

**DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR QUALITY
Permit Application Analysis
A0001127**

August 20, 2015

NAME OF FIRM: Linn Operating Inc.

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Boulder, WY 82923

RESPONSIBLE OFFICIAL: Keith Raney
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TYPE OF OPERATION: multiple wells, gas/condensate central production facility

FACILITY NAME: **Stud Horse Butte 10E PAD**

FACILITY LOCATION: SW¼ NW¼ Section 10, T29N, R108W
Latitude: 42.49985° Longitude: 109.71101°
Sublette County, Wyoming

DATE FACILITY BECAME OPERATIONAL: 2/22/2015

REVIEWER: Heather Bleile, Air Quality Engineer

PURPOSE OF APPLICATION: Linn Operating Inc. filed this application to construct a new gas/condensate production facility, known as the Stud Horse Butte 10E PAD, consisting of the Stud Horse Butte 10 D5 and 10 E5 wells.

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

The following equipment operates at the Stud Horse Butte 10E PAD:

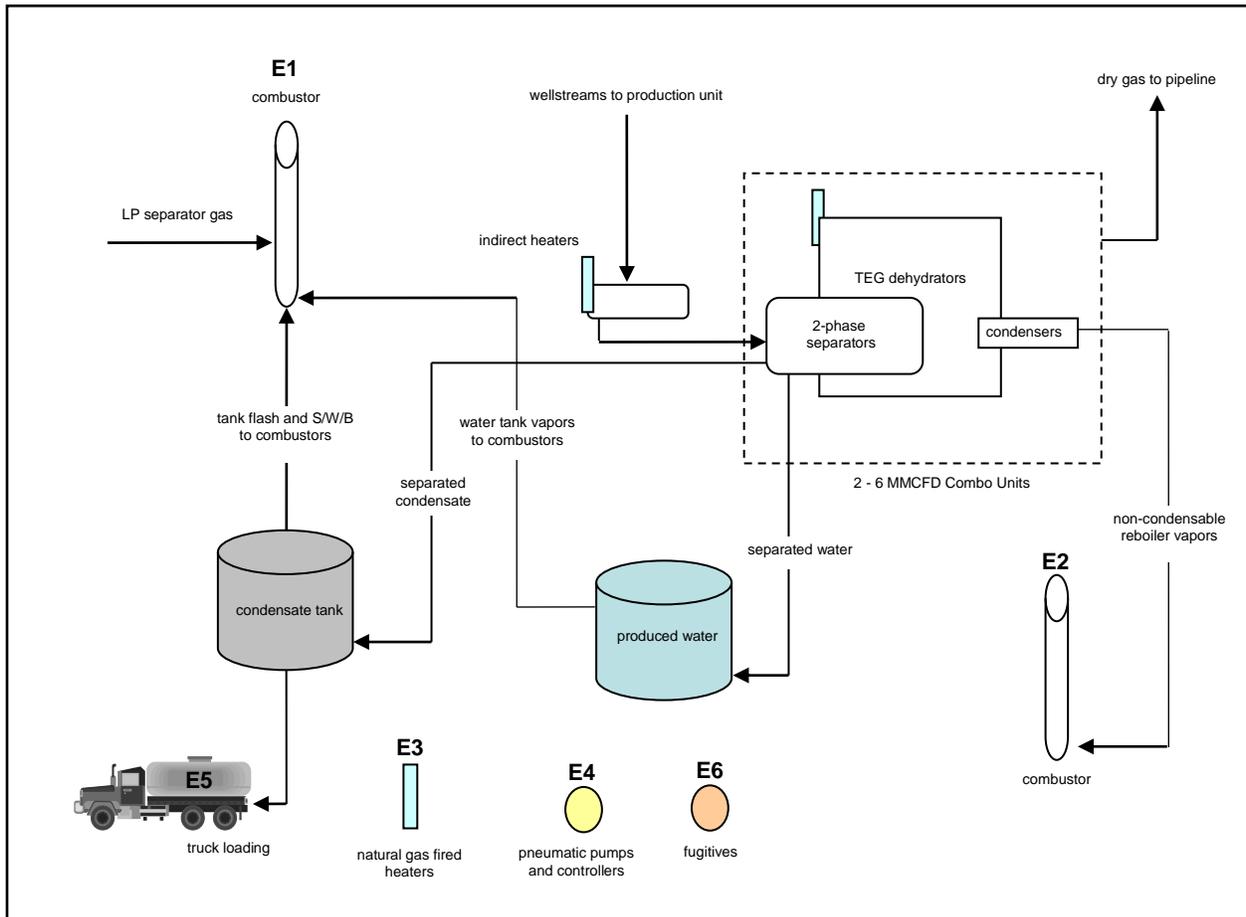
- two (2) three-phase low pressure (LP) separators
- two (2) two-phase high pressure (HP) separators
- two (2) 0.25 million Btu per hour (MMBtu/hr) ethylene glycol bath heaters
- two (2) 6.0 million cubic feet per day (MMCFD) triethylene glycol (TEG) dehydration units w/ Kimray Model 2015SC glycol pumps, 0.125 MMBtu/hr reboiler heaters and reboiler overheads condensers
- one (1) 400-barrel (bbl) condensate tank
- one (1) 400-bbl produced water tank
- four (4) pneumatic heat trace pumps
- six (6) low-bleed pneumatic liquid level controllers

Equipment list continued:

- one (1) common smokeless combustion device w/ continuous monitoring system (condensate tank, active produced water tank, LP separator and pneumatic pump control)
- one (1) smokeless combustion device w/ continuous monitoring system (non-condensable reboiler control)

For future modifications described under this permit, involving the installation of equipment associated with a new well or the tying in of production associated with wells at separate locations, the permitting and emission control guidance which is specific to oil and gas production facilities in the Upper Green River Basin, revised September 2013, applies.

PROCESS DESCRIPTION: The following is a simplified process schematic for this facility and is not intended to represent actual equipment placement. A complete process description is found in the permit application.



ESTIMATED EMISSIONS: (summarized in the attached tables)

condensate storage tank:

flashing losses:

Uncontrolled volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions are estimated using Promax software based on the average composite extended hydrocarbon composition of condensate from the separators and the daily condensate production rate projected by the applicant.

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

Uncontrolled VOC emissions are estimated using EPA Tanks 4.0 software.

Controlled VOC and HAP emissions associated with flashing and S/W/B losses (**Emission Source E1, Process Flow Diagram**) are based on the reported 98% destruction efficiency of the common combustion device. Nitrogen oxide (NO_x) and carbon monoxide (CO) emissions from combustion of the vapors are based on 0.14 lb NO_x/MMBtu and 0.035 lb CO/MMBtu and the volume of vapors calculated with the Promax software.

active produced water tank: (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 combustion device for 98% control.

LP separator gas:

Uncontrolled VOC and HAP emissions associated with LP separator flash gas were calculated using Promax software based on the average composite extended hydrocarbon composition of condensate from the separators and the daily condensate production rate projected by the applicant.

Controlled VOC and HAP emissions (**Emission Source E1, Process Flow Diagram**) associated with the LP separator gas are based on the reported 98% destruction efficiency of the common combustion device. NO_x and CO emissions are based on 0.14 lb NO_x/MMBtu and 0.035 lb CO/MMBtu and the volume of produced gas.

dehydration units:

reboiler still vents:

Potential uncontrolled VOC and HAP emissions are estimated using GRI-GLYCalc V4.0 software based on the maximum circulation rates for the Kimray 2015SC glycol pumps, reported equipment operating parameters, average extended hydrocarbon composition of wet gas from area wells and gas production rates reported by the applicant.

Controlled VOC and HAP emissions (**Emission Source E2, Process Flow Diagram**) were estimated in the same fashion except condensers were added to the reboiler still vents and a combustion device was added to the non-condensable reboiler still vent streams. The condensers are proposed to operate at 100°F and 12 psia. The combustion device is reported to have 98% destruction efficiency. NO_x and CO emissions from the combustion of non-condensable reboiler vapors are based on 0.14 lb NO_x/MMBtu and 0.035 lb CO/MMBtu and the estimated volume of vapors.

natural gas fired heaters: (Emission Source E3, 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 E4, Process Flow Diagram)

Uncontrolled emissions from the pneumatic pumps are based on the estimated gas consumption rates for the pumps, the VOC and HAP content of the instrument gas used and vented by the pumps and 4380 annual operating hours.

Uncontrolled emissions from pneumatic controllers are based on the manufacturer's bleed rate for each controller, the VOC and HAP content of the gas used and 8760 annual operating hours.

Controlled emissions from the pneumatic pumps are based on the reported 98% destruction efficiency of the common combustion device. Emissions from the pneumatic controllers are vented to the atmosphere.

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

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

fugitive sources: (Emission Source E6, Process Flow Diagram)

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

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	4/23/2015 (within 60-days of startup)	6/15/2015
Tank / LP Separator Emissions Control	2/22/2015 (upon startup)	2/22/2015
Dehy Emissions Control	2/22/2015 (upon startup)	2/22/2015
Continuous Monitoring	2/22/2015 (upon startup)	2/22/2015
Active Water Tank Emission Control	2/22/2015 (upon startup)	2/22/2015
No/Low-Bleed Controllers	2/22/2015 (upon startup)	2/22/2015

The application was submitted approximately two (2) months late; therefore, the emission reporting requirements under the 2013 C6 S2 Guidance have not been met.

Periodic site evaluations of air pollution control equipment, institution of annual equipment maintenance programs and operator training on the proper operation of pollution control equipment have been incorporated in the conditions of this permit to ensure effective operation of the pollution control equipment installed to meet the BACT requirements of the C6 S2 Guidance.

NEW SOURCE PERFORMANCE STANDARDS (NSPS): The condensate 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 Stud Horse Butte 10E PAD 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): 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.

Linn Operating Inc. operates glycol dehydration unit(s) which are affected area sources under 40 CFR part 63, subpart HH. Based on the information in the application, the glycol dehydration unit(s) are exempt from the control requirements of 40 CFR part 63, subpart HH for glycol dehydration units because the actual annual average flowrate of natural gas to the glycol dehydration unit is less than 85 thousand standard cubic meters (3.0 MMSCFD) or the actual average emissions of benzene from the glycol dehydration unit process vents to the atmosphere are less than 0.90 megagrams per year (1.0 tons per year). Linn Operating Inc. shall maintain records of the actual annual average flowrate of natural gas to the glycol dehydration units or actual average emissions of benzene from the glycol dehydration unit process vents for each year of operation in accordance with 63.774(d)(1). The procedures in 63.772(b) shall be used to determine the glycol dehydration unit flowrate or benzene emissions. Linn Operating Inc. shall comply with all applicable requirements of 40 CFR part 63, subpart HH.

CHAPTER 6, SECTION 13 – NON-ATTAINMENT PERMIT REQUIREMENTS: The Stud Horse Butte 10E PAD is located in an area that has been designated as non-attainment for ozone. Since the facility is a minor source (<100 tpy of VOC based on a “Marginal” classification for the area) this permitting action is not subject to the non-attainment permitting requirements of Chapter 6, Section 13 of the WAQSR.

CHAPTER 6, SECTION 2(c)(ii) DEMONSTRATION: Under the Wyoming Air Quality Standards and Regulations (WAQSR), applicants for permits are required to demonstrate to the Administrator of the Air Quality Division (AQD), that “the proposed facility will not prevent the attainment or maintenance of any ambient air quality standard.” [WAQSR Chapter 6, Section 2(c)(ii)].

Options for the Chapter 6, Section 2(c)(ii) Demonstration include:

- a. Ambient ozone modeling for any application requesting increases in VOCs and/or NO_x emissions.
- b. Emission reductions for VOCs and/or NO_x emissions.
- c. Applicants may propose alternate innovative Demonstrations to the AQD.

A Chapter 6, Section 2(c)(ii) demonstration in accordance with the Division's Interim Policy has been conducted. Emission offset requirements, if applicable, have been applied to this permitting action at a ratio of 1.5:1.0 for VOCs and 1.1:1.0 for NO_x.

Linn Operating Inc. has chosen to offset VOC emissions by replacing the existing dehydration unit lean glycol circulation pumps with smaller pumps at multiple facilities and by controlling previously uncontrolled production equipment. Permit conditions have been established to make the commitments to control emissions federally enforceable.

To ensure offsets are not being double counted and credits are available for future applications, Linn Operating Inc.'s offset bank is being tracked via the Division's database.

Permitting actions to date have resulted in a decrease in actual VOC emissions of 169.2 tpy and a decrease in actual NO_x emissions of 178.1 tpy. Therefore, Linn Operating Inc. has met the offset requirements for VOCs and NO_x.

Based on Linn Operating Inc.'s Demonstration, the Division is satisfied that the proposed permitting actions will not prevent the attainment or maintenance of any ambient air quality standard as required by WAQSR Chapter 6, Section 2(c)(ii).

PROPOSED PERMIT CONDITIONS: The Division proposes to issue an Air Quality Permit to Linn Operating Inc. for the Stud Horse Butte 10E 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, 510 Meadowview Dr., Lander, WY 82520. 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 condensate tanks and all active produced water tanks, including tank flash and S/W/B vapors, shall be routed to the common combustion device 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. For the TEG dehydration units with condensers, reboiler still vent vapors shall be routed to the condensers. Condensed reboiler still vent liquids shall be collected and routed to a liquids storage tank. The non-condensable reboiler still vent vapors shall be routed to the combustion device. The condensers and combustion device shall reduce the mass content of total HAP and VOC emissions in the reboiler still vent by at least ninety-eight percent (98%) by weight.
14. Vapors from the low pressure (LP) separator shall be routed to the common combustion device 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.

15. 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.
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. The presence of the combustion device 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 facility 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.
18. 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 wells are 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.
19. All combustion devices 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.
20. Emissions from this facility shall not exceed the major source threshold as defined in Chapter 6, Section 3 of the WAQSR.
21. Linn Operating Inc. shall comply with all applicable requirements of 40 CFR part 63, subpart HH.
22. Linn Operating Inc. shall comply with all applicable requirements of 40 CFR part 60, subpart OOOO.

EQUIPMENT LIST

- two (2) three-phase LP separators
- two (2) two-phase HP separators
- two (2) 0.25 MMBtu/hr ethylene glycol bath heaters
- two (2) 6.0 MMCFD TEG dehydration units w/ Kimray Model 2015SC glycol pumps, 0.125 MMBtu/hr reboiler heaters and reboiler overheads condensers
- one (1) 400-bbl condensate tank
- one (1) 400-bbl produced water tank
- four (4) pneumatic heat trace pumps
- six (6) low-bleed pneumatic liquid level controllers
- one (1) common smokeless combustion device w/ continuous monitoring system (condensate tank, active produced water tank, LP separator and pneumatic pump control)
- one (1) smokeless combustion device w/ continuous monitoring system (non-condensable reboiler control)

Offset Requirements ¹

Emissions / Production	VOC (TPY)	NO_x (TPY)
Current Actual Emissions (22.1 BPD and 2.1 MMCFD)	2.4	1.0
Baseline Emissions	N/A	N/A
Difference	+2.4	+0.6
Offset Required	2.4*1.5 = +3.6	1.0*1.1 = +1.1

¹ application received after August 1, 2008; therefore, offsets required are 1.5*VOC and 1.1*NO_x

EMISSIONS SUMMARY

Stud Horse Butte 10E PAD				
22.1 BPD condensate and 2.1 MMCFD total gas ¹				
two wells: Stud Horse Butte 10 D5 and 10 E5				
SOURCE	EMISSIONS (TPY) ²			
	VOC	HAP	NO _x	CO
Dehydration Units				
POTENTIAL	25.5	14.9		
CONTROLLED	0.2	0.1	0.1	insig
Condensate Tank				
UNCONTROLLED	8.1	0.6		
CONTROLLED	0.2	insig	insig	insig
LP Separator				
UNCONTROLLED	14.5	1.0		
CONTROLLED	0.3	insig	0.1	insig
Pneumatic Pumps				
UNCONTROLLED	12.8	1.0		
CONTROLLED	0.3	insig	0.4	0.1
Process Heaters				
	insig	insig	0.4	0.3
Truck Loading				
	0.5	insig		
Pneumatic Controllers				
	insig	insig		
Process Fugitives				
	0.9	0.1		
Total Uncontrolled Facility Emissions				
	62.3	17.6	0.4	0.3
Total Proposed Controlled Facility Emissions				
	2.4	0.2	1.0	0.4

¹ production rates reported by applicant

² rounded to the nearest 0.1 ton

Appendix A
Offset Spreadsheet

App Num	Company	Facility	Permit Number	Permit Date	Current VOC	Current NOx	Base VOC	Base NOx	Delta VOC	Delta NOx	Offset VOC	Offset NOx	Demo Comments
2008-2012	Linn				358.9	108	557.8	340.7	-198.9	-232.7	-146.6	-230	Sum of Previous Permitting Actions
13615	Linn	Cabrigo 13-18	MD-13615	2/28/2013	0.1	0	9	0	-8.9	0	-8.9	0	control dehydration unit
13616	Linn	Stud Horse Butte 3-20X	MD-13616	2/28/2013	0.3	0.3	16.6	0	-16.3	0.3	-16.3	0	voluntary reduction including controlling tank, dehy and pump. No NOx offsets are required for voluntary reductions
13617	Linn	Stud Horse Butte 15-16	MD-13617	2/28/2013	0.3	0.5	15.7	0	-15.4	0.5	-15.4	0	voluntary reduction including controlling tank, dehy and pump. No NOx offsets are required for voluntary reductions
13618	Linn	Stud Horse Butte 3-17	MD-13618	2/28/2013	0.2	0.3	23.2	0	-23	0.3	-23	0	voluntary reduction including controlling tank, dehy and pump. No NOx offsets are required for voluntary reductions
15934	Linn	Stud Horse Butte 39-20 PAD	CT-15934	5/20/2014	7	3.7	0	0	7	3.7	10.5	4.1	new facility
16290	Linn	Antelope 3-9	wv-16290	5/29/2014	0	0	0	0	0	0	0	0	no change in production or emissions
16291	Linn	Antelope 15-4	wv-16291	5/29/2014	0	0	0	0	0	0	0	0	no change in production or emissions
15597	Linn	Stud Horse Butte 23-16 PAD	CT-15597	6/3/2014	7.9	4.9	0	0	7.9	4.9	11.9	5.4	new facility
16553	Linn	Stud Horse Butte 39-15 PAD	CT-16553	10/21/2014	5.3	4	0	0	5.3	4	8	4.4	new facility
14597	Linn	Drill Rig Fleet	CT-14597	2/6/2015	0.7	24.2	0	0	0.7	24.2	1.1	26.6	Drill Rig Fleet
16733	Linn	Corona 8-11 PAD	MD-16733	3/18/2015	5.9	3.3	17.2	4.7	-11.3	-1.4	-11.3	-1.4	replace high-bleed controllers with low-bleed controllers and control pneumatic pumps
A0000302	Linn	Portable Rod Pump Engines (4 units)	P0008311	5/5/2015	2.8	2	0	0	2.8	2	4.2	2.2	new facility - 4 portable 104 hp rod pump engines to be used at Linn Operating facilities within JPAD.
A0000656	Linn	Cabrigo 19F PAD	P0017604	7/9/2015	10.1	2.8	0	0	10.1	2.8	15.2	3.1	
A0000351	Linn	Cabrigo 15-30 PAD	P0018384	7/30/2015	15.6	7.1	20.9	0.5	-5.3	6.6	-5.3	7.3	control dehydration unit, pneumatic pumps and install low-bleed controllers
8844	Linn	Stud Horse Butte 13-03			0	0	12.7	0.4	-12.7	-0.4	-12.7	-0.4	Permit Actions: AP-8844 Notes: well was plugged and abandoned on 12/18/08
A0000789	Linn	Jonah Water Disposal Well #1	P0019740		4.5	3.5	5.3	7.5	-0.8	-4	-0.8	-4	Remove of the Caterpillar 3412SITA engine, and increase hours of operation for the Caterpillar G3408SITA engine

App Num	Company	Facility	Permit Number	Permit Date	Current VOC	Current NOx	Base VOC	Base NOx	Delta VOC	Delta NOx	Offset VOC	Offset NOx	Demo Comments
A0000934	Linn	Stud Horse Butte 13J PAD			7	1.9	0	0	7	1.9	10.5	2.1	
A0001020	Linn	Stud Horse Butte 10J PAD			2.1	0.6	0	0	2.1	0.6	3.2	0.7	
A0001120	Linn	Stud Horse Butte 9o PAD			1.9	0.6	0	0	1.9	0.6	2.9	0.7	
A0001127	Linn	Stud Horse Butte 10E PAD			2.4	1	0	0	2.4	1	3.6	1.1	
Linn Total					433	168.7	678.4	353.8	-245.4	-185.1	-169.2	-178.1	