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DANA AVANT LEWIS, *DIRECTOR*

# RAILROAD COMMISSION OF TEXAS

## HEARINGS DIVISION

**OIL AND GAS DOCKET NO. 06-0326620**

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**APPLICATION OF KUDU MIDSTREAM LLC (478441) PURSUANT TO STATEWIDE RULE 9 AND 36 FOR A PERMIT TO DISPOSE OF OIL AND GAS WASTE INCLUDING HYDROGEN SULFIDE BY INJECTION INTO A POROUS FORMATION NOT PRODUCTIVE OF OIL OR GAS FOR THE MARTINSVILLE AGI LEASE, MARTINSVILLE (TRAVIS PEAK) FIELD, NACOGDOCHES COUNTY, TEXAS**

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**OIL AND GAS DOCKET NO. 06-0326602**

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**APPLICATION OF KUDU MIDSTREAM LLC (478441) FOR APPROVAL OF A NEW FIELD DESIGNATION FOR THE MARTINSVILLE (RODESSA H<sub>2</sub>S DISPOSAL) FIELD AND AS A HYDROGEN SULFIDE DISPOSAL FIELD, NACOGDOCHES COUNTY, TEXAS**

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**HEARD BY:** Austin Gaskamp – Technical Examiner  
Jennifer Cook – Administrative Law Judge

**HEARING DATE:** May 29, 2020

**CONFERENCE DATE:** October 20, 2020

**APPEARANCES:** **REPRESENTING:**

Mickey R. Olmstead  
John Copeland  
Jason Moxley  
Steve Pattee  
Ramona Hovey  
Parker Jessee  
Peter W. Jordan  
Ted Lilly  
Jacob Mezey  
Emily Olson

Kudu Midstream, LLC

### **EXAMINERS' REPORT AND RECOMMENDATION**

#### **STATEMENT OF THE CASE**

Kudu Midstream, LLC ("Kudu") requests authority, pursuant to Statewide Rules 9 and 36, to inject hydrogen sulfide (H<sub>2</sub>S) and carbon dioxide (CO<sub>2</sub>) into a formation not productive of oil and gas for its Martinsville AGI No. 1 Well ("AGI well"). Kudu also

requests that a new field, the Martinsville (Rodessa H<sub>2</sub>S Disposal) Field, be approved and established for this disposal well.

Kudu has filed Form W-14, *Application to Dispose of Oil and Gas Waste by Injection into a Formation Not Productive of Oil and Gas* pursuant to Statewide Rule 9. In the application, Kudu has requested authority to inject up to 6.5 million cubic feet per day (“MMCFD”) of fluids containing H<sub>2</sub>S and CO<sub>2</sub> into its Martinsville AGI No. 1 Well, with an estimated average daily injection volume of 3.25 MMCFD. The Commission Underground Injection Control (UIC) staff reviewed the application and determined it to be administratively complete. The Statewide Rule 9 application is unopposed and may be administratively processed pursuant to Statewide Rule 9(5)(F), pending approval of this Statewide Rule 36 application.

Statewide Rule 36(c)(10)(A) states that “injection of fluids containing hydrogen sulfide shall not be allowed under the conditions specified in this provision unless first approved by the Commission after public hearing:

- (i) where injection fluid is a gaseous mixture, or would be a gaseous mixture in the event of a release to the atmosphere, and where the 100 ppm radius of exposure is in excess of 50 feet and includes any part of a public area except a public road; or, if the 500 ppm radius of exposure is in excess of 50 feet and includes any part of a public road; or if the 100 ppm radius of exposure is 3,000 feet or greater;
- (ii) where the hydrogen sulfide content of the gas or gaseous mixture to be injected has been increased by a processing plant operation.”

Kudu seeks to inject acid gas containing hydrogen sulfide and carbon dioxide. The modeled exposure in the event of a catastrophic release from the well for the 500 ppm radius of exposure (“ROE”) is estimated to be 12.5 feet, and the 100 ppm ROE to be 161 feet. However, the H<sub>2</sub>S contained in the inlet gas has been concentrated by the Martinsville processing plant. Thus, a public hearing was required pursuant to Statewide Rule 36(c)(10)(A)(ii). A hearing on the application was held on May 29, 2020.

Prior to the hearing, the Commission’s Hydrogen Sulfide Coordinator for District 6 reviewed and approved the proposed H<sub>2</sub>S Contingency Plan and determined that the proposed application complies with the applicable provisions of Statewide Rule 36. However, the Commission’s H<sub>2</sub>S Coordinator cannot process Kudu’s Form H-9 (Certificate of Compliance Statewide Rule 36) without a designated H<sub>2</sub>S disposal field in Nacogdoches County. Upon approval of the requested Martinsville (Rodessa H<sub>2</sub>S Disposal) Field, the Commission’s District 6 H<sub>2</sub>S Coordinator can then process and approve Kudu’s Form H-9.

Kudu requested that, following approval of this Statewide Rule 36 application, the Statewide Rule 9 application be remanded to the UIC Section for administrative processing of the application. The Technical Examiner and Administrative Law Judge

(collectively, "Examiners") recommend Statewide Rule 36 authorization be granted and the Rule 9 application administratively processed pursuant to Statewide Rule 9(5)(F), as the application is unopposed.

### **DISCUSSION OF THE EVIDENCE**

The AGI well will dispose of gas which primarily contains H<sub>2</sub>S and CO<sub>2</sub>. Kudu selected this location for its proposed acid gas injection well because the area is not densely populated and does not have a large number of roads or traffic. Work performed by Kudu's experts showed that the fluids will be contained within the formation.

Kudu's gas processing plant is currently operating to strip the H<sub>2</sub>S and CO<sub>2</sub> from the full well stream so the natural gas can be sold. The remaining vapors are vented to the atmosphere pursuant to a TCEQ permit. Approving this injection permit will allow Kudu to inject the acid gas into the nonproductive Rodessa formation.

The feed gas entering Kudu's gas processing plant has a very low H<sub>2</sub>S concentration. Thus, the concentrated acid gas to be injected has a very low H<sub>2</sub>S concentration. Accordingly, the 100 ppm ROE is only 161 feet from the proposed injection well. If there were a catastrophic release of acid gas from the proposed injection well, the 100 ppm H<sub>2</sub>S vapor would likely not leave Kudu's gas plant property.

Kudu's gas processing plant and proposed injection well are located in a very rural part of Nacogdoches County. Kudu's gas plant is at the very end of a dead-end road, which is Kudu's private road. There are no homes, public roads, or other public areas within the 100 ppm ROE. The proposed injection well is located approximately 14 miles east of the City of Nacogdoches.

The proposed disposal interval from 7,328 feet to 7,644 feet is in the nonproductive Rodessa formation. The Rodessa formation is not productive for at least 7.15 miles in all directions. There is no H<sub>2</sub>S field currently designated in Nacogdoches County. Kudu is applying to have the non-productive Rodessa formation in this immediate area designated as an H<sub>2</sub>S disposal field. Establishing a new field designation called the Martinsville (Rodessa H<sub>2</sub>S Disposal) Field will identify the proposed disposal zone as a formation now containing hydrogen sulfide. This will alert any operators drilling in the area to the potential of H<sub>2</sub>S existing in an otherwise non-sour formation. Kudu's structure maps and cross-sections demonstrated that the Rodessa formation is laterally extensive.

At the hearing, Kudu's experts offered exhibits and testimony to demonstrate that the proposed wellbore for the Martinsville AGI Well No. 1 will be well suitable for acid gas injection and can be operated safely using equipment and materials suitable for injection of H<sub>2</sub>S and CO<sub>2</sub> gas. The entire facility is fenced and locked to restrict access to the Martinsville AGI Well No. 1.

Notice of the application pursuant to Statewide Rule 9 and Statewide Rule 36 was provided to the surface owner, operators within the ½-mile radius of the wellbore, and to the Nacogdoches County Clerk. The Notice of Application was published, pursuant to

Statewide Rules 9 and 36, in The Daily Sentinel, a newspaper of general circulation in Nacogdoches County, on October 17, 2019. Kudu provided notice to all operators and landowners located within the 100 ppm and 500 ppm radii of exposure of the Martinsville AGI Well No. 1. There are no receptor points within the 100 ppm and 500 ppm radii of exposure. The application pursuant to Statewide Rule 9 and Statewide Rule 36 is unprotested.

Computer simulations of fluid migration were performed to predict the maximum probable extent of the underground waste plume migration. The numerical model SWIFT was used for the plume migration predictions. Input data included a net pay thickness range of 27.2 to 96.9 feet, a porosity range of 4.2% to 15.3%, and a permeability of 50 md. This input data is conservative and results in an over-prediction of the maximum probable extent of waste plume migration. The model assumed injection at the maximum permitted rate for 50 years and then 50 years of drift. The model also accounted for the injection operations of Rodessa disposal wells located more than 5.78 miles to the northeast of the proposed injector. The SWIFT model has been accepted nationally for hazardous waste disposal wells by the EPA and has been previously accepted by the Railroad Commission.

Acid gas concentrations were calculated and mapped based on the modeling. The outer edge of the underground injection plume is represented by a 1% contour line, where the fluid is 99% formation fluid and 1% acid gas. After 100 years, allowing for 50 years of injection and 50 years of drift, the maximum extent of the 1% line is only 6,879 feet from the injection well. There are no wells of concern within the modeled injection plume that penetrate the disposal interval. There are no faults within the modeled injection plume or within the immediate area. Therefore, there will not be a conduit for the migration of the injected fluid outside the disposal interval.

The maximum escape rate of gas containing H<sub>2</sub>S is estimated to be 770.9 MMCFD, which uses the worst-case conditions of complete wellhead failure and direct gas discharge from the open casing. Kudu employed Flatrock Engineering ("Flatrock") to perform gas dispersion modeling based on the results of the maximum escape rate, using a dispersion model called CANARY to determine the radius of exposure of H<sub>2</sub>S. The CANARY model has been previously accepted by the Railroad Commission for radius of exposure calculations. Flatrock obtained express approval for the use of the CANARY model for this application from the Commission's District 6 Coordinator for Hydrogen Sulfide Operations. The calculated ROE for 500 ppm H<sub>2</sub>S, due to the maximum catastrophic release at the proposed injection well, is 12.5 feet from the wellbore. For 100 ppm, the calculated ROE is 161 feet from the wellbore.

Form H-9 (Certificate of Compliance Statewide Rule 36) and a contingency plan were prepared for the proposed disposal operations, based on the calculated ROE values. Kudu worked with Commission's Hydrogen Sulfide Coordinator for District 6 to obtain approval of the proposed contingency plan for the Martinsville AGI No. 1 Well, following a thorough review and discussions about Kudu's modeling of the maximum escape rate of the gas using the CANARY model.

### **FINDINGS OF FACT**

1. Kudu requests authority pursuant to Statewide Rule 36 to inject fluids containing primarily hydrogen sulfide (H<sub>2</sub>S) and carbon dioxide (CO<sub>2</sub>) into the proposed Martinsville AGI No. 1 Well.
2. Kudu has filed Form W-14, *Application to Dispose of Oil and Gas Waste by Injection into a Formation Not Productive of Oil and Gas* pursuant to Statewide Rule 9.
3. The Statewide Rule 9 application is unprotested and may be administratively processed pursuant to Statewide Rule 9(5)(F).
4. Statewide Rule 36 requires a public hearing to be held for the injection of fluids containing hydrogen sulfide where:
  - a. injection fluid is a gaseous mixture, or would be a gaseous mixture in the event of a release to the atmosphere, and where the 100 ppm radius of exposure is in excess of 50 feet and includes any part of a public area except a public road; or, if the 500 ppm radius of exposure is in excess of 50 feet and includes any part of a public road; or if the 100 ppm radius of exposure is 3,000 feet or greater; or
  - b. the hydrogen sulfide content of the gas or gaseous mixture to be injected has been increased by a processing plant operation.
5. The proposed injection well will be drilled, cased and cemented with H<sub>2</sub>S corrosion resistant tubulars, packers, and cement sufficient to confine the injected fluid to the proposed Rodessa disposal interval.
6. Kudu will dispose of waste gas that contains H<sub>2</sub>S and CO<sub>2</sub> into the Rodessa formation, which is not productive in this area.
  - a. A public hearing is required pursuant to Statewide Rule 36(c)(10)(A).
  - b. A hearing on the application was held on May 29, 2020.
  - c. The application is unprotested.
7. The field name of Martinsville (Rodessa H<sub>2</sub>S Disposal) Field should be approved for this disposal interval to alert other operators in the area to the possibility of encountering H<sub>2</sub>S in this otherwise non-sour formation.
8. The maximum escape rate of fluids containing H<sub>2</sub>S is estimated to be 770.9 MMCFD, which assumes worst case conditions of complete wellhead failure and direct gas discharge from the opening casing.
9. Kudu employed experts to perform gas dispersion modeling based on the results of the 770.9 MMCFD maximum escape rate.

- a. Kudu used a dispersion model called CANARY to determine the radius of exposure of H<sub>2</sub>S.
  - b. This model has been previously accepted by the Railroad Commission for ROE calculations, including Oil and Gas Docket Nos. 01-0300843, 01-0271975 and 01-0249550, and has been approved by the Commission's District 6 Coordinator for Hydrogen Sulfide Operations for use in this application.
  - c. The calculated ROE for 500 ppm H<sub>2</sub>S, modeled based on the maximum catastrophic release at the proposed injection well, is 12.5 feet from the wellbore. For 100 ppm, the calculated ROE is 161 feet from the wellbore.
10. Notice of the application pursuant to Statewide Rule 9 and Statewide Rule 36 was provided to the surface owner, operators within ½ mile, and to the Nacogdoches County Clerk. Notice and information regarding the application, pursuant to Rule 36, was also provided to all receptor points in the 100 ppm and 500 ppm area of exposure.
  11. The Notice of Application pursuant to Statewide Rules 36 and 9 was published in The Daily Sentinel, a newspaper of general circulation in Nacogdoches County on October 17, 2019.
  12. The Commission's District 6 Coordinator for Hydrogen Sulfide Operations has reviewed and approved the H<sub>2</sub>S Contingency Plan and has determined that the proposed application complies with the applicable provisions of Statewide Rule 36 regarding materials and operation. The Commission's H<sub>2</sub>S Coordinator cannot process Kudu's Form H-9 without a properly established H<sub>2</sub>S field designated for this well in Nacogdoches County. Once the Commission approves the establishment of Kudu's proposed Martinsville (Rodessa H<sub>2</sub>S Disposal) Field, the Commission's District 6 H<sub>2</sub>S Coordinator can approve and process Kudu's Form H-9.
  13. Kudu agreed on the record that, pursuant to the provisions of Texas Government Code §2001.144(a)(4)(A), the Final Order in this case shall be effective on the date a Master Order relating to the Final Order is signed.

#### **CONCLUSIONS OF LAW**

1. Proper notice was issued as required by all applicable statutes and regulatory codes.
2. All things have occurred and been accomplished to give the Commission jurisdiction in this matter.
3. Kudu has complied with the requirements of Statewide Rule 36(c)(10)(A)(ii).

4. Kudu's Statewide Rule 9 application is unopposed and can be administratively processed pursuant to Statewide Rule 9(5)(F).
5. Pursuant to § 2001.144(a)(4)(A) of the Texas Government Code, and the agreement of the applicant on the record, the Final Order in this case can be effective when a Master Order relating to the Final Order is signed.

**EXAMINERS' RECOMMENDATION**

Based on the above findings of fact and conclusions of law, the Examiners recommend that the Commission grant Statewide Rule 36 authorization for the Martinsville AGI No. 1 Well, in Nacogdoches County, Texas, and Kudu Midstream, LLC's application for a permit pursuant to Statewide Rule 9 for the above-referenced well be remanded for administrative processing.

Respectfully submitted,

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*Austin Gaskamp*  
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Austin Gaskamp  
Technical Examiner

DocuSigned by:  
**Jennifer Cook**  
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Jennifer Cook  
Administrative Law Judge