DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
Permit Application Analysis
A0001351

September 16, 2015

NAME OF FIRM:	RKI Exploration & Production, LLC
MAILING ADDRESS:	210 Park Avenue, Suite 900 Oklahoma City, OK 73102
RESPONSIBLE OFFICIAL:	Jeffrey L. Ingerson Senior Air Permitting Engineer
TELEPHONE NUMBER:	(405) 987-2181
TYPE OF OPERATION:	multiple well, sweet crude oil and natural gas production facility
FACILITY NAME:	**Split Hill Unit 27 PAD**
FACILITY LOCATION:	SW¼ SW¼ Section 27, T37N, R68W Latitude: 43.14725° Longitude: -105.01626° Converse County, Wyoming
DATE FACILITY BECAME OPERATIONAL:	4/28/2015
REVIEWER:	Heather Bleile, Air Quality Engineer

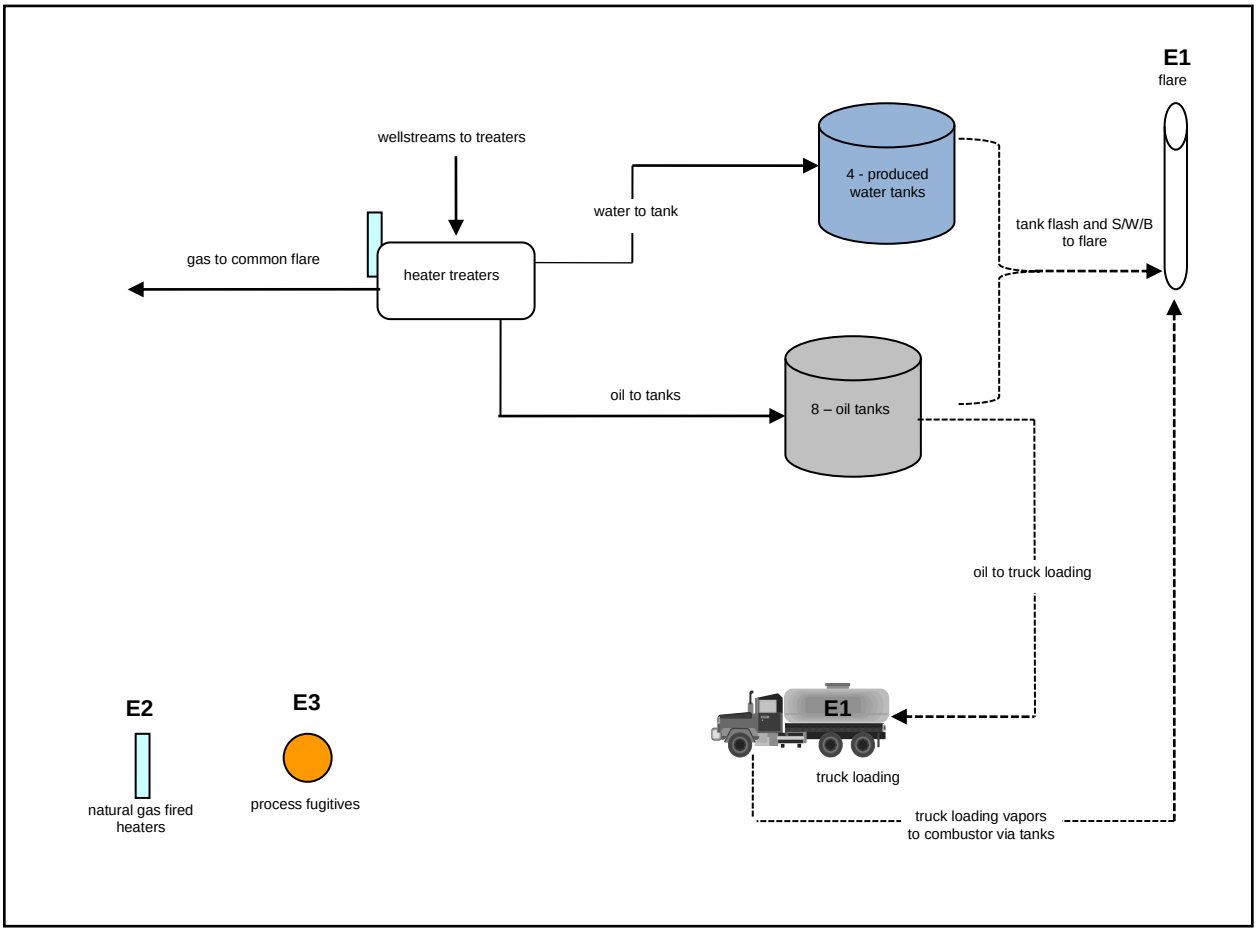
PURPOSE OF APPLICATION: RKI Exploration & Production filed this application to construct a new sweet crude oil and natural gas production facility, known as the Split Hill Unit 27 PAD, consisting of the Split Hill Unit 27 1TH and 3TH wells.

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

The following equipment operates at the Split Hill Unit 27 PAD:

- two (2) heater treaters w/ 0.5 million Btu per hour (MMBtu/hr) heaters
- two (2) two-phase unheated separators
- eight (8) 400-barrel (bbl) oil storage tanks
- four (4) 400-bbl produced water tanks
- two (2) low-bleed pneumatic controllers
- one (1) combination high pressure and low pressure smokeless combustion device w/ continuous pilot monitoring system (oil tank, active produced water tank, truck loading and produced gas control)

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:

flashing and standing/working/breathing (S/W/B) losses:

Uncontrolled volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions were estimated using the E&P Tank V2.0 software based on a composite extended hydrocarbon analysis of pressurized oil from the Teapot Formation and the daily oil production reported by the applicant.

Controlled VOC and HAP emissions (**Emission Source E1, Process Flow Diagram**) associated with flashing and S/W/B losses 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 volume of vapors calculated with the E&P Tanks software.

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.

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 E1, Process Flow Diagram**) associated with truck loading are based on the reported 98% destruction efficiency of the common flare for the vapors recovered (approximately 70%).

produced gas:

Uncontrolled VOC and HAP emissions associated with produced gas were calculated using a mass balance equation based on the metered volume of gas produced and an extended hydrocarbon analysis of the gas.

Controlled VOC and HAP emissions (**Emission Source E2, Process Flow Diagram**) associated with the produced gas 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 volume of produced gas.

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.

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	7/27/2015 (within 90-days of startup)	7/21/2015
Oil Tank Emission Control	6/27/2015 (within 60-days of startup)	4/28/2015
Water Tank Emission Control	not required	4/28/2015
Continuous Monitoring	6/27/2015 (within 60-days of startup)	4/28/2015
Low/No-Bleed Controllers	4/28/2015 (upon startup)	4/28/2015

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 2.1 TPY. RKI will utilize a vapor collection system for the truck loading operation that is assumed, based on AP-42 Section 5.2, to capture 70% of the truck loading vapors. The captured vapors are routed to a smokeless combustion device with a reported destruction efficiency of 98% which reduces emissions to 0.6 TPY VOC.

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 Split Hill Unit 27 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 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 RKI Exploration & Production, LLC for the Split Hill Unit 27 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 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, 152 North Durbin Street, Suite 100, Casper, WY 82601. 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, all active produced water tanks and all truck loading, 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 vapors vented to the device by at least ninety-eight percent (98%) by weight.

13. All produced gas from the wells, including gas evolved in the heater treaters and separators, which is not used as fuel for process burners and is not routed into a gas collection line or system, shall be routed to the common flare to reduce the mass content of VOCs and HAPs in the produced gas vented to the device by at least ninety-eight percent (98%) by weight.

14. 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.

15. 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.

16. 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.

17. Emission control equipment, including the VOC and HAP emission control system or device, 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. RKI Exploration & Production, LLC shall comply with all applicable requirements of 40 CFR part 60, subpart OOOO.

Conditions applicable to blowdown/venting operations at the Split Hill Unit 27 PAD:

19. 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, 152 North Durbin Street, Suite 100, Casper, WY 82601. Submissions may also be done electronically through https://airimpact.wyo.gov to satisfy requirements of this permit.

20. 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.

21. 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.

22. 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.

23. VOC and HAP emission estimates required under Condition 22(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.

24. Within nine (9) months after the date of issuance of this permit, a summary of the information recorded under Condition 22 shall be submitted to the Division. The data required under Condition 22 shall be collected for a minimum of 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 23.

25. 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

- two (2) heater treaters w/ 0.5 MMBtu/hr heaters
- two (2) two-phase unheated separators
- eight (8) 400-bbl oil storage tanks
- four (4) 400-bbl produced water tanks
- two (2) low-bleed pneumatic controllers
- one (1) combination high pressure and low pressure smokeless combustion device w/ continuous pilot monitoring system (oil tank, active produced water tank, truck loading and produced gas control)

EMISSIONS SUMMARY

Split Hill Unit 27 PAD 101.4 BPD total oil and 66 MCFD total gas [1]				
SOURCE	EMISSIONS (TPY) [2]			
	VOC	HAP	NO_X	CO
Oil Tanks (flashing and S/W/B)				
UNCONTROLLED	153.5	2.8		
CONTROLLED	3.1	0.1	0.5	0.1
Truck Loading				
UNCONTROLLED	2.1	0.2		
CONTROLLED	0.6	0.1	insig	insig
Produced Gas				
UNCONTROLLED	311.6	9.9		
CONTROLLED	6.2	0.2	2.3	0.6
Process Heaters	insig	insig	0.6	0.5
Fugitives	2.6	insig		
Pneumatic Controller	insig	insig		
Total Uncontrolled Facility Emissions	**469.8**	**12.9**	**0.6**	**0.5**
Total Controlled Facility Emissions	**12.5**	**0.4**	**3.4**	**1.2**

[1] daily oil production reported by 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