DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
Permit Application Analysis
A0001424

September 18, 2015

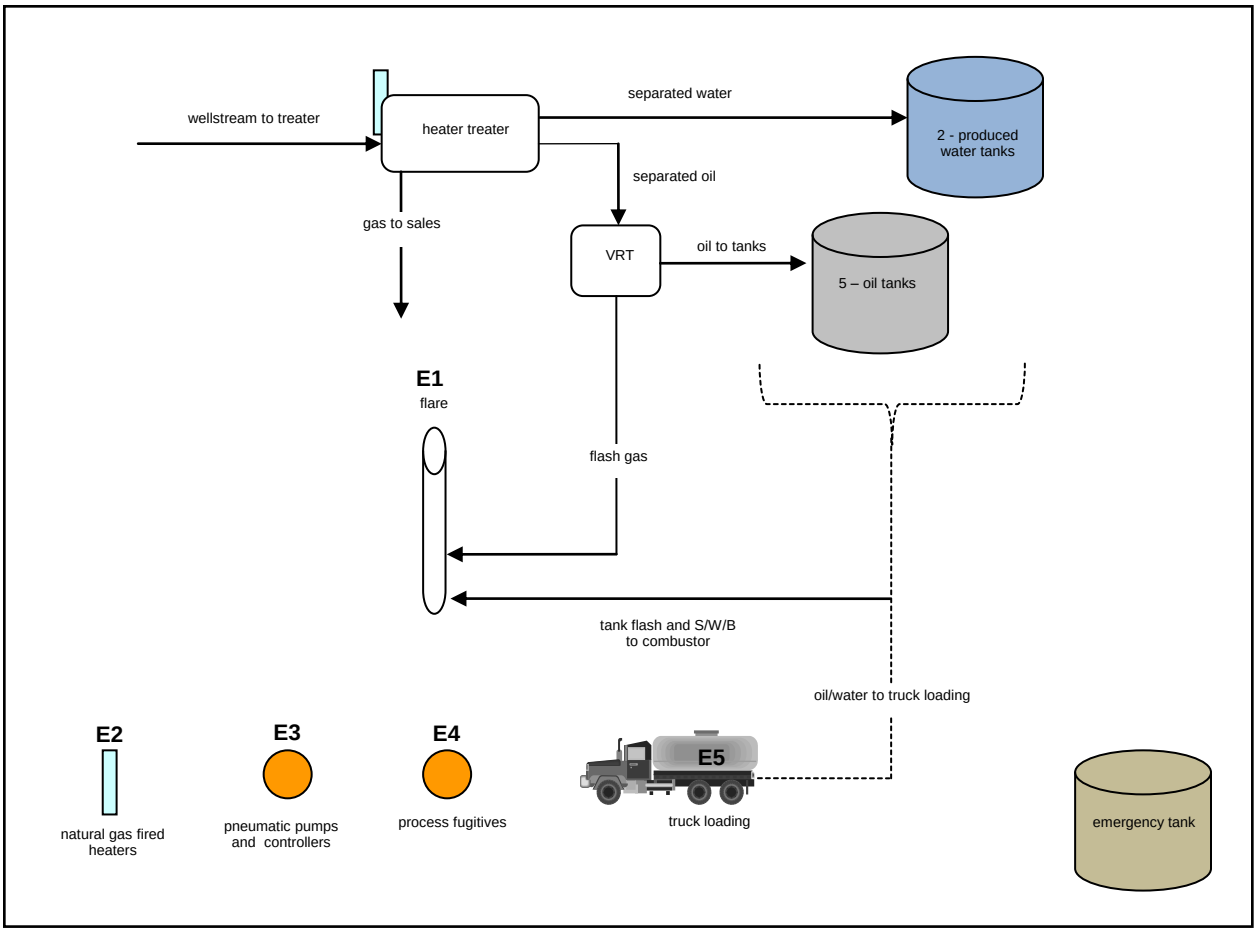
NAME OF FIRM:	EOG Resources, Inc.
MAILING ADDRESS:	600 17th Street, Suite 1000N Denver, CO 80202
RESPONSIBLE OFFICIAL:	Curtis Rice Senior Environmental Specialist
TELEPHONE NUMBER:	(303) 262-9946
TYPE OF OPERATION:	single well, sweet crude oil and natural gas production facility
FACILITY NAME:	**Flatbow 200-25H**
FACILITY LOCATION:	SE¼ SE¼ Section 25, T42N, R73W Latitude: 43.57711° Longitude: -105.56607° Campbell County, Wyoming
DATE FACILITY BECAME OPERATIONAL:	5/15/2015
REVIEWER:	Christopher Sorensen, Air Quality Engineer

PURPOSE OF APPLICATION: EOG Resources filed this application to construct a new sweet crude oil and natural gas production facility, known as the Flatbow 200-25H.

The following equipment operates at the Flatbow 200-25H:

- one (1) heater treater w/ 0.375 million Btu per hour (MMBtu/hr) heater
- one (1) 0.50 MMBtu/hr trace line heater
- five (5) 400-barrel (bbl) oil tanks
- two (2) 400-bbl produced water tanks
- one (1) 400-bbl emergency tank
- two (2) 500-gallon propane tanks
- one (1) vapor recovery tower (VRT)
- two (2) pneumatic pumps (tank vent scrubber and VRT scrubber)
- two (2) electrically-driven pumps (recycle and trace)
- various no-bleed pneumatic controllers
- various scrubbers (sales gas, fuel gas, VRT vent line and tank vent line combustor)
- one (1) common smokeless tri-tip flare w/ continuous pilot monitoring system (oil tank, active produced water tank, VRT and pneumatic pump control) – (produced gas control during upset conditions)

PROCESS DESCRIPTION: The following is a schematic representation of the production process at this facility. A complete process description is found in the permit application.



ESTIMATED EMISSIONS: (summarized in the attached tables)

oil storage tanks:

tank flash and S/W/B vapors:

Uncontrolled volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions are estimated using Promax process simulation software based on the extended hydrocarbon composition of oil from the heater treater and the daily oil production rate reported by the applicant.

Controlled VOC and HAP emissions (**Emission Source E1, Process Flow Diagram**) are based on the reported 98% destruction efficiency of the common flare. Nitrogen oxide (NO_X) and carbon monoxide (CO) emissions are based on 0.14 lb NO_X/MMBtu and 0.035 lb CO/MMBtu and the calculated volume of incinerated vapors.

vapor recover tower flash gas:

Uncontrolled VOC and HAP emissions are estimated using Promax process simulation software based on the extended hydrocarbon composition of oil from the heater treater and the daily oil production rate reported by the applicant.

Controlled VOC and HAP emissions (**Emission Source E1, Process Flow Diagram**) are based on the reported 98% destruction efficiency of the common flare. Nitrogen oxide (NO_X) and carbon monoxide (CO) emissions are based on 0.14 lb NO_X/MMBtu and 0.035 lb CO/MMBtu and the calculated volume of incinerated vapors.

active produced water tanks: (**Emission Source E1, Process Flow Diagram**)

The Division is currently not requiring emission calculations for active produced water tanks. Vapors from the active produced water tanks are routed to the common flare for 98% control.

natural gas fired heaters: **(Emission Source E2, Process Flow Diagram)**

NO_x and CO emissions are based on AP-42 EF for fuel boilers and heaters.

pneumatic pumps and controllers: (**Emission Source E3, Process Diagram**)

Uncontrolled VOC and HAP emissions are based on pump gas usage/vent rates, the hydrocarbon composition of the motive gas and hours of operation.

Controlled pneumatic pump emissions are based on the reported 98% destruction efficiency of the common flare.

Pneumatic controllers are no-bleed; therefore, emissions are considered insignificant.

fugitive sources: (**Emission Source E4, Process Flow Diagram**)

VOC and HAP emissions are based on EPA and API EF and the number of fugitive sources at the well site.

truck loading: (**Emission Source E5, Process Flow Diagram**)

VOC and HAP emissions are based on AP-42 EF and the reported oil production rate.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT): The following table summarizes Presumptive BACT notice and control installation requirements under the 2013 Chapter 6, Section 2 Oil and Gas Production Facilities Permitting Guidance (C6 S2 Guidance).

Application, Emissions Controls, Monitoring	Date Due	Date Filed/Installed
Application	8/13/2015 (within 90-days of startup)	8/10/2015
Tank Emission Control	7/14/2015 (within 60-days of startup)	5/15/2015
Pneumatic Pump Control	7/14/2015 (within 60-days of startup)	5/15/2015
Continuous Monitoring	7/14/2015 (within 60-days of startup)	5/15/2015
No-Bleed / Low-Bleed Controllers	5/15/2015 (upon startup)	5/15/2015

The emission control, reporting and monitoring requirements under the 2013 C6 S2 Guidance have been met.

Since this facility is potentially a major source of VOCs, conditions requiring one (1) quarterly inspection per year be done with an optical gas imaging instrument have been incorporated into this proposed permit.

NEW SOURCE PERFORMANCE STANDARDS (NSPS): The oil storage tanks are operated prior to custody transfer and are not subject to Subpart K, K_a or K_b.

40 CFR part 60, subpart OOOO - *Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution* applies to any new, modified or reconstructed emission source installed after August 23, 2011 at oil and gas production and gas processing facilities. The Flatbow 200-25H facility is subject to 40 CFR part 60, subpart OOOO as the facility was constructed after the effective date.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD): Emissions from this facility are less than the major source levels defined in WAQSR Chapter 6, Section 4.

CHAPTER 6, SECTION 3 (Operating Permit): Under the federally enforceable conditions of this permit, emissions from this facility are less than the major source levels defined in WAQSR Chapter 6, Section 3.

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (MACT): Emissions from this facility are less than the major source levels of 10 TPY of any individual HAP and 25 TPY of any combination of HAPs; therefore this facility is not subject to 40 CFR part 63, subpart HH requirements for oil and gas production facilities which are major sources of HAP emissions.

PROPOSED PERMIT CONDITIONS: The Division proposes to issue an Air Quality Permit to EOG Resources, Inc. for the Flatbow 200-25H with the following conditions:

1. Authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being installed for the purpose of investigating actual or potential sources of air pollution and for determining compliance or non-compliance with any rule, regulation, standard, permit or order.

2. All substantive commitments and descriptions set forth in the application for this permit, unless superseded by a specific condition of this permit, are incorporated herein by this reference and are enforceable as a condition of this permit.

3. A permit to operate in accordance with Chapter 6, Section 2(a)(iii) of the WAQSR is required after a 120-day startup period in order to operate this facility.

4. All notifications, reports and correspondence required by this permit shall be submitted to the Stationary Source Compliance Program Manager, Air Quality Division, 122 West 25th Street, Cheyenne, WY 82002 and a copy shall be submitted to the District Engineer, Air Quality Division, 2100 West 5th Street, Sheridan, WY 82801. Submissions may also be done electronically through https://airimpact.wyo.gov to satisfy requirements of this permit.

5. All records required under this permit shall be kept for a period of at least five (5) years and shall be made available to the Division upon request.

6. Periodic training on the proper operation of equipment, systems and devices used to contain, control, eliminate or reduce pollution shall be provided to company personnel whose primary job is to regularly ensure that facility production equipment is functional. The training shall provide these personnel with the ability to recognize, correct and report all instances of malfunctioning equipment, systems and devices associated with air pollution control. These equipment, systems and devices include, but are not limited to combustion units, reboiler overheads condensers, hydrocarbons liquids storage tanks, drip tanks, vent lines, connectors, fittings, valves, relief valves, hatches and any other appurtenance employed to, or involved with, eliminating, reducing, containing or collecting vapors and transporting them to a pollution control system or device.

7. Trained personnel shall perform, at a minimum, a quarterly site evaluation of the operation of the air pollution control equipment, systems and devices under Condition 6. The first quarterly site evaluation shall be conducted within the second quarter after issuance of this permit.

8. At least one of the quarterly evaluations per calendar year under Condition 7 shall include an evaluation of the facility for leaks from the equipment, systems and devices under Condition 6 using an optical gas imaging instrument. Monitoring utilizing the no detectable emissions test methods and procedures in 40 CFR §60.5416(b)(1) through (8) may be utilized to satisfy the requirements of this condition for the equipment, systems, and devices under Condition 6 in lieu of using an optical gas imaging instrument.

9. Notification shall be provided to the Division at least fifteen (15) days prior to each quarterly evaluation under Condition 7.

10. An annual preventative maintenance program shall be instituted to inspect and replace equipment, systems and devices under Condition 6 as necessary to ensure their proper operation.

11. Results of all inspections, evaluations and periodic monitoring shall be documented and maintained for review by the Division upon request. Digital files of any optical gas imaging instrument evaluations need not be maintained.

12. Vapors from all oil tanks and all active produced water tanks, including tank flash and S/W/B vapors, shall be routed to the common flare to reduce the mass content of VOCs and HAPs in the tank vapors vented to the device by at least ninety-eight percent (98%) by weight.

13. Flash gas from the vapor recovery tower shall be routed to the common flare to reduce the mass content of total VOCs and HAPs in the vapors routed to the device by at least ninety-eight percent (98%) by weight.

14. The motive gas discharge line on each pneumatic pump shall be routed into a fuel gas supply line or any gas or liquid collection line which is ultimately routed into a closed system or emission control system or each pump shall be replaced with an electric, solar or air-operated pump or other device in order to reduce VOC emissions associated with the pump discharge gas stream by at least ninety-eight percent (98%) by weight.

15. All natural gas-operated pneumatic process controllers (temperature control, pressure control, level control, flow control, etc.) shall be low or no-bleed controllers, with low bleed defined as less than six (6) cubic feet per hour vent or bleed rate, or the controller discharge streams shall be routed into a closed loop system so there are no volatile organic compound or hazardous air pollutants emitted to the atmosphere.

16. The presence of the common flare pilot flame shall be monitored using a thermocouple and continuous recording device or any other equivalent device to detect and record the presence of the flame. Records shall be maintained noting periods during active well site operation when the pilot flame is not present. The records shall contain a description of the reason(s) for absence of the pilot flame and steps taken to return the pilot flame to proper operation.

17. Emission control equipment, including the VOC and HAP emission control systems or devices, reboiler overheads condensers and all vent lines, connections, fittings, valves, relief valves, hatches or any other appurtenance employed to contain and collect vapors and transport them to the emission control system or device, shall be maintained and operated during any time the well is producing such that the emissions are controlled at all times. Records shall be maintained noting dates and durations of times during such operation when any VOC or HAP emissions control system or device or the associated containment and collection equipment is not functioning to control emissions as required by this permit.

18. The common flare shall be designed, constructed, operated and maintained to be smokeless, per Chapter 3, Section 6(b)(i) of the WAQSR, with no visible emissions except for periods not to exceed a total of five (5) minutes during any two (2) consecutive hours as determined by 40 CFR part 60, appendix A, Method 22.

19. EOG Resources shall comply with all applicable requirements of 40 CFR part 60, subpart OOOO.

Conditions applicable to blowdown/venting operations at the Flatbow 200-25H:

20. All notifications, reports, and correspondence required by this permit shall be submitted to the O&G permitting engineer, 152 North Durbin Street, Suite 100 Casper, WY 82601 and a copy shall be submitted to the District Engineer, Air Quality Division, 2100 West 5th Street, Sheridan, WY 82801. Submissions may also be done electronically through https://airimpact.wyo.gov to satisfy requirements of this permit.

21. Emissions of volatile organic compounds (VOC) and hazardous air pollutants (HAP) resulting from episodes of manual and automatic blowdown and venting of hydrocarbon fluids (liquids and gas) associated with liquids unloading, well purging, wellbore depressurization, hydrate clearing, emergency operations, equipment depressurization, etc., shall be minimized to the extent practicable.

22. During manual blowdown and venting episodes, personnel shall remain on site for the duration of the episode to ensure minimal gas venting occurs by ending the episode as soon as possible once the intended purpose for the episode has been accomplished. The requirement for the personnel to remain on site does not apply to automated blowdown and venting episodes and does not apply to any episode where remaining on site might be considered a safety hazard.

23. For all manual and automatic blowdown and venting episodes the following shall be recorded.

    A. Facility name and legal location (Section, Township, Range, County) and associated Air Quality Permit number;
    B. Date, duration, start and end time;
    C. Reason for episode, i.e. unload well by venting well tubing to blowdown tank, relieve annulus pressure, depressurize well for downhole repair, etc.;
    D. Measure(s) taken to ensure emissions were minimized to the extent practical;
    E. Name of person(s) remaining on site for the duration of manual blowdown and venting episode;
    F. Summary of total volumes of hydrocarbon fluids (barrels of oil, condensate, and water and MCF of gas) recovered and vented;
    G. Estimated pounds of VOC and HAP emissions associated with the vapors vented to the atmosphere.

24. VOC and HAP emission estimates required under Condition 23(G) shall be determined using the spreadsheets illustrated in Appendix A. The spreadsheets are available for download from the DEQ/AQD website or may be obtained upon request. An emission estimation method other than that provided by the Division may be used upon approval.

25. Within nine (9) months after the date of issuance of this permit, a summary of the information recorded under Condition 23 shall be submitted to the Division. The data required under Condition 23 shall be collected for six (6) months after the date of permit issuance and shall include all gas analyses used as sources for the input information in the spreadsheets required under Condition 24.

26. The Division will reopen and revise this permit, as necessary, to add or delete requirements should the Division determine that:

    A. The practical application of the terms and conditions of the permit are unfeasible or fail to achieve the intent of the permit, or;

    B. The monitoring, recordkeeping, notification or reporting requirements are inadequate to assure compliance with applicable requirements.

EQUIPMENT LIST

- one (1) heater treater w/ 0.375 million Btu per hour (MMBtu/hr) heater
- one (1) 0.50 MMBtu/hr trace line heater
- five (5) 400-barrel (bbl) oil tanks
- two (2) 400-bbl produced water tanks
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- two (2) electrically-driven pumps (recycle and trace)
- various no-bleed pneumatic controllers
- various scrubbers (sales gas, fuel gas, VRT vent line and tank vent line combustor)
- one (1) common smokeless tri-tip flare w/ continuous pilot monitoring system (oil tank, active produced water tank, VRT and pneumatic pump control) – (produced gas control during upset conditions)

EMISSIONS SUMMARY

Flatbow 200-25H 386 BPD total oil [1]				
SOURCE	EMISSIONS (TPY) [2]			
	VOC	HAP	NO_X	CO
Oil Tanks				
UNCONTROLLED	48.4	1.2		
CONTROLLED	1.0	insig	0.2	insig
Vapor Recovery Tower				
UNCONTROLLED	38.9	0.9		
CONTROLLED	0.8	insig	0.2	insig
Pneumatic Pumps				
UNCONTROLLED	66.2	1.5		
CONTROLLED	1.3	insig	0.4	0.1
Process Heaters	insig	insig	0.6	0.5
Pneumatic Controllers	insig	insig		
Truck Loading	3.4	0.1		
Fugitives	5.4	0.1		
Total Uncontrolled Facility Emissions	**162.3**	**3.8**	**0.6**	**0.5**
Total Controlled Facility Emissions	**11.9**	**0.2**	**1.4**	**0.6**

[1] daily rates reported by the applicant
[2] rounded to the nearest 0.1 ton

Appendix A

Blowdown/Venting Spreadsheet

Spreadsheet for calculating emissions associated with gas vented from ANNULUS when there is an associated pressure drawdown ($P_1 > P_2$).

	INPUT		CALCULATED		
Gas HAP Content (**wt%**)	6				
Gas VOC Content (**wt%**)	15				
Gas Compressibility (**Z**)*	0.98				
Gas Molecular Weight	17.74	lb/lbmol			
Universal Gas Constant (**R**)	10.732	ft^3 psi/°R lb-mol			
Starting Pressure (P_1)	1500	psig	1512	psia	
Ending Pressure (P_2)	0	psig	12	psia	
Starting Temperature (T_1)	55	°F	515	°R	
Ending Temperature (T_2)	55	°F	515	°R	
Tubing Outside Diameter (**OD**)	2.875	in	Starting Gas Density (ρ_1) 4.9521	lb/ft³	$\rho_1=(P_1*MW)/R*T_1*Z$
Casing Inside Diameter (**ID**)	3.92	in	Ending Gas Density (ρ_2) 0.0393	lb/ft³	$\rho_2=(P_2*MW)/R*T_2*Z$
Annulus Length (**AL**)	500	ft	4.9128	lb/ft³	$\rho_1 - \rho_2$
			0.0387	ft^3/ft	Annular Volume per Linear Foot **(AV)**

Gas Release	**95**	**lb**	Pounds of Gas per Linear Foot = (ρ_1 - ρ_2) * (**AL**) * (**AV**)
Gas Release	**2,032**	**SCF**	Conversion to SCF = (Gas Release (lb)) * (379 SCF/lb-mol) / (molecular wt of gas (lb/lb-mol))
VOC Release	**14**	**lb**	VOC release = (Gas Release (lb)) * (Gas VOC Content / 100)
HAP Release	**6**	**lb**	HAP release = (Gas Release (lb)) * (Gas HAP Content / 100)

Tubing Sizes			Casing Sizes		
nom.	OD inches	ID inches	nom.	OD inches	ID inches
2 3/8	2.375	1.94	4 1/2	4.5	3.92
2 7/8	2.875	2.26	4 3/4	4.75	4.2
3 1/2	3.5	2.76	5	5	4.41
			5 1/2	5.5	4.82

* For the purposes of this spreadsheet, assume the starting Z factor = the ending Z factor.

Spreadsheet for calculating emissions associated with gas vented from tubing or casing when there is an associated pressure drawdown ($P_1 > P_2$)

	INPUT		CALCULATED		
Gas VOC Content (wt%)	50				
Gas HAP Content (wt%)	6				
Gas Compressibility (**Z**)*	0.95				
Gas Molecular Weight	17.74	lb/lbmol			
Universal Gas Constant (**R**)	10.732	ft^3 psi/°R lb-mol			
Starting Pressure (P_1)	600	psig	612	psia	
Starting Temperature (T_1)	600	°F	1060	°R	
Ending Pressure (P_2)	200	psig	212	psia	
Ending Temperature (T_2)	55	°F	515	°R	
Tubing or Casing Inside Diameter (**ID**)	1.875	in	Starting Gas Density (ρ_1) 1.0046	lb/ft³	$\rho_1=(P_1*MW)/R*T_1*Z$
Tubing/Casing Length (**TL**)	15000	ft	Ending Gas Density (ρ_2) 0.7163	lb/ft³	$\rho_2=(P_2*MW)/R*T_2*Z$
			0.2883	lb/ft³	$\rho_1 - \rho_2$
			0.0192	ft^3/ft	Volume per Linear Foot **(TV)**
			Gas Release 83	**lb**	Release = (ρ_1 - ρ_2) * (**TL**) * (**TV**)
			Gas Release 1772	**SCF**	Conversion to SCF = (Gas Release (lb)) * (379 SCF/lb-mol) / (molecular wt of gas (lb/lb-mol))
			VOC Release 41	**lb**	VOC release = (Gas Release (lb)) * (Gas VOC Content / 100)
			HAP Release 5	**lb**	HAP release = (Gas Release (lb)) * (Gas HAP Content / 100)

Tubing Sizes			Casing Sizes		
nom.	OD inches	ID inches	nom.	OD inches	ID inches
2 3/8	2.375	1.94	4 1/2	4.5	3.92
2 7/8	2.875	2.26	4 3/4	4.75	4.2
3 1/2	3.5	2.76	5	5	4.41
			5 1/2	5.5	4.82

* For purposes of these calculations assume starting Z = ending Z.

Spreadsheet for calculating blowdown/venting emissions from tubing, casing or annulus when there is minimal or no pressure differential during the event ($P_1 = P_2$)

	INPUT	
Fill in the five parameters below.		
Average Daily Gas Production Rate	1	MSCFD
Vented Gas VOC Content	50	wt%
Vented Gas HAP Content	35	wt%
Vented Gas Molecular Weight	20	lb/lb-mol
Blowdown Duration	120	minutes

	CALCULATED	
Total Gas Emitted	0.083	MSCF
VOC Emissions	2.2	lbs
HAP Emissions	1.5	lbs