changed since they were last permitted, in 2008. A list is included with this application package, for completeness.

Because there is still some uncertainty of how the field/reservoirs will react to operational changes Marathon is planning, we have presented our best engineering estimates for the next 2 to 3 years. After changes have been made and production has stabilized, Marathon will revise our permits as necessary. We will also, revise as necessary, if additional controls or emissions change significantly.

Further, we would like to request that flaring 90 at least percent of the hours in the year (with an estimated 10 percent downtime) be considered BACT for this field at this time. Currently, there is no water discharge and there is no economically feasible option of gas injection.

Please feel free to contact me at (307) 527-2145 or rdoyle@marathonoil.com if you have questions regarding the enclosed application or require additional information.

Sincerely,

Regina Doyle

Regina Doyle
Adv. Environmental Professional

Encl: Permit Application

Cc: G. Meeker, District Engineer, Lander, WY (7013 1090 0002 2506 8673)
HES Files
L.Taylor
T. Moore
P. Moore

DESCRIPTIONS

Gooseberry Battery A
Emission Description

Currently there are no controls at the Gooseberry Battery A. The air permits were last updated in 2008. Since then process changes occurred that necessitated the use of propane as a makeup gas to maintain pressure in the heater/treater/testers for proper operation. This gas is vented to the atmosphere through the water and/or oil tanks. This creates an inflated VOC content in the vented gas.

Controlled and uncontrolled emissions represented in this application are based on a current gas analysis collected in May and July 2014. This gas analysis is representative of what is currently being vented to the atmosphere (i.e. including the additional propane). Marathon proposes to control emissions from the heater/treater/testers, oil tanks, and water tanks with a flare for at least 90% of the production throughputs. The application provides the controlled and uncontrolled (10%) emission in Tables 2 and 2a respectively.

Propane is used for fuel for equipment burners. Compressed air is used to operate pneumatic devices. Miscellaneous pumps for circulating wet oil and water are electric.

Gooseberry Battery A
Process Description

Oil and water from 15 wells is routed to one of two heater/treater/testers (i.e. either the 1.25 MMbtu/hr vertical heater or 1.5 MMBtu/hr horizontal heater). A portion of the produced fluids is routed through a heat exchanger in order to heat the Madison water supply water and is then routed to the 1.5 MMBtu/hr heater. There are no emissions associated with the heat exchanger as there is no contact with the produced fluid. Oil from both heaters is routed to the oil/production tanks before being shipped via pipeline. The water is routed to a 1500 bbl water tank then two 500 bbl water tanks before being re-injected. There is no water discharge at this site.

WDEQ-AQD OIL AND GAS FORMS

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Department of Environmental Quality - Air Quality Division

Oil & Gas Production Facilities

Checklist for Complete Application

INDUSTRY		DEQ-AQD
X	Company Name/Contact Information	
X	Well/Facility Name and API #	
X	Legal Locations	
X	Existing Permit/Waiver #'s	
X	List of Equipment Onsite	
X	Plot Plan	
X	Process Description	
X	Current Production Rates	
X	Gas/Condensate Analyses	
	All Pertinent Dates (date of first production, control installation date)	
X	Emission Models (Input/Output)	
X	Other Calculations (heaters, pneumatic equipment, truck loading, etc.)	
X	All Applicable Application Forms	
X	DEQ Application Cover Sheet	
X	Facility Location Specify: STATEWIDE	
SCENARIO 1 SCENARIO 2 NA	Dehydration Unit Presumptive BACT check appropriate box	SCENARIO 1 SCENARIO 2 NA

Form AQD-OG00

Completeness Checklist September 2013

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division

Oil & Gas Production Facilities C6 S2 Permit Application

Company Name: Marathon Oil Company

Facility Name: A Tank Battery (Gooseberry Field)

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To Be Completed by WDEQ-AQD

Reviewer _____

Copy to _____

D.E. _____

File: _____

Form AQD-OG0

Application September 2013

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STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Application Cover Sheet

submit (1) one signed original copy AND (1) one electronic copy of the application OR (3) paper copies, one w/ original signature

Company Name	Marathon Oil Company
Facility Name	Gooseberry A Tank Battery
API Number	

For more than one well, list additional wells & associated API numbers on Form AQD-OG8.

OFFICIAL CONTACT PERSON

Name	Regina Doyle	Title	Adv. HES Professional
Address	1501 Stampede Ave		
Telephone	307-527-2145	Fax 307-527-2139	E-mail rdoyle@marathonoil.com

LOCATION

County	Park County							
Legal Description	1/4 1/4	SE NE	Section	28	T	47N	R	100W
Latitude	44.0114			Longitude	-108.6311			

FACILITY INFORMATION

Type of Facility:	Single Well		PAD		Central Tank Battery	X
Type of Application:	New Construction		Modified Facility	X
	First Date of Production	1950	Date of Modification	
	Producing Field Name	Gooseberry Field		
	Producing Formation(s)	Tensleep Phosphoria		
Existing Air Quality Permit / Waiver Numbers		AP-8520		
Pending Air Quality Permit Application Numbers		None		

I, Keith F. Mingus (**Responsible Official**) RMO Operations Manager (**Title**)

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 emission rates listed on this certification reflect the anticipated emissions due to the operation of this facility. The facility will operate in compliance with all Wyoming Air Quality Standards and Regulations.

Signature [signature] Date 7/22/14

Signature Required

FORM AQD-OG1

Application Coversheet September 2013

STATE OF WYOMING
Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application

Equipment List

Company Name	Marathon Oil Company
Facility Name	Gooseberry Battery A

List all production equipment at the site including all pressurized vessels with the potential for flash emissions, all hydrocarbon liquids and produced water storage tanks, all dehydration units, all pneumatic pumps, all natural gas-fired burners and heaters and all emission control equipment and devices. Pressurized vessels with the potential for flash emissions are all vessels that vent vapors to the atmosphere during times other than upset or emergency conditions (water knockouts, 2-phase and 3-phase separators, heater treaters, gun barrels, scrubber pots, etc). Provide design ratings for dehys (MMCFD), process heaters, burners and pilots (MMBtu/hr, SCFH). Provide size of production & water storage tanks (BPD). For dehydration units indicate if the unit includes a glycol flash separator and/or reboiler still vent condenser. For emission control combustors/flares indicate design rating (MMBtu/hr, SCFD) and combustor/flare height (ft). Provide pneumatic pump motive gas useage (SCFH).

If more space is required, continue on page 2 of this sheet.

PROVIDE INSTALLATION DATES OF ALL EMISSION CONTROL EQUIPMENT & MONITORING DEVICES/SYSTEMS !!!

(1) 8' x 25' Vertical tester w/ 1.25 million Btu per hour (MMBtu/hr) heater

(1) 10' x 50' Vertical treater w/ 1.5 MMBtu/hr heater

(5) 400 barrel (bbl) oil tanks

(1) 1,500-bbl skim tank

(2) 500-bbl produced water tanks

(2) 400-bbl mobile workover tanks (previously only 1)

(1) spare 400-bbl production tank (this tank is located onsite but not connected to any piping).

(1) Continuous flame pilot flare (to be installed)

(1) 10' X 30' Free Water Knock Out (FWKO) (to be installed)

Example:

1 2-phase high pressure separator (unheated)

1 3-phase low pressure separator w/ 0.5 MMBtu/hr heater

2 0.5 MMBtu/hr line heaters

1 5 MMCFD TEG dehydration unit w/ 0.5 MMBtu/hr reboiler heater, glycol flash separator(0.5 MMBtu/hr heater) and overheads condenser

2 400-bbl condensate tanks

1 400-bbl produced water tank

1 30-ft enclosed combustor (3.0 MMBtu/hr, 5 MCFD) for flashing & reboiler vent/glycol flash separator emissions control installed 1/1/2007

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application
Storage Tanks, Pressurized Vessels & Pneumatic Pumps

Use as many copies of this form as necessary to include all tanks, vessels and pumps.

Company Name Marathon Oil Company

Facility Name Gooseberry Battery A

STORAGE TANKS

Below, list all atmospheric tanks used to store liquids transferred from an upstream vessel or wellhead. Upstream vessels include separators, treaters, flash tanks, FWKOs, gun barrels, tanks, etc. If more than one tank of the same size is used for the same purpose, receiving fluids from the same upstream vessel, those tanks may be combined on one line.

E X A M P L E S				
2-400	condensate	100	2-phase separator	600
1-1000	produced water, skim oil	1000 water, 5 oil	treater	30
1-300	bad oil tank	5 oil	run tank	atmospheric
size (bbl)	use (condensate / oil / H_2O)	total throughput (bpd)	upstream vessel	upstream vessel pressure (psig)
5-400 (bbl)	Oil Tanks	781 (proposed bpd)	Vertical Treater	20 psig
1-1,500 bbl	Skim Tank	19871 (proposed bpd)	Vertical Treater	20 psig
2-500 bbl	Produced Water Tank	19871 (proposed bpd)	Skim Tank	atmospheric

PRESSURIZED VESSELS List each vessel separately.

Pressurized vessels include FWKO's, heater-treaters, separators (2-phase & 3-phase), gas boots, gun barrels, flash tanks, etc...

E X A M P L E S			
HP 2-phase separator	600	well	1000
LP 3-phase separator	300	HP separator	600
3-phase heater treater	30	well	40
vessel	operating pressure (psig)	upstream vessel	upstream vessel pressure (psig)
(1) - 10' x 50' Vertical Treater	20	20	Wellhead (FWKO after installed)
(1) Free Water Knockout (Proposed)	20	20	Wellhead

What is the API gravity of the SALES oil or condensate at this facility? 19.9

Does this facility handle sour oil / gas? YES X NO ____

EMISSION CONTROL DEVICES & SYSTEMS for FLASH VAPORS & PRESSURE VESSEL PROCESS STREAMS

Identify each emission control system or device and the date(s) of installation for each.

E X A M P L E: 30-foot ACME smokeless combustor for tank vapor emissions control, installed 1/1/2008

(1) Continous-Flame Pilot Flare (to be installed)

Combustion Device Emission Controls (if applicable)

Date of Installation: TBD

Manufacturer: TBD

Smokeless Design? Yes X No ____

Excess Oxygen (%) ____

VOC Destruction Effeciency (%) ____ HAP Destruction Efficiency (%) 98

Maximum Design Throughput (SCFD) ____ Minimum Design throughput (SCFD) ____

Actual Waste Gas Volume (SCFD) ____ Waste Gas Heat Content (Btu/SCF) ____

Burner Rating (MMBtu/hr) ____

Ignition System: Pilot X Electric Spark ____ Other ____

Continuous Pilot? Yes X No ____

Pilot Gas Volume (SCFM) ~4

Is the Combustion Device Monitored? Yes X No ____ How? Fire eye

PNEUMATIC PUMPS

Describe each pneumatic pump using natural gas as the motive gas. Indicate where motive gas is vented (atmosphere or other).

E X A M P L E: 50 SCFH Acme brand heat trace circulation pump operated w/ produced gas, vented to gas collection system.

None

Form AQD-OG3

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division
Oil and Gas Production Facilities C6 S2 Permit Application

EMISSION SUMMARY

Company Name Marathon Oil Company

Facility Name Gooseberry Battery A

This form must be completed for each emission source at the facility. A list of the emission sources which must be considered is found in Appendix B of the C6 S2 O&G Production Facilities Permitting Guidance.

UNCONTROLLED EMISSIONS (Tons Per Year)

These are the total uncontrolled, potential emissions from each source.

EMISSION SOURCE (i.e., tank, natural gas-fired heater, reboiler still vent, glycol flash separator, pneumatic pump, separator gas vent, water knockout vent, etc.)	VOCs	total HAPs	NO_X	CO	SO_2	H_2S
Treater Flashing Emissions	483.46	2.7	-	-	-	27.14
Crude Tanks (S/W/B)	1.25	0.01	-	-	-	0.07
Produced Water Tanks (S/W/B)	24.16	0.13	-	-	-	1.36
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners	4.47	insig.	0.77	0.19	-	-
Fugitives	0.01	insig.	-	-	-	-

CONTROLLED EMISSIONS (Tons Per Year)

These are the total emissions from each source. Include controlled emissions from each controlled source and uncontrolled emissions from each source which does not require control, such as process equipment burners.

EMISSION SOURCE	VOCs	total HAPs	NO_X	CO	SO_2	H_2S
Treater Flashing Emissions	9.67	0.05	1.76	-	45.93	0.54
Crude Tanks (S/W/B)	0.03	insig.	-	-	0.14	0.07
Produced Water Tanks (S/W/B)	0.48	insig.	-	-	2.71	1.36
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners	4.47	insig.	0.77	0.19	-	-
Fugitives	0.01	insig.	-	-	-	-

HAZARDOUS AIR POLLUTANT SUMMARY (Tons Per Year)

Complete this section for each emissions source if TOTAL HAPs from that source are 9 TPY or greater.

SOURCE	Benzene	Toluene	Ethyl-Benzene	Xylenes	Other

STATE OF WYOMING

Department of Environmental Quality - Air Quality Division

Change of Ownership Form

NEW OWNER

Company Name: Marathon Oil Company

Mailing Address: 1501 Stampede Ave

City: Cody State: WY Zip Code: 82414

Owner or Company Official to contact regarding air pollution matters:

Name: Regina Doyle Title: Adv. HES Professional

Address: 1501 Stampede Ave

Telephone: 307-527-2145 Fax: 307-527-2139 E-mail: rdoyle@marathonoil.com

PREVIOUS OWNER

Company Name: Encore Operating L.P.

Mailing Address: 777 Main Street, Suite 1400

City: Fort Worth State: TX Zip Code: 76102

Telephone: 817-339-0871 Fax: _____ E-Mail: pnavratil@encoreacq.com

FACILITY INFORMATION

Facility Name: Gooseberry A Tank Battery County: Park

Date of Ownership Change: May 1, 2014

Legal Description ¼ ¼ Section: SENE Section: 28 T: 47N R: 100W

Lat/Long Coordinates Latitude: 44.0114 Longitude: -108.6311

Type of Facility Tank Battery: X Wellsite Facility: ____ Dehydration Unit: ____

Compressor Station: ____ Gas Plant: ____ Other: ____

Describe if other: _____

FOR MULTIPLE SITES...

On a separate piece of paper continue the list of the facility names, counties, location descriptions and facility types for each site for which ownership has changed.

Form AQD-OG9

Change of Ownership September2013

EMISSION CALCULATIONS

TABLE 1: Uncontrolled Current Gooseberry Battery A Emissions (TPY) - 10 MCFD						
Emission Source	**VOCs**	**Total HAPs**	**NO_X**	**CO**	**SO_2**	**H_2S**
Treater Flashing Emissions	74.38	0.41	-	-	-	4.18
Crude Tanks (S/W/B)	0.74	0.00	-	-	-	0.04
Produced Water Tanks (S/W/B)	4.39	0.02	-	-	-	0.20
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners*	4.47	0.00	0.77	0.19	-	-
Fugitives	0.01	0.00	-	-	-	-
TOTALS	**83.99**	**0.44**	**0.77**	**0.19**	**0.00**	**4.41**

TABLE 2a: Uncontrolled Proposed Gooseberry Battery A Emissions (TPY) - 65 MCFD						
Emission Source	**VOCs**	**Total HAPs**	**NO_X**	**CO**	**SO_2**	**H_2S**
Treater Flashing Emissions	483.46	2.70	-	-	-	27.14
Crude Tanks (S/W/B)	1.25	0.01	-	-	-	0.07
Produced Water Tanks (S/W/B)	24.16	0.13	-	-	-	1.36
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners	4.47	0.00	0.77	0.19	-	-
Fugitives	0.01	0.00	-	-	-	-
TOTALS	**513.36**	**2.84**	**0.77**	**0.19**	**0.00**	**28.57**

TABLE 2: Controlled Proposed Gooseberry Battery A Emissions (TPY) - 65 MCFD						
Emission Source	**VOCs**	**Total HAPs**	**NO_X**	**CO**	**SO_2**	**H_2S**
Treater Flashing Emissions	9.67	0.05	1.76	-	45.93	0.54
Crude Tanks (S/W/B)	0.03	0.00	-	-	0.14	0.07
Produced Water Tanks (S/W/B)	0.48	0.00	-	-	2.71	1.36
(2) 1.25 MMBtu/hr and (1) 1.5 MMBtu/hr propane-fired burners	4.47	0.00	0.77	0.19	-	-
Fugitives	0.01	0.00	-	-	-	-
TOTALS	**14.66**	**0.06**	**2.52**	**0.19**	**48.78**	**1.97**

TABLE 3: Gooseberry Battery A Marathon Oil Company Current Venting Emissions (10 mcfd*)		
Basis		**Units**
Waste Gas*	416.67	scf/hr
Fuel Heat Content (HHV)	1175.86	BTU/scf
Pilot Supply Rate*	6.32	Mscfd
NOx Emission Factor**	0.14	lb/MMBtu
CO Emission Factor**	0.035	lb/MMBtu
Hours of Operation	8760	hrs
H_2S weight %	2.14	
H_2S mole %	2.55	
Tank Vapor MW	40.51	lb/lbmol
SO_2 MW	64	lb/lbmol
VOC weight %	38.13	
HAP weight %	0.21	
VOC weight fraction	0.38	
HAP weight fraction	0.00	
Emissions:	**lb/hr**	**tpy**
NOX	0.07	0.30
Unflared H_2S Emissions	0.95	4.18
Flared H_2S Emissions	0.02	0.08
SO_2 Emissions	1.79	7.85
VOC Uncontrolled	16.98	74.38
VOC Controlled (98%)	0.34	1.49
HAPs Uncontrolled	0.09	0.41
HAPs Controlled (98%)	0.00	0.01

* Provided by Marathon Engineering

** From Chapter 6 Section 2 Permitting Guidance Appendix B

TABLE 4: Gooseberry Battery A Marathon Oil Company Proposed Flaring Emissions (65 mcfd*)		
Basis		**Units**
Waste Gas*	2708.33	scf/hr
Fuel Heat Content (HHV)	1175.86	BTU/scf
Pilot Supply Rate*	6.32	Mscfd
NOx Emission Factor**	0.14	lb/MMBtu
CO Emission Factor**	0.035	lb/MMBtu
Hours of Operation	7884	hrs
H_2S weight %	2.14	
H_2S mole %	2.55	
Tank Vapor MW	40.51	lb/lbmol
SO_2 MW	64	lb/lbmol
VOC weight %	38.13	
HAP weight %	0.21	
VOC weight fraction	0.38	
HAP weight fraction	0.00	
Emissions:	**lb/hr**	**tpy**
NOX	0.40	1.76
Unflared H_2S Emissions	6.20	27.14
Flared H_2S Emissions	0.12	0.54
SO_2 Emissions	10.49	45.93
VOC uncontrolled	110.38	483.46
Controlled VOC (98%)	2.21	9.67
HAPs uncontrolled	0.62	2.70
Controlled HAPs (98%)	0.01	0.05

* Provided by Marathon Engineering

** From Chapter 6 Section 2 Permitting Guidance Appendix B

TABLE 5: Gooseberry Battery A Oil Tank Standing/Working/Breathing Losses Current Throughput: 330 BOPD Marathon Oil Company		
Basis	**Value**	**Units**
Tank 4.09d Emission Output	3858.32	lb/yr
	1.93	tpy
	0.44	lb/hr
VOC weight %	38.13	%
HAP weight %	0.21	%
VOC weight fraction	0.38	-
HAP weight fraction	0.00	-
H_2S weight %	2.14	%
H_2S mole %	2.55	%
Emissions:	lb/hr	tpy
H_2S Emissions	0.01	0.04
VOC Uncontrolled	0.17	0.74
VOC Controlled	0.00	0.01
HAPs Uncontrolled	0.00	0.00
HAPs Controlled	0.00	0.00

TABLE 6: Gooseberry Battery A Oil Tank Standing/Working/Breathing Losses Proposed Throughput: 781 BOPD Marathon Oil Company		
Basis	**Value**	**Units**
Tank 4.09d Emission Output	6582.58	lb/yr
	3.29	tpy
	0.75	lb/hr
VOC weight %	38.13	%
HAP weight %	0.21	%
VOC weight fraction	0.38	-
HAP weight fraction	0.00	-
H_2S weight %	2.14	%
H_2S mole %	2.55	%
Emissions:	lb/hr	tpy
H_2S Emissions	0.02	0.07
Unflared H_2S Emissions*	0.00	0.00
SO_2 Emissions**	0.03	0.14
VOC Uncontrolled	0.29	1.25
VOC Controlled	0.01	0.03
HAPs Uncontrolled	0.00	0.01
HAPs Controlled	0.00	0.00

**Assume 100% conversion of H_2S to SO_2

TABLE 7: Gooseberry Battery A Water Tank Standing/Working/Breathing Losses Current Throughput: 2,703 BWPD Marathon Oil Company		
Basis	**Value**	**Units**
Tank 4.09d Emission Output (Based on Oil)	23049.55	lb/yr
	11.52	tpy
	2.63	lb/hr
VOC weight %	38.13	%
HAP weight %	0.21	%
VOC weight fraction	0.38	-
HAP weight fraction	0.00	-
H_2S weight %	1.71	%
H_2S mole %	2.55	%
Oil Fraction	1	%
SO2 MW	64	lb/lbmol
Emissions:	lb/hr	tpy
H_2S Emissions	0.05	0.20
Unflared H_2S Emissions	0.00	0.00
VOC Uncontrolled	1.00	4.39
HAPs Uncontrolled	0.01	0.02

TABLE 8: Gooseberry Battery A Water Tank Standing/Working/Breathing Losses Proposed Throughput: 19,871 BWPD Marathon Oil Company		
Basis	**Value**	**Units**
Tank 4.09d Emission Output (Based on RVP 5)	126752.54	lb/yr
	63.38	tpy
	14.47	lb/hr
VOC weight %	38.13	%
HAP weight %	0.21	%
VOC weight fraction	0.38	-
HAP weight fraction	0.00	-
H_2S weight %	2.14	%
H_2S mole %	2.55	%
Oil Fraction	1	%
SO2 MW	64	lb/lbmol
Emissions:	lb/hr	tpy
H_2S Emissions	0.31	1.36
Unflared H_2S Emissions	0.01	0.03
SO_2 Emissions*	0.62	2.71
VOC Uncontrolled	5.52	24.16
VOC Controlled	0.11	0.48
HAPs Uncontrolled	0.03	0.13
HAPs Controlled	0.00	0.00

*Assume 100% conversion of H_2S to SO_2

TABLE 9: Gooseberry Battery A Marathon Oil Company Flaring Emissions - Pilot Flame		
Basis		**Units**
scf/h	263.33	scf/hr
Fuel Heat Content (HHV)	1050.00	BTU/scf
Pilot Supply Rate*	4.39	scf/min
NOx Emission Factor**	0.14	lb/MMBtu
CO Emission Factor**	0.04	lb/MMBtu
Hours of Operation	7884	hrs
Sweet Gas MW	31.52	lb/lbmol
VOC weight %	0.01	
HAP weight %	0.00	
Emissions	**lb/hr**	**tpy**
NOx	0.04	0.17
CO	0.01	0.04
VOCs	0.00	0.00
HAPs	0.00	0.00

* Provided by Marathon Engineering

** From Chapter 6 Section 2 Permitting Guidance Appendix B

TABLE 10: Gooseberry Battery A Marathon Oil Company Heater/Tester Burner Emissions - Pilot Flame		
Basis		Units
scf/h	263.33	scf/hr
Fuel Heat Content (HHV)	2371.00	BTU/scf
Pilot Supply Rate*	4.39	scf/min
NOx Emission Factor**	0.14	lb/MMBtu
CO Emission Factor**	0.04	lb/MMBtu
Hours of Operation	8760	hrs
Propane MW	44.10	lb/lbmol
VOC weight %	100.00	%
HAP weight %	0.00	%
Emissions - per Pilot	lb/hr	tpy
NOx	0.09	0.38
CO	0.02	0.10
VOCs	0.51	2.24
HAPs	0.00	0.00
Emissions - Total (2 pilots)	lb/hr	tpy
NOx	0.17	0.77
CO	0.04	0.19
VOCs	1.02	4.47
HAPs	0.00	0.00

* Provided by Marathon Engineering

** From Chapter 6 Section 2 Permitting Guidance Appendix B

TABLE 11: Gooseberry Battery A Fugitives				
Equipment Type	Emission Factor[1,2] (lb/component-day)	Counts[3]	VOCs[1] (tpy)	Total HAPs (BTEX)[1] (tpy)
Connector	0.0004	38	0.00081	4.2997E-06
Flange	0.000021	44	4.924E-05	2.61377E-07
Open Ended Line	0.0074	17	0.0067039	3.55857E-05
Other[4]	0.0017	30	0.0027178	1.44266E-05
Pump	0	0	0	0
Valve	0.00044	24	0.0005627	2.98716E-06
Total			**0.0108437**	**5.75605E-05**

[1] EF from WDAQ C4 S2 O&G Production Facilities Permitting Guidance

[2] EF based on "Heavy Oil"

[3] Equipment type counts are estimated using 40 CFR Part 98 Subpart W, except "other" (ba diagram)

[4] Other includes compressor, PRV, diaphragms, drains, dump arms, hatches, instruments, n polished rods and vents.

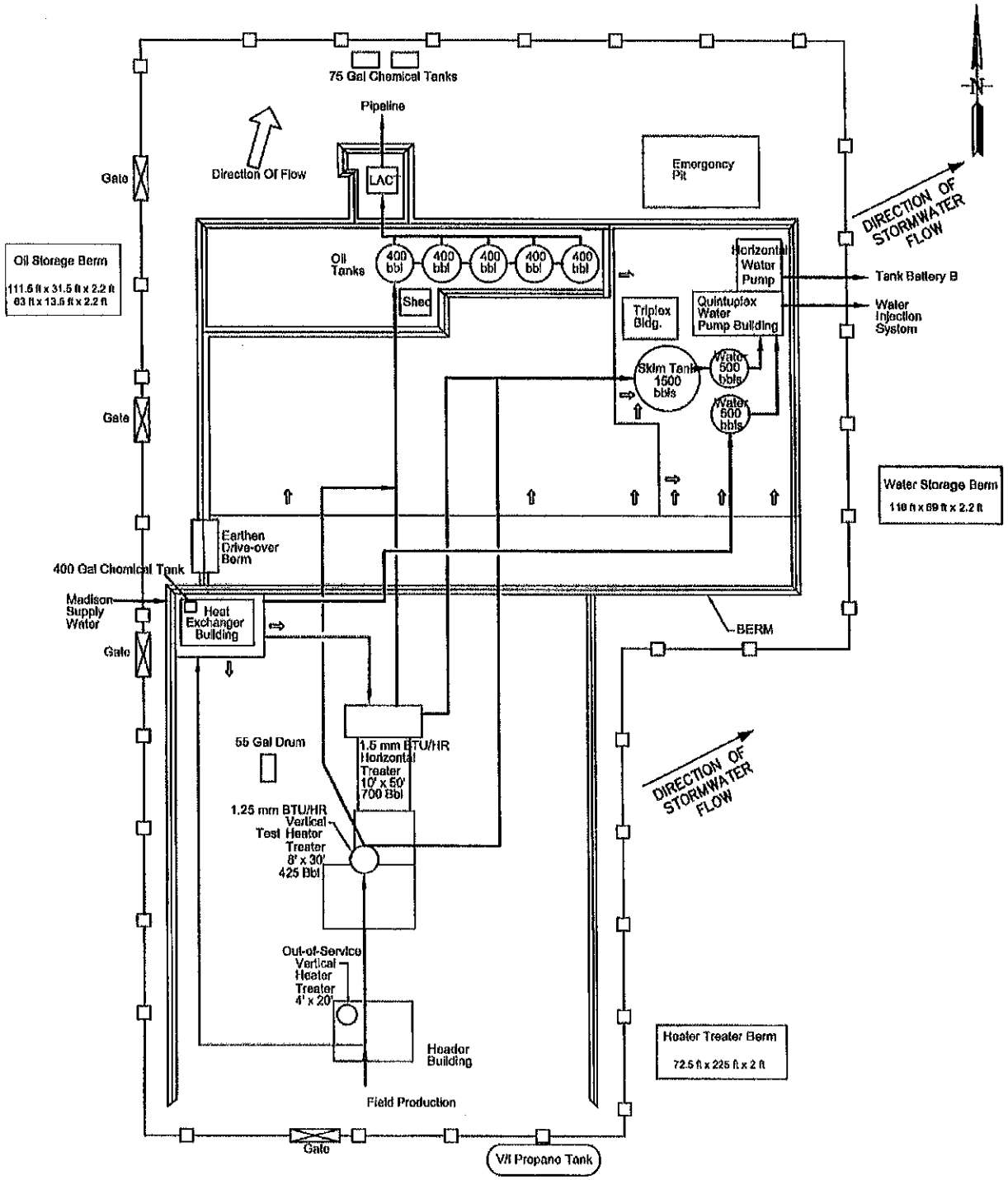
WELL INFORMATION

Well Information
Gooseberry Battery A
Marathon Oil Company

Name	1/4 1/4	Section	T	R	Latitude	Longitude	Startup
Gooseberry A 36-33G	NE SW	33	47N	100W	43.99541	-108.86866	1/11/1955
Gooseberry A 33-33G	NSE NW	33	47N	100W	44.00198	-108.86837	2/14/1955
Gooseberry A T25X-33G	NW SW	33	47N	100W	43.99830	-108.87021	10/19/1991
Gooseberry A T45X-33G	NE SW	33	47N	100W	43.99705	-108.86440	9/5/1992
Gooseberry Fed A 27-33H	SW SW	33	47N	100W	43.99186	-108.86996	5/7/1997
Gooseberry A 8X-28P	SW SW	28	47N	100W	44.00762	-108.87321	4/4/1991
Gooseberry A T84-29P	SE NE	29	47N	100W	44.01459	-108.87668	6/9/1974
Gooseberry A T86-29P	NE SE	29	47N	100W	44.01125	-108.87690	4/3/1985
Gooseberry A 32-4[1]	NW NW	4	46N	100W	43.98964	-108.86949	2/12/1997
Gooseberry A 22-33	NE NW	33	47N	100W	44.00099	-108.86904	3/1/1997
Gooseberry A 23-33	NW SW	33	47N	100W	43.99698	-108.87317	8/30/1997
Gooseberry A 84-29-2	SE NE	29	47N	100W	44.01448	-108.87565	5/1/2003
Gooseberry A 28-28	SW SW	28	47N	100W	44.00856	-108.87171	6/1/2003
Gooseberry A 4-28	NE NE	18	47N	100W	44.01743	-108.87767	11/4/2008
Gooseberry A 37-33	NW NW	33	47N	100W	44.00439	-108.87297	10/25/2008
Gooseberry A 17-28	SW SW	29	47N	100W	44.00764	-108.87498	10/17/1996

[1] This well is in Hot Springs County. All others are in Park County.

PLOT PLAN



LEGEND

- OIL
- WATER
- NATURAL GAS
- INLET OIL / WATER / NATURAL GAS

Cameron-Cole
5777 CENTRAL AVENUE, SUITE 200
BOULDER, COLORADO 80301
PHONE: (303) 938-5500
FAX: (303) 938-5520
http://www.cameron-cole.com

ENCORE OPERATING L.P.

GOOSEBERRY TANK BATTERY A
SENE, SEC. 28, T47N, R100W
PARK COUNTY, WYOMING

SCALE	DATE	PROJECT #
NOT TO SCALE	7/29/10	1826

GAS ANALYSES

PRECISION ANALYSIS GAS MEASUREMENT EMISSIONS TESTING LABORATORY

307.856.0866
www.precision-labs.com

Client:	MARATHON	**Analysis Date:**	7/1/2014
Sample ID:	GOOSEBERRY TREATER A	**Date Sampled:**	7/1/2014
Unique #:	N/A	**Purpose:**	SPECIAL REQ
Sample Temperature:	100 DEG F	**Sample Pressure:**	20 PSI
Sampled By:	JACOB MCKERCHIE	**Type Sample:**	ON SITE
County:	PARK	Witnessed By: Clay Shumway	

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide.....	38.2202	42.1507	30.4847
Hydrogen Sulfide.....	2.4343	2.0790	1.5381
Nitrogen.....	6.6478	4.6667	3.4181
Methane.....	12.2090	4.9081	9.6736
Ethane.....	12.0577	9.0855	15.0710
Propane.....	19.6439	21.7064	25.2936
iso-Butane.....	1.0223	1.4890	1.5635
n-Butane.....	2.9134	4.2433	4.2927
iso-Pentane.....	1.3529	2.4460	2.3124
n-Pentane.....	1.5832	2.8624	2.6822
Cyclopentane.....	0.0308	0.0541	0.0426
n-Hexane.....	0.5287	1.1417	1.0161
Cyclohexane.....	0.2884	0.6082	0.4585
Other Hexanes	0.3973	0.8580	0.7636
Heptanes.....	0.3504	0.8798	0.7555
Methylcyclohexane.....	0.0684	0.1683	0.1284
2,2,4-Trimethylpentane...	0.0000	0.0000	0.0000
Benzene.....	0.0336	0.0658	0.0439
Toluene.....	0.0586	0.1353	0.0917
Ethylbenzene.....	0.0103	0.0274	0.0186
Xylenes.....	0.0089	0.0237	0.0161
C8+ Heavies.....	0.1399	0.4005	0.3350
Totals	100.0000	100.0000	100.0000

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.0308	0.0541	0.0426
Cyclohexane	0.2884	0.6082	0.4585
2-Methylpentane	0.2501	0.5400	0.4806
3-Methylpentane	0.1472	0.3180	0.2830
n-Hexane	0.5287	1.1417	1.0161
Methylcyclohexane	0.0684	0.1683	0.1284
2,2,4-Trimethylpentane	0.0000	0.0000	0.0000
Benzene	0.0336	0.0658	0.0439
Toluene	0.0586	0.1353	0.0917
Ethylbenzene	0.0103	0.0274	0.0186
m-Xylene	0.0014	0.0038	0.0026
p-Xylene	0.0060	0.0160	0.0109
o-Xylene	0.0015	0.0039	0.0026

SPECIFIC GRAVITY @ 60/60 F, calculated	1.3778
TOTAL GPM (Ethane Inclusive)	11.712
CALCULATED BTU / REAL CF @ 14.73 PSIA, dry basis	1197.541
CALCULATED BTU / REAL CF @ 14.73 PSIA, wet basis	1177.464
AVERAGE MOLECULAR WEIGHT	39.906
MOLAR MASS RATIO	1.3778
RELATIVE DENSITY (G x Z (Air) / Z), calculated	1.3903
IDEAL GROSS HEATING VALUE, BTU / IDEAL CF @ 14.696 PSIA	1184.106
COMPRESSIBILITY FACTOR (Z)	0.99105

PROPANE GPM	5.3980
BUTANE GPM	1.2498
GASOLINE GPM (PENTANE AND HEAVIER)	1.8479

TOTAL ACID GAS MOLE %	40.6545
H2S MOLE %	2.4343
H2S PPM	24343

VOC WEIGHT FRACTION	0.371

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-09, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

PRECISION ANALYSIS GAS MEASUREMENT EMISSIONS TESTING LABORATORY

307.856.0866
www.precision-labs.com

Client:	MARATHON	**Analysis Date:**	7/1/2014
Sample ID:	GOOSEBERRY TREATER A 2	**Date Sampled:**	7/1/2014
Unique #:	N/A	**Purpose:**	SPECIAL REQ
Sample Temperature:	100 DEG F	**Sample Pressure:**	20 PSI
Sampled By:	JACOB MCKERCHIE	**Type Sample:**	ON SITE
County:	PARK	Witnessed By: Clay Shumway	

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide.....	38.3808	42.4338	30.6882
Hydrogen Sulfide.....	2.4286	2.0793	1.5382
Nitrogen.....	6.6928	4.7100	3.4498
Methane.....	12.2852	4.9511	9.7579
Ethane.....	12.0316	9.0885	15.0754
Propane.....	19.5491	21.6558	25.2335
iso-Butane.....	1.0262	1.4984	1.5733
n-Butane.....	2.9209	4.2649	4.3144
iso-Pentane.....	1.3469	2.4413	2.3078
n-Pentane.....	1.5643	2.8353	2.6567
Cyclopentane.....	0.0298	0.0525	0.0413
n-Hexane.....	0.5003	1.0831	0.9639
Cyclohexane.....	0.2605	0.5508	0.4152
Other Hexanes	0.3825	0.8281	0.7370
Heptanes.....	0.3163	0.7962	0.6837
Methylcyclohexane.....	0.0613	0.1512	0.1154
2,2,4-Trimethylpentane...	0.0000	0.0000	0.0000
Benzene.....	0.0305	0.0599	0.0400
Toluene.....	0.0520	0.1204	0.0815
Ethylbenzene.....	0.0091	0.0243	0.0164
Xylenes.....	0.0081	0.0216	0.0147
C8+ Heavies.....	0.1232	0.3535	0.2957
Totals	100.0000	100.0000	100.0000

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.0298	0.0525	0.0413
Cyclohexane	0.2605	0.5508	0.4152
2-Methylpentane	0.2408	0.5212	0.4638
3-Methylpentane	0.1418	0.3069	0.2731
n-Hexane	0.5003	1.0831	0.9639
Methylcyclohexane	0.0613	0.1512	0.1154
2,2,4-Trimethylpentane	0.0000	0.0000	0.0000
Benzene	0.0305	0.0599	0.0400
Toluene	0.0520	0.1204	0.0815
Ethylbenzene	0.0091	0.0243	0.0164
m-Xylene	0.0013	0.0034	0.0023
p-Xylene	0.0055	0.0146	0.0099
o-Xylene	0.0013	0.0035	0.0024

SPECIFIC GRAVITY @ 60/60 F, calculated	1.3744
TOTAL GPM (Ethane Inclusive)	11.615
CALCULATED BTU / REAL CF @ 14.73 PSIA, dry basis	1187.613
CALCULATED BTU / REAL CF @ 14.73 PSIA, wet basis	1167.710
AVERAGE MOLECULAR WEIGHT	39.806
MOLAR MASS RATIO	1.3744
RELATIVE DENSITY (G x Z (Air) / Z), calculated	1.3866
IDEAL GROSS HEATING VALUE, BTU / IDEAL CF @ 14.696 PSIA	1174.405
COMPRESSIBILITY FACTOR (Z)	0.99115

PROPANE GPM	5.3720
BUTANE GPM	1.2534
GASOLINE GPM (PENTANE AND HEAVIER)	1.7805

TOTAL ACID GAS MOLE %	40.8094
H2S MOLE %	2.4286
H2S PPM	24286

VOC WEIGHT FRACTION	0.367

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-09, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

PRECISION ANALYSIS GAS MEASUREMENT EMISSIONS TESTING LABORATORY

307.856.0866
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Client:	MARATHON	**Analysis Date:**	7/1/2014
Sample ID:	GOOSEBERRY TREATER A 3	**Date Sampled:**	7/1/2014
Unique #:	N/A	**Purpose:**	SPECIAL REQ
Sample Temperature:	100 DEG F	**Sample Pressure:**	20 PSI
Sampled By:	JACOB MCKERCHIE	**Type Sample:**	ON SITE
County:	PARK	Witnessed By: Clay Shumway	

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide.....	38.1634	42.1258	30.4440
Hydrogen Sulfide.....	2.4296	2.0768	1.5353
Nitrogen.....	6.6417	4.6666	3.4155
Methane.....	12.2022	4.9098	9.6696
Ethane.....	12.0545	9.0912	15.0693
Propane.....	19.8325	21.9345	25.5403
iso-Butane.....	1.0339	1.5072	1.5815
n-Butane.....	2.8989	4.2260	4.2720
iso-Pentane.....	1.3366	2.4187	2.2849
n-Pentane.....	1.5567	2.8170	2.6377
Cyclopentane.....	0.0297	0.0522	0.0411
n-Hexane.....	0.5032	1.0876	0.9672
Cyclohexane.....	0.2732	0.5767	0.4344
Other Hexanes	0.3823	0.8263	0.7349
Heptanes.....	0.3352	0.8424	0.7229
Methylcyclohexane.....	0.0679	0.1672	0.1275
2,2,4-Trimethylpentane...	0.0000	0.0000	0.0000
Benzene.....	0.0323	0.0633	0.0422
Toluene.....	0.0607	0.1403	0.0950
Ethylbenzene.....	0.0105	0.0280	0.0189
Xylenes.....	0.0093	0.0248	0.0168
C8+ Heavies.....	0.1457	0.4174	0.3489
Totals	100.0000	100.0000	100.0000

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.0297	0.0522	0.0411
Cyclohexane	0.2732	0.5767	0.4344
2-Methylpentane	0.2406	0.5201	0.4625
3-Methylpentane	0.1417	0.3062	0.2723
n-Hexane	0.5032	1.0876	0.9672
Methylcyclohexane	0.0679	0.1672	0.1275
2,2,4-Trimethylpentane	0.0000	0.0000	0.0000
Benzene	0.0323	0.0633	0.0422
Toluene	0.0607	0.1403	0.0950
Ethylbenzene	0.0105	0.0280	0.0189
m-Xylene	0.0015	0.0039	0.0027
p-Xylene	0.0063	0.0168	0.0114
o-Xylene	0.0015	0.0041	0.0028

SPECIFIC GRAVITY @ 60/60 F, calculated	1.3766
TOTAL GPM (Ethane Inclusive)	11.721
CALCULATED BTU / REAL CF @ 14.73 PSIA, dry basis	1197.324
CALCULATED BTU / REAL CF @ 14.73 PSIA, wet basis	1177.251
AVERAGE MOLECULAR WEIGHT	39.870
MOLAR MASS RATIO	1.3766
RELATIVE DENSITY (G x Z (Air) / Z), calculated	1.3890
IDEAL GROSS HEATING VALUE, BTU / IDEAL CF @ 14.696 PSIA	1183.914
COMPRESSIBILITY FACTOR (Z)	0.99107

PROPANE GPM	5.4498
BUTANE GPM	1.2490
GASOLINE GPM (PENTANE AND HEAVIER)	1.8066

TOTAL ACID GAS MOLE %	40.5930
H2S MOLE %	2.4296
H2S PPM	24296

VOC WEIGHT FRACTION	0.371

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-09, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

PRECISION ANALYSIS GAS MEASUREMENT EMISSIONS TESTING LABORATORY

307.856.0866
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Client:	MARATHON	**Analysis Date:**	5/16/2014
Sample ID:	GOOSEBERRY TREATER A	**Date Sampled:**	5/16/2014
Unique #:	N/A	**Purpose:**	SPECIAL REQ
Sample Temperature:	92 DEG F	**Sample Pressure:**	20 PSI
Sampled By:	JACOB MCKERCHIE	**Type Sample:**	ON-SITE
County:	PARK	Witnessed by: Clay Shumway	

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide	46.0457	47.7078	36.4415
Hydrogen Sulfide	2.8982	2.3254	1.8170
Nitrogen	3.8546	2.5421	1.9666
Methane	4.9981	1.8877	3.9294
Ethane	5.5441	3.9247	6.8759
Propane	30.3527	31.5098	38.7792
iso-Butane	0.8239	1.1274	1.2503
n-Butane	2.4256	3.3191	3.5463
iso-Pentane	0.9802	1.6649	1.6624
n-Pentane	1.0456	1.7760	1.7577
Cyclopentane	0.0172	0.0284	0.0236
n-Hexane	0.2926	0.5936	0.5580
Cyclohexane	0.1414	0.2802	0.2231
Other Hexanes	0.2210	0.4484	0.4215
Heptanes	0.1785	0.4211	0.3819
Methylcyclohexane	0.0347	0.0802	0.0647
2,2,4-Trimethylpentane	0.0000	0.0000	0.0000
Benzene	0.0129	0.0237	0.0167
Toluene	0.0312	0.0677	0.0484
Ethylbenzene	0.0031	0.0077	0.0055
Xylenes	0.0067	0.0167	0.0120
C8+ Heavies	0.0920	0.2474	0.2186
Totals	100.0000	100.0000	100.0000

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.0172	0.0284	0.0236
Cyclohexane	0.1414	0.2802	0.2231
2-Methylpentane	0.1391	0.2822	0.2653
3-Methylpentane	0.0819	0.1662	0.1562
n-Hexane	0.2926	0.5936	0.5580
Methylcyclohexane	0.0347	0.0802	0.0647
2,2,4-Trimethylpentane	0.0000	0.0000	0.0000
Benzene	0.0129	0.0237	0.0167
Toluene	0.0312	0.0677	0.0484
Ethylbenzene	0.0031	0.0077	0.0055
m-Xylene	0.0011	0.0027	0.0019
p-Xylene	0.0045	0.0113	0.0081
o-Xylene	0.0011	0.0027	0.0020

SPECIFIC GRAVITY @ 60/60 F, calculated	1.4666
TOTAL GPM (Ethane Inclusive)	12.011
CALCULATED BTU / REAL CF @ 14.73 PSIA, dry basis	1181.837
CALCULATED BTU / REAL CF @ 14.73 PSIA, wet basis	1162.035
AVERAGE MOLECULAR WEIGHT	42.476
MOLAR MASS RATIO	1.4666
RELATIVE DENSITY (G x Z (Air) / Z), calculated	1.4812
IDEAL GROSS HEATING VALUE, BTU / IDEAL CF @ 14.696 PSIA	1167.504
COMPRESSIBILITY FACTOR (Z)	0.99014

PROPANE GPM	8.3407
BUTANE GPM	1.0317
GASOLINE GPM (PENTANE AND HEAVIER)	1.1595

TOTAL ACID GAS MOLE %	48.9439
H2S MOLE %	2.8982
H2S PPM	28982

VOC WEIGHT FRACTION	0.416

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-09, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

TANKS 4.09 RUNS

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

Identification

User Identification:	GB A Current Oil Rate 400 bbl Tank
City:	Cody
State:	Wyoming
Company:	Marathon Oil Corporation
Type of Tank:	Vertical Fixed Roof Tank
Description:	Tanks 4.09d run for 330 bopd throughput.

Tank Dimensions

Shell Height (ft):		20.00
Diameter (ft):		12.00
Liquid Height (ft) :		18.00
Avg. Liquid Height (ft):		9.00
Volume (gallons):		15,228.53
Turnovers:		332.20
Net Throughput(gal/yr):		5,058,900.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good
Roof Color/Shade:	Gray/Medium
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		1.50
Slope (ft/ft) (Cone Roof)		0.25

Breather Vent Settings

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

Meterological Data used in Emissions Calculations: Billings, Montana (Avg Atmospheric Pressure = 12.92 psia)

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

GB A Current Oil Rate 400 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Crude oil (RVP 5)	All	55.79	45.49	66.10	50.11	2.6479	2.1465	3.2396	50.0000			207.00	Option 4: RVP=5

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

GB A Current Oil Rate 400 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	784.8725
Vapor Space Volume (cu ft):	1,300.6194
Vapor Density (lb/cu ft):	0.0239
Vapor Space Expansion Factor:	0.1806
Vented Vapor Saturation Factor:	0.3826
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,300.6194
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	11.5000
Tank Shell Height (ft):	20.0000
Average Liquid Height (ft):	9.0000
Roof Outage (ft):	0.5000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.5000
Roof Height (ft):	1.5000
Roof Slope (ft/ft):	0.2500
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0239
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Daily Avg. Liquid Surface Temp. (deg. R):	515.4649
Daily Average Ambient Temp. (deg. F):	47.0333
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	509.7833
Tank Paint Solar Absorptance (Shell):	0.6800
Tank Paint Solar Absorptance (Roof):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,309.9021
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1806
Daily Vapor Temperature Range (deg. R):	41.2245
Daily Vapor Pressure Range (psia):	1.0931
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	2.1465
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	3.2396
Daily Avg. Liquid Surface Temp. (deg R):	515.4649
Daily Min. Liquid Surface Temp. (deg R):	505.1588
Daily Max. Liquid Surface Temp. (deg R):	525.7711
Daily Ambient Temp. Range (deg. R):	22.6167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.3826
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	2.6479

Vapor Space Outage (ft):	11.5000
Working Losses (lb):	3,073.4491
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Annual Net Throughput (gal/yr.):	5,058,900.0000
Annual Turnovers:	332.1988
Turnover Factor:	0.2570
Maximum Liquid Volume (gal):	15,228.5332
Maximum Liquid Height (ft):	18.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	0.7500
Total Losses (lb):	3,858.3216

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

Emissions Report for: Annual

GB A Current Oil Rate 400 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude oil (RVP 5)	3,073.45	784.87	3,858.32

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

Identification

User Identification:	GB A Proposed Oil Rate 400 bbl Tank
City:	Cody
State:	Wyoming
Company:	Marathon Oil Corporation
Type of Tank:	Vertical Fixed Roof Tank
Description:	Tanks 4.09d run for 781 bopd throughput.

Tank Dimensions

Shell Height (ft):		20.00
Diameter (ft):		12.00
Liquid Height (ft) :		18.00
Avg. Liquid Height (ft):		9.00
Volume (gallons):		15,228.53
Turnovers:		786.20
Net Throughput(gal/yr):		11,972,730.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good
Roof Color/Shade:	Gray/Medium
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		1.50
Slope (ft/ft) (Cone Roof)		0.25

Breather Vent Settings

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

Meterological Data used in Emissions Calculations: Billings, Montana (Avg Atmospheric Pressure = 12.92 psia)

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

GB A Proposed Oil Rate 400 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Crude oil (RVP 5)	All	55.79	45.49	66.10	50.11	2.6479	2.1465	3.2396	50.0000			207.00	Option 4: RVP=5

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

GB A Proposed Oil Rate 400 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	784.8725
Vapor Space Volume (cu ft):	1,300.6194
Vapor Density (lb/cu ft):	0.0239
Vapor Space Expansion Factor:	0.1806
Vented Vapor Saturation Factor:	0.3826
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	1,300.6194
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	11.5000
Tank Shell Height (ft):	20.0000
Average Liquid Height (ft):	9.0000
Roof Outage (ft):	0.5000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.5000
Roof Height (ft):	1.5000
Roof Slope (ft/ft):	0.2500
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0239
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Daily Avg. Liquid Surface Temp. (deg. R):	515.4649
Daily Average Ambient Temp. (deg. F):	47.0333
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	509.7833
Tank Paint Solar Absorptance (Shell):	0.6800
Tank Paint Solar Absorptance (Roof):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,309.9021
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1806
Daily Vapor Temperature Range (deg. R):	41.2245
Daily Vapor Pressure Range (psia):	1.0931
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	2.1465
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	3.2396
Daily Avg. Liquid Surface Temp. (deg R):	515.4649
Daily Min. Liquid Surface Temp. (deg R):	505.1588
Daily Max. Liquid Surface Temp. (deg R):	525.7711
Daily Ambient Temp. Range (deg. R):	22.6167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.3826
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	2.6479

Vapor Space Outage (ft):	11.5000
Working Losses (lb):	5,797.7063
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Annual Net Throughput (gal/yr.):	11,972,730.0000
Annual Turnovers:	786.2038
Turnover Factor:	0.2048
Maximum Liquid Volume (gal):	15,228.5332
Maximum Liquid Height (ft):	18.0000
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	0.7500
Total Losses (lb):	6,582.5788

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

Emissions Report for: Annual

GB A Proposed Oil Rate 400 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude oil (RVP 5)	5,797.71	784.87	6,582.58

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

Identification

User Identification:	GB A Proposed Water Rate 1500 bbl Tank
City:	Cody
State:	Wyoming
Company:	Marathon Oil Corporation
Type of Tank:	Vertical Fixed Roof Tank
Description:	Tanks 4.09d run for 19,871 bwpd throughput for 1500 bbl tank.

Tank Dimensions

Shell Height (ft):		16.00
Diameter (ft):		26.00
Liquid Height (ft) :		13.00
Avg. Liquid Height (ft):		9.00
Volume (gallons):		51,631.31
Turnovers:		5,899.96
Net Throughput(gal/yr):		304,622,430.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good
Roof Color/Shade:	Gray/Medium
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		1.50
Slope (ft/ft) (Cone Roof)		0.12

Breather Vent Settings

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

Meterological Data used in Emissions Calculations: Billings, Montana (Avg Atmospheric Pressure = 12.92 psia)

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

GB A Proposed Water Rate 1500 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Crude oil (RVP 5)	All	55.79	45.49	66.10	50.11	2.6479	2.1465	3.2396	50.0000			207.00	Option 4: RVP=5

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

GB A Proposed Water Rate 1500 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	3,060.1513
Vapor Space Volume (cu ft):	3,981.9687
Vapor Density (lb/cu ft):	0.0239
Vapor Space Expansion Factor:	0.1806
Vented Vapor Saturation Factor:	0.4872
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	3,981.9687
Tank Diameter (ft):	26.0000
Vapor Space Outage (ft):	7.5000
Tank Shell Height (ft):	16.0000
Average Liquid Height (ft):	9.0000
Roof Outage (ft):	0.5000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.5000
Roof Height (ft):	1.5000
Roof Slope (ft/ft):	0.1200
Shell Radius (ft):	13.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0239
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Daily Avg. Liquid Surface Temp. (deg. R):	515.4649
Daily Average Ambient Temp. (deg. F):	47.0333
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	509.7833
Tank Paint Solar Absorptance (Shell):	0.6800
Tank Paint Solar Absorptance (Roof):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,309.9021
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1806
Daily Vapor Temperature Range (deg. R):	41.2245
Daily Vapor Pressure Range (psia):	1.0931
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	2.1465
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	3.2396
Daily Avg. Liquid Surface Temp. (deg R):	515.4649
Daily Min. Liquid Surface Temp. (deg R):	505.1588
Daily Max. Liquid Surface Temp. (deg R):	525.7711
Daily Ambient Temp. Range (deg. R):	22.6167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.4872
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	2.6479

Vapor Space Outage (ft):	7.5000
Working Losses (lb):	123,692.3839
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Annual Net Throughput (gal/yr.):	304,622,430.0000
Annual Turnovers:	5,899.9557
Turnover Factor:	0.1718
Maximum Liquid Volume (gal):	51,631.3078
Maximum Liquid Height (ft):	13.0000
Tank Diameter (ft):	26.0000
Working Loss Product Factor:	0.7500
Total Losses (lb):	126,752.5352

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

Emissions Report for: Annual

GB A Proposed Water Rate 1500 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude oil (RVP 5)	123,692.38	3,060.15	126,752.54

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

Identification

User Identification:	GB A Current Water Rate 1500 bbl Tank
City:	Cody
State:	Wyoming
Company:	Marathon Oil Corporation
Type of Tank:	Vertical Fixed Roof Tank
Description:	Tanks 4.09d run for 2703 bwpd (current) throughput.

Tank Dimensions

Shell Height (ft):		16.00
Diameter (ft):		26.00
Liquid Height (ft) :		13.00
Avg. Liquid Height (ft):		9.00
Volume (gallons):		51,631.31
Turnovers:		802.56
Net Throughput(gal/yr):		41,436,990.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Medium
Shell Condition	Good
Roof Color/Shade:	Gray/Medium
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		1.50
Slope (ft/ft) (Cone Roof)		0.12

Breather Vent Settings

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

Meterological Data used in Emissions Calculations: Billings, Montana (Avg Atmospheric Pressure = 12.92 psia)

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

GB A Current Water Rate 1500 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Crude oil (RVP 5)	All	55.79	45.49	66.10	50.11	2.6479	2.1465	3.2396	50.0000			207.00	Option 4: RVP=5

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

GB A Current Water Rate 1500 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

Annual Emission Calcaulations	
Standing Losses (lb):	3,060.1513
Vapor Space Volume (cu ft):	3,981.9687
Vapor Density (lb/cu ft):	0.0239
Vapor Space Expansion Factor:	0.1806
Vented Vapor Saturation Factor:	0.4872
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	3,981.9687
Tank Diameter (ft):	26.0000
Vapor Space Outage (ft):	7.5000
Tank Shell Height (ft):	16.0000
Average Liquid Height (ft):	9.0000
Roof Outage (ft):	0.5000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.5000
Roof Height (ft):	1.5000
Roof Slope (ft/ft):	0.1200
Shell Radius (ft):	13.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0239
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Daily Avg. Liquid Surface Temp. (deg. R):	515.4649
Daily Average Ambient Temp. (deg. F):	47.0333
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	509.7833
Tank Paint Solar Absorptance (Shell):	0.6800
Tank Paint Solar Absorptance (Roof):	0.6800
Daily Total Solar Insulation Factor (Btu/sqft day):	1,309.9021
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.1806
Daily Vapor Temperature Range (deg. R):	41.2245
Daily Vapor Pressure Range (psia):	1.0931
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	2.1465
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	3.2396
Daily Avg. Liquid Surface Temp. (deg R):	515.4649
Daily Min. Liquid Surface Temp. (deg R):	505.1588
Daily Max. Liquid Surface Temp. (deg R):	525.7711
Daily Ambient Temp. Range (deg. R):	22.6167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.4872
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	2.6479

Vapor Space Outage (ft):	7.5000
Working Losses (lb):	19,989.3943
Vapor Molecular Weight (lb/lb-mole):	50.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	2.6479
Annual Net Throughput (gal/yr.):	41,436,990.0000
Annual Turnovers:	802.5555
Turnover Factor:	0.2040
Maximum Liquid Volume (gal):	51,631.3078
Maximum Liquid Height (ft):	13.0000
Tank Diameter (ft):	26.0000
Working Loss Product Factor:	0.7500
Total Losses (lb):	23,049.5455

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

Emissions Report for: Annual

GB A Current Water Rate 1500 bbl Tank - Vertical Fixed Roof Tank
Cody, Wyoming

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Crude oil (RVP 5)	19,989.39	3,060.15	23,049.55