DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
Permit Application Analysis
A0001204

September 2, 2015

NAME OF FIRM:	Ballard Petroleum Holdings, LLC
MAILING ADDRESS:	845 12th Street West Billings, MT 59102
RESPONSIBLE OFFICIAL:	Benjamin J. Davis Regulatory & Operations Technician
TELEPHONE NUMBER:	(406) 281-8230
TYPE OF OPERATION:	multiple well, sweet crude oil and natural gas production facility
FACILITY NAME:	**Reno 11-10 TH, 11-10 PH & 42-9 TH PAD**
FACILITY LOCATION:	SW¼ NW¼ of Section 10, T42N, R73W Latitude: 43.62969° Longitude: -105.62393° Campbell County, Wyoming
DATE FACILITY BECAME OPERATIONAL:	3/29/2015
REVIEWER:	Heather Bleile, Air Quality Engineer

PURPOSE OF APPLICATION: Ballard Petroleum Holdings, LLC filed this application to construct the Reno 11-10 TH, 11-10 PH & 42-9 TH PAD sweet crude oil and natural gas production facility.

Production and equipment for the three wells are co-located and/or shared and all associated air emissions are aggregated for permitting determinations.

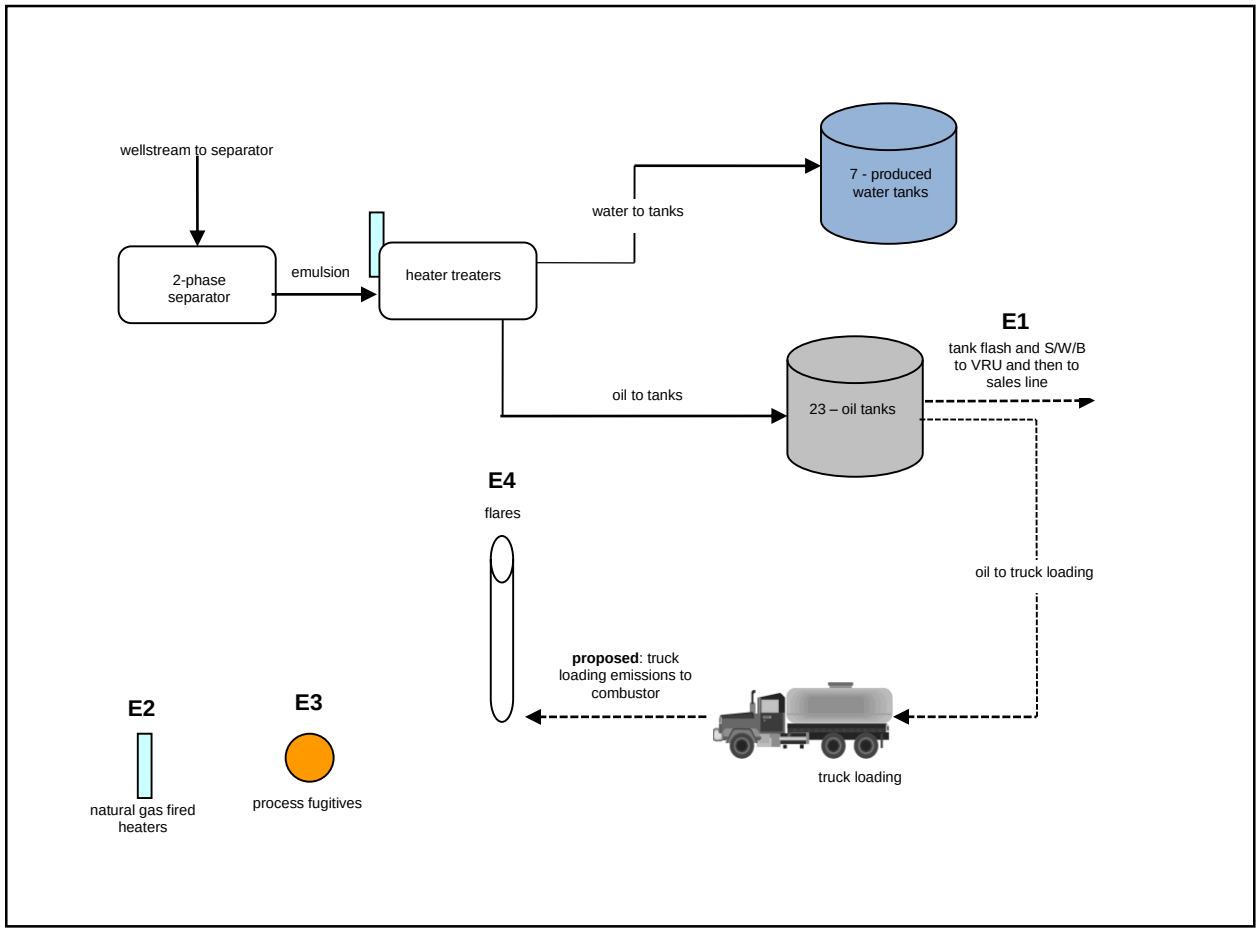
The following equipment operates at the Reno 11-10 TH, 11-10 PH & 42-9 TH PAD:

- three (3) heater treaters w/ 0.5 million Btu per hour (MMBtu/hr) heaters
- one (1) two-phase unheated separator
- two (2) free water knockouts w/ 0.5 MMBtu/hr heaters
- one (1) unheated free water knockout
- twenty-three (23) 400-barrel (bbl) oil tanks
- seven (7) 400-bbl produced water tanks
- three (3) electrically-driven recycle pumps
- three (3) electrically-driven vapor recovery units (primary oil tank control)
- **proposed:** Truck Loadout Vapor Balancing (TLVB) system
- one (1) common smokeless flare w/ continuous pilot monitoring system (back-up oil and **proposed** truck loading control for the Reno 11-10 TH & 11-10 PH wells)

Equipment list continued:

- one (1) emergency flare (produced gas control during upset conditions for the Reno 11-10 TH & 11-10 PH wells)
- one (1) common smokeless dual-tip flare w/ continuous pilot monitoring system (back-up oil tank and **proposed** truck loading control - produced gas control during upset conditions for the Reno 42-9 TH well)

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 E&P Tanks V2.0 software based on the average extended hydrocarbon composition of oil from area wells and the daily oil production rate reported by the applicant.

Tank emissions (**Emission Source E1, Process Flow Diagram**) are captured by the vapor recovery units and routed to a sales pipeline. Controlled VOC and HAP emissions are based on a 98% capture rate.

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.

fugitive sources: (**Emission Source E3, 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:

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

Controlled VOC and HAP emissions (**Emission Source E4, Process Flow Diagram**) associated with truck loading are based on the reported 98% destruction efficiency of the common flares for the vapors recovered (approximately 70%).

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	6/29/2015 (within 90-days of startup)	6/29/2015
Tank Emission Control	5/29/2015 (within 60-days of startup)	3/29/2015
Continuous Monitoring	5/29/2015 (within 60-days of startup)	3/29/2015

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

VOC emissions associated with truck loading are estimated to be 16.2 TPY. The 2013 C6 S2 Guidance requires a BACT analysis for emission sources with greater than 8 TPY VOC. Ballard submitted a BACT analysis stating that submerged fill or bottom loading meets BACT requirements for truck loading emissions. Submerged fill/bottom loading is not considered a method for controlling truck loading emissions rather it is a method for filling the tanker truck. Therefore, the Division does not accept this as BACT.

There are similar facilities operating in Campbell County using a Truck Loadout Vapor Balancing (TLVB) system to capture truck loading vapors and the vapors are routed to smokeless combustion devices. The Division has found this method of control to be both economically reasonable and technically feasible. Therefore, the Division has incorporated conditions into this permit requiring Ballard to install a TLVB system that is assumed, based on AP-42 Section 5.2, to capture 70% of the truck loading vapors. The captured vapors shall be routed to the smokeless combustion device with a reported destruction efficiency of 98% which reduces emissions to 4.8 TPY VOC. The TLVB shall be installed and operational within sixty (60) days of permit issuance.

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 Reno 11-10 TH, 11-10 PH & 42-9 TH PAD is subject to 40 CFR part 60, subpart OOOO as the facility was constructed after the effective date.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD): 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 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 Ballard Petroleum Holdings, LLC for the Reno 11-10 TH, 11-10 PH & 42-9 TH PAD 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 start-up 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, including tank flash and S/W/B vapors, shall be captured by the vapor recovery units and routed to a sales pipeline to reduce the mass content of VOCs and HAPs in the tank vapors by at least ninety-eight percent (98%) by weight. During times when the vapor recovery units are not operational, vapors from all oil tanks, including tank flash and S/W/B vapors, shall be routed to the common smokeless flares to reduce the mass content of VOCs and HAPs in the tank vapors by at least ninety-eight percent (98%) by weight.

13. Vapors from all truck loading operations shall be routed to the common flares using Truck Loadout Vapor Balancing to reduce the mass content of total HAP and VOC emissions in the captured vapors by at least ninety-eight percent (98%) by weight.

14. The Truck Loadout Vapor Balancing system under Condition 13 shall be installed and operational within sixty (60) days of permit issuance. Ballard Petroleum Holdings, LLC shall notify the Division of the installation of the Truck Loadout Vapor Balancing system within fifteen (15) days of installation.

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

16. The common flares 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.

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. Ballard Petroleum Holdings, LLC shall comply with all applicable requirements of 40 CFR part 60, subpart OOOO.

19. The emergency flare shall be designed, constructed, operated and maintained to meet the requirements of Chapter 3, Section 6 of the WAQSR.

Conditions applicable to blowdown/venting operations at the Reno 11-10 TH, 11-10 PH & 42-9 TH PAD:

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

- three (3) heater treaters w/ 0.5 MMBtu/hr heaters
- one (1) two-phase unheated separator
- two (2) free water knockouts w/ 0.5 MMBtu/hr heaters
- one (1) unheated free water knockout
- twenty-three (23) 400-bbl oil tanks
- seven (7) 400-bbl produced water tanks
- three (3) electrically-driven recycle pumps
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- **proposed:** Truck Loadout Vapor Balancing (TLVB) system
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- one (1) emergency flare (produced gas control during upset conditions for the Reno 11-10 TH & 11-10 PH wells)
- one (1) common smokeless dual-tip flare w/ continuous pilot monitoring system (back-up oil tank and **proposed** truck loading control - produced gas control during upset conditions for the Reno 42-9 TH well)

EMISSIONS SUMMARY

Reno 11-10 TH, 11-10 PH & 42-9 TH PAD 1250 BPD total oil [1]				
SOURCE	EMISSIONS (TPY) [2]			
	VOC	HAP	NO_X	CO
Oil Tanks				
UNCONTROLLED	321.8	5.0		
CONTROLLED	6.4	0.1	insig	insig
Truck Loading				
UNCONTROLLED	16.2	0.2		
CONTROLLED	4.8	0.1	0.1	insig
Process Heaters	insig	insig	1.5	1.3
Fugitives	5.3	0.1		
Total Uncontrolled Facility Emissions	**343.3**	**5.3**	**1.5**	**1.3**
Total Controlled Facility Emissions	**16.5**	**0.3**	**1.6**	**1.3**

[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 <u>there is an associated pressure drawdown ($P_1 > P_2$)</u>

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