

OIL AND GAS DOCKET NO. 05-0263914

THE APPLICATION OF ENBRIDGE G & P (EAST TEXAS) LP FOR AUTHORITY PURSUANT TO STATEWIDE RULES 9 AND 36 TO DISPOSE OF OIL AND GAS WASTE CONTAINING HYDROGEN SULFIDE INTO ITS AKER GAS INJECTION LEASE, WELL NO. 1, AKER (WOODBINE H₂S DISPOSAL) FIELD, FREESTONE COUNTY, TEXAS

HEARD BY: Richard D. Atkins, P.E. - Technical Examiner
Mark J. Helmueller - Legal Examiner

DATE OF HEARING: May 27, 2010

APPEARANCES:

REPRESENTING:

APPLICANT:

Mark Santos
Kerry A. Pollard
David Billinger

Enbridge G & P (East Texas) LP

EXAMINER'S REPORT AND PROPOSAL FOR DECISION

STATEMENT OF THE CASE

Enbridge G & P (East Texas) LP ("Enbridge") requests authority to inject acid gas into its Aker Gas Injection Lease, Well No. 1. Enbridge also requests that a new field, the Aker (Woodbine H₂S Disposal) Field, be set up for this disposal well.

Statewide Rule 36(c)(10)(A) requires that a public hearing be held before the injection of fluid containing hydrogen sulfide ("H₂S" or "sour gas"), when "injection fluid is a gaseous mixture...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." In this case, the 500 ppm radius of exposure ("ROE") is greater than 50 feet and includes parts of County Road 181.

The Commission's Field Operations section has reviewed the application and has approved the contingency plan which incorporates the injection well. The Commission's Technical Permitting staff recommends approval of the application contingent on a showing by applicant that the proposed disposal will not cause acid gas migration into productive horizons not known to contain hydrogen sulfide. This application was unopposed and the examiners recommend approval.

To satisfy Statewide Rule 9, notice of the subject application was published in the *Fairfield Recorder*, a newspaper of general circulation in Freestone County, on October 29, 2009. To satisfy Statewide Rule 36, notice of the hearing was published in the *Fairfield Recorder*, a newspaper of general circulation in Freestone County, on May 6, 2010. Additionally, notice of the application was sent to the Freestone County Clerk, and offset operators within ½ mile of the proposed well on November 4, 2009. Finally, notice of application was sent to all surface owners of each tract which adjoins the tract where the proposed well is located and to all surfaces owners of tracts located within the 100 ppm ROE on November 4, 2009.

DISCUSSION OF THE EVIDENCE

Enbridge's Aker Gas Processing Plant has been in operation for many years, removing carbon dioxide ("CO₂") and H₂S from the gas stream produced by wells in the area. The daily throughput for the Akers Plant is approximately 100 MMCFGPD. At least ½ of the treated gas contains H₂S when it enters the processing plant. Currently, Enbridge is injecting the waste gas, or acid gas, into the productive Smackover Formation in its Anderson Lease, Well No. 1. The Smackover Formation produces sour gas and has a limited aerial extent. The only productive well is Enbridge's McConnico Lease, Well No. 1 which produces approximately 1,000 MCFGPD. Enbridge is concerned that its current permitted H₂S disposal well, the Anderson No. 1, which is permitted to dispose into the Smackover Formation will pressure up within the next few years. If the Anderson well is unable to accept any further gas, Enbridge will no longer be able to dispose of the processing plant's waste gas.

Enbridge is proposing that the waste gas be compressed into a liquid and disposed into the proposed Aker Gas Injection Lease, Well No. 1. This well has not yet been drilled, but is proposed to be located adjacent and south of the existing gas plant operated by Enbridge, which is situated approximately six miles northeast of Streetman, Texas. Enbridge requests authority to dispose of a maximum of 6,500 MCFPD of compressed acid gas, which is the same volume permitted for the existing Anderson Lease, Well No. 1, disposal well. The requested maximum surface injection pressure is 1,850 psig.

The Aker Gas Injection Lease, Well No. 1, will be drilled to a total depth of approximately 4,500 feet. The well will have 8 5/8" surface casing set at 450 feet and will be cemented to surface. The 5 1/2" long string casing will be set at approximately 4,500 feet, with top of cement estimated to be at 200 feet. The TCEQ recommends that useable quality water be protected to a depth of 425 feet. Injection will be through tubing set on a packer no higher 100 feet above the proposed injection interval (See attached Enbridge Exhibit No. 15 - Wellbore Diagram). All of the tubular equipment which may come in contact with CO₂ and H₂S are resistant stainless steels and alloys that meet all Commission and industry standards for handling CO₂ and H₂S.

The proposed disposal interval includes the non-productive Woodbine A, B, C and D Sands. These sands occur in the correlative interval between 3,700 feet and 4,400 feet

as shown on the log of the Redmon Operating - Howell Lease, Well No. 1 (API No. 42-161-33247). The Woodbine Sands are not productive for at least several miles in all directions. Establishing a new field designation called the Aker (Woodbine H₂S Disposal) Field will identify the proposed disposal zone as a formation now containing hydrogen sulfide. Any operators drilling in the area will be aware of the potential of H₂S existing in an otherwise non-sour formation.

There are no wellbores located within the ¼ mile radius of the proposed well. The closest well is a plugged saltwater disposal well, the Koch Midstream Services - Aker Plant SWD Lease, Well No. 1. This well had a total depth of 4,250 feet and, because it is properly plugged, it will not be a conduit for migration of injected fluids.

The closest well to penetrate the entire Woodbine Formation is the Redmon Operating - Howell Lease, Well No. 1, located approximately 1 mile north of the proposed well. The well is a plugged Smackover Formation dry hole that was drilled to 11,350 feet. The log of the well demonstrates hundreds of feet of shale above and fifty feet of shale and the non-productive Buda Formation below the Woodbine Formation disposal interval. The thick shale intervals and the non-productive Buda Formation will provide barriers to migration of injected fluids out of the Woodbine Formation. A structure map demonstrates that the Woodbine Formation is laterally extensive with approximately 2 degrees of dip trending from the northwest to the southeast. The net thickness of the four Woodbine Sands range from 125 feet to 200 feet in the area. Enbridge estimated a "most likely" net pay thickness of 160 feet, a porosity of 23% and a permeability of 450 millidarcies.

Computer simulations of pressure and fluid migration were performed to predict the maximum probable extent of underground waste migration. The numerical model SWIFT was used for the predictions. Input data included the "most likely" parameters listed above, a project life of 20 years, the geologic structure map and an average daily injection rate of 6,500 MCFGPD. This model has been accepted nationally for hazardous waste wells by the EPA and has been previously accepted by the Railroad Commission.

The waste being disposed of consists of approximately 35% hydrogen sulfide and 65% carbon dioxide. 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. The maximum extent of the 1% line is less than 4,000 feet from the injection well after 20 years of injection. The only wellbore within this area which penetrates the Woodbine Formation is the Koch Midstream Services - Aker Plant SWD Lease, Well No. 1. Since it is properly plugged, no existing wellbore within the injection plume will be a conduit for migration of the injected fluid outside the disposal interval.

The maximum escape rate is estimated to be 19 MMCFGPD, which assumes worst case conditions with escape through the 2 7/8" tubing. Enbridge employed Quest Consultants, Inc. to perform gas dispersion modeling based on the results of the 19 MMCFGPD maximum escape rate. Quest used a dispersion model called CANARY to

determine the ROE to H₂S. This model calculates release conditions, initial dilution of the vapor, and subsequent vapor dispersion. The model accounts for thermodynamics, mixture behavior, transient release rates, gas cloud density, initial velocity of the gas and heat transfer effects. This model has been previously accepted by the Railroad Commission. The calculated ROE for 100 ppm H₂S, due to the maximum catastrophic release at the proposed injection well, is 2,410 feet. For 500 ppm H₂S, the calculated ROE is 1,280 feet.

Both of the calculated ROE's encompass the Aker Gas Plant. Enbridge has modified the contingency plan for the Aker Gas Processing Plant to incorporate the proposed disposal operations. There are no residences located within the 100 ppm ROE for the disposal well and parts of County Road 181 are located within the 500 ppm ROE for the well. The modified contingency plan has been reviewed and approved by the Commission's Field Operations section.

The proposed injection well is designed to meet all safety requirements of Rule 36. The wellhead will be equipped with emergency shut-down controls. Four permanent H₂S detectors will be installed at locations 100 feet from the wellhead, with continuous monitoring at the adjacent Aker gas processing facility. The Aker facility is a full-time manned installation which has been Rule 36 certified for many years. Enbridge also proposes to drill and complete north and south monitor wells to verify that the injected gas is being contained as predicted.

FINDINGS OF FACT

1. Notice of this hearing was provided to all persons entitled to notice at least ten (10) days prior to the date of the hearing.
2. Notice of the subject application was published in the *Fairfield Recorder*, a newspaper of general circulation in Freestone County, on October 29, 2009.
3. Notice of the subject application was sent to the Freestone County Clerk, offset operators within ½ mile and surface owners of each tract which adjoins the disposal tract on November 4, 2009.
4. Notice of the subject application was provided to the surface owners of all tracts located within the 100 ppm ROE on November 4, 2009.
5. Notice of the hearing was published in the *Fairfield Recorder*, a newspaper of general circulation in Freestone County, on May 6, 2010.
6. The proposed injection well, the Aker Gas Injection Lease, Well No. 1, will be used to dispose of waste gas containing CO₂ and H₂S. This waste gas is removed from hydrocarbon gas at Enbridge's Aker Gas Processing Plant.

7. The Aker Gas Injection Lease, Well No. 1, will inject at rates up to 6,500 MCFPD of compressed acid gas. The acid gas contains approximately 35% hydrogen sulfide and 65% carbon dioxide.
8. The proposed Aker Gas Injection Lease, Well No. 1, will be drilled, cased and cemented to confine the injected fluid to the proposed Woodbine disposal zone.
 - a. The proposed disposal interval includes the non-productive Woodbine A, B, C and D Sands. These sands occur in the correlative interval between 3,700 feet and 4,400 feet as shown on the log of the Redmon Operating - Howell Lease, Well No. 1 (API No. 42-161-33247).
 - b. The TCEQ recommends that useable quality water be protected to a depth of 425 feet.
 - c. The well is proposed to have 8 $\frac{5}{8}$ " surface casing set at 450 feet cemented to surface and 5 $\frac{1}{2}$ " long string casing set at approximately 4,500 feet, with the top of cement estimated to be at 200 feet.
 - d. Injection will be through tubing set on a packer no higher than 100 feet above the proposed disposal interval.
 - e. All of the equipment installed that might come in contact with CO₂ and H₂S will be stainless steel and alloys that meet all Commission and industry safety standards.
 - f. If the injection fluid is not confined to the approved strata, then the disposal well permit will be suspended and disposal cease until the fluid migration from such strata is eliminated.
 - g. Enbridge plans to drill and complete north and south monitor wells to verify that the injected gas is being contained as predicted.
9. The field name of Aker (Woodbine H₂S Disposal) should be approved for the disposal interval to alert other operators in the area to the possibility of encountering sour gas in this otherwise non-sour formation.
10. The proposed disposal well is adjacent and south of the existing gas plant operated by Enbridge, which is situated approximately six miles northeast of Streetman, Texas.
11. The requested maximum surface injection pressure is 1,850 psig.

12. The injection well, compressor and flow lines transmitting sour gas, will be designed to contain the sour gas, and monitoring devices will immediately shut down the system if any leakage of sour gas is detected.
13. Enbridge has modified the contingency plan for the Aker Gas Processing Plant to incorporate the proposed disposal operations.
14. The calculated ROE for 100 ppm H₂S due to a catastrophic release from the well is 2,410 feet. The calculated exposure radius ROE for 500 ppm H₂S due to a catastrophic release from the well is 1,280 feet.
15. There are no residences located within the 100 ppm ROE for the proposed disposal well. Parts of County Road 181 are located within the 500 ppm ROE for the proposed disposal well.
16. No existing well will be a conduit for migration of injected fluid outside the disposal interval because the only well within ¼ mile is properly plugged.
17. Computer simulations of pressure and fluid migration were performed to predict the maximum probable extent of underground waste migration. 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. The maximum extent of the 1% line is less than 4,000 feet from the injection well after 20 years of injection.
18. Enbridge has met the conditions for approval set forth by the Field Operations and Technical Permitting sections of the Railroad Commission.

CONCLUSIONS OF LAW

1. Proper notice was issued as required by Statewide Rule 9 and Statewide Rule 36.
2. All things have occurred and been accomplished to give the Commission jurisdiction in this matter.
3. The application of Enbridge G & P (East Texas) LP to inject hydrogen sulfide gas into the Aker Gas Injection Lease, Well No. 1, Aker (Woodbine H₂S Disposal) Field, Freestone County, complies with the applicable provisions of Statewide Rules 9 and 36.

EXAMINERS' RECOMMENDATION

Based on the above findings of fact and conclusions of law, the examiners recommend that the application of Enbridge G & P (East Texas) LP be approved and a new field designation of Aker (Woodbine H2S Disposal) Field be approved for the disposal interval.

Respectfully submitted,

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