



DEPARTMENT OF ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov



October 31, 2014

Sean LiSooney
Drilling/Production/Operations Engineer
Zenergy Operating Company, LLC
6100 S. Yale Ave, Suite 1700
Tulsa, Ok 74136

Dear Mr. LiSooney:

Re: Case No. 11-2014 – approval of permit to inject

Thank you for your application filed August 27, 2014, requesting a permit to inject into the existing Gunderson 31P-30-19H well located in the SE ¼ SE ¼ Section 31, Township 23 North, Range 3 East, Harding County, South Dakota, for the purpose of disposing of production water into the Inyan Kara formation at a depth of approximately 4,422 feet below land surface. The injection water is produced water from nearby wells producing from the Red River formation (“B” Zone).

The department published a Notice of Recommendation for Case No. 11-2014 (enclosed), recommending conditional approval of the application. The date for intervention was October 8, 2014, and no parties petitioned the Board of Minerals and Environment for a hearing on the application by the deadline. Therefore, in accordance with the Administrative Rules of South Dakota (ARSD) 74:12:07 and 74:12:09, approval of the application is hereby granted. The permit is conditioned on the terms outlined in the Notice of Recommendation and compliance with all applicable requirements of South Dakota Codified Laws 45-9 and ARSD 74:12.

In order to satisfy condition seven in the department’s Notice of Recommendation, EPA’s approval of the recommended aquifer exemption was required. EPA approved the aquifer exemption on October 24, 2014 (see enclosed approval letter), however, EPA’s approved exempted area is larger than the 1,500 foot radius described in the department’s Notice of Recommendation. This difference does not change the department’s recommendation. Therefore, the extent of the approved aquifer exemption is limited to 1,500 feet. If, in the future, Zenergy requires a larger exempted area at this well, a major permit modification would be required.

If you have any questions about this letter please contact Brian Walsh of my staff at 605.773.3296 or brian.walsh@state.sd.us.

Sincerely,

Steven M. Pirner
Secretary

Enclosures

STATE OF SOUTH DAKOTA
SECRETARY OF THE
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IN THE MATTER OF THE APPLICATION OF
ZENERGY OPERATING COMPANY, LLC, TULSA,
OKLAHOMA, FOR APPROVAL OF A PERMIT TO
INJECT PRODUCTION WATER INTO THE EXISTING
GUNDERSON 31P-30-19H WELL LOCATED IN THE
SE¼ SE¼ SECTION 31, TOWNSHIP 23 NORTH,
RANGE 3 EAST, IN THE BORDER FIELD, HARDING
COUNTY, ABOUT TWENTY-SIX MILES
NORTHWEST OF BUFFALO, SOUTH DAKOTA.

NOTICE
OF
RECOMMENDATION
FOR A PERMIT TO INJECT

OIL AND GAS
CASE NO. 11-2014

Notice is hereby given to the public and to all interested persons that pursuant to South Dakota Codified Laws (SDCL) Chapter 1-26 and Chapter 45-9 and further pursuant to the Administrative Rules of South Dakota (ARSD) 74:12:07 and 74:12:09, the following matter has come to the attention of the Secretary of the Department of Environment and Natural Resources, hereinafter "Secretary."

The Gunderson 31P-30-19H well was completed with 2,018 feet of 9.625-inch steel surface casing, cemented to protect underground sources of drinking water, and 9,014 feet of 7-inch steel production casing, cemented to protect underground sources of drinking water. The injection zone will be in the Inyan Kara Formation. Injection water will be produced water from the Pronghorn 32P-29-20H and Tecton 2-1H wells producing from the Red River Formation ("B" zone). There are no other wells located within the one-half mile area of review, or maximum calculated radius of influence. Injection into this well will not affect any underground sources of drinking water.

Water from the Inyan Kara Formation, near the proposed injection well, has a total dissolved solid content of less than 10,000 milligrams per liter; therefore, an aquifer exemption is required to conduct injection operations at this well. The Secretary recommends granting a 1,500-foot radius aquifer exemption in the Inyan Kara Formation around the proposed injection well. The Secretary has made this recommendation because the Inyan Kara Formation, near the proposed injection well, does not currently serve as a source of drinking water, is not expected to supply a public water system, and will not serve as a source of drinking water in the future because its location and depth make recovery of water for drinking water purposes economically impractical.

The requested maximum injection pressure is 1,532 pounds per square inch and the requested duration of this application is 20 years or the time required to inject 43,800,000 cumulative barrels of water, whichever comes first.

The Secretary recommends approval of the application with the following conditions:

- 1) Injection operations authorized under the permit to inject must be conducted in accordance with SDCL Chapter 45-9, ARSD 74:12 and any applicable orders or rules promulgated by the board;
- 2) The total number of barrels injected during the life of this permit may not exceed 43,800,000 barrels of water;
- 3) The maximum injection rate must not exceed 6,000 barrels of water per day;
- 4) The life of the permit may not exceed 20 years;

- 5) The maximum pressure must not exceed 1,532 pounds per square inch surface pressure during injection operations;
- 6) Prior to the commencement of injection, a water compatibility analysis of the water to be injected and water from the injection formation at the Gunderson 31P-30-19H well must be completed and submitted to the department for review. If the analysis indicates the waters are incompatible, action must be taken to prevent potential damage to the injection well or the injection formation;
- 7) Prior to the commencement of injection, the Secretary's recommended Aquifer Exemption for this operation must be approved by the United States Environmental Protection Agency;
- 8) A mechanical integrity test must be successfully conducted prior to the commencement of injection activity. The well must pass the mechanical integrity test at 1,000 pounds per square inch surface pressure. The operator is required to notify the Secretary a minimum of 72 hours prior to running a mechanical integrity test;
- 9) Once mechanical integrity is established, the well must be retested at least once every five years to ensure that mechanical integrity is maintained, unless the department indicates differently;
- 10) If an unsuccessful pressure test occurs, the operator must cease operations immediately if it is determined the injection will threaten any underground source of drinking water. If the failure is not threatening ground water, the operator must cease operations within 48 hours after receipt of the department secretary's notice, and take corrective action on the well as soon as feasible. Corrective action options include repairing the well so that a successful test result can be obtained, plugging and abandoning the well, or any other action approved by the department.

Authority for the Secretary to approve this application is contained in ARSD 74:12:07 and 74:12:09. Unless a person files a petition requesting a hearing on the above application pursuant to the provisions of ARSD 74:09:01 on or before October 8, 2014, the Secretary's recommendation will be considered final and the Secretary will approve the application in accordance with that recommendation.

The application and notice of recommendation are also posted on the department's website at: <http://denr.sd.gov/des/og/pubhearing.aspx>. Additional information about this application is available from Brian Walsh, Environmental Scientist III, Ground Water Quality Program, Department of Environment and Natural Resources, 523 East Capitol Avenue, Pierre, SD 57501, telephone (605) 773-3296, email brian.walsh@state.sd.us.

September 18, 2014



Steven M. Pirner
Secretary

Published once at the total approximate cost of _____.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8

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OCT 24 2014

RECEIVED

OCT 30 2014

Dept. of Environment &
Natural Resources
GROUND WATER QUALITY

Ref: 8P-W-UIC

Mr. Brian Walsh, Environmental Scientist III
Groundwater Quality Program
South Dakota Department of Environment and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3182

RE: Aquifer Exemption Approval:
Inyan Kara Formation
Zenergy Operating Company
Gunderson 31P-30-19H Salt Water Disposal
Well, Harding County, South Dakota
API # 40-063-20761

Dear Mr. Walsh:

The U.S. Environmental Protection Agency Region 8 (EPA) Underground Injection Control (UIC) staff has reviewed your request on behalf of Zenergy Operating Company (Zenergy) regarding an aquifer exemption (AE) in the Border Field located in Harding County, South Dakota, for the Gunderson 31P-30-19H well. Based on the review of the supporting information provided by the South Dakota Department of Environment and Natural Resources (DENR), and pursuant to 40 CFR section 144.7(b)(3) and the EPA Ground Water Protection Branch (GWPB), Guidance #34, the EPA offers concurrence with the AE. The AE was requested in conjunction with a DENR permit action.

Zenergy is the operator of producing wells in the Border Field of Harding County, inclusive of the lands upon which the Gunderson 31P-30-19H well is located (SE ¼ SE ¼ of Section 31, Township 23 North, Range 3 East, Harding County, South Dakota). This request is connected to Zenergy's request to the DENR for a permit approving the conversion of the Gunderson 31P-30-19H oil-producing well to a salt water disposal (SWD) injection well.

APPROVAL OF PROPOSED AQUIFER EXEMPTION: Based on the EPA's review of the supporting documentation provided by the DENR, and pursuant to the Code of Federal Regulations at 40 CFR 144.7(b)(3) and the EPA's Groundwater Protection Branch Guidance #34, the EPA hereby approves a non-substantial program revision to include exemption of the Inyan Kara Formation within 1,615 feet of the Gunderson 31P-30-19H well, located at SESE Section 31, Township 23 North, Range 3 East, between the approximate depths of 4,251 – 4,572 feet, in Harding County, South Dakota. The Carlisle Shale lies directly above and the Swift Shale lies directly below this exempted zone.

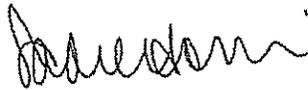
Based on our review of the information provided, the EPA is approving the aquifer exemption using the regulatory criteria listed below:

- this portion of the aquifer does not currently serve as a source of drinking water (40 CFR §146.4(a)),
- it cannot now and will not in the future serve as a source of drinking water because it is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical (40 CFR §146.4(b)(2)), and
- The Total Dissolved Solids (TDS) is between 3,000 and 10,000 milligrams per liter (40 CFR §146.4(c) and it is not reasonably expected to supply a public water system.

EPA's approval is limited to this 1,615 foot radius at this location and the injection activities described herein. Additional approvals by EPA may be required for additional injection activities at this project site. Enclosed please find the ROD, which provides the rationale supporting our decision. EPA maintains its discretion to approve or disapprove future AE requests. The EPA's determination that the 40 CFR § 146.4 criteria are met in this case should not be construed as binding on or indicative of EPA's future AE decisions. The EPA maintains discretion to disapprove an AE request, even when the 40 CFR § 146.4 criteria are met.

Should you have questions or concerns, please contact me at (303) 312-6434, or have your staff contact Bruce Suchomel at (303) 312-6001.

Sincerely,



 Callie A. Videtich
Acting Assistant Regional Administrator
Office of Partnerships and Regulatory Assistance

Enclosure: Record of Decision

cc: Robert EU Smith, OGWDW

U.S. EPA Region 8
Underground Injection Control (UIC) Program
October 7, 2014

AQUIFER EXEMPTION RECORD OF DECISION

This Record of Decision provides EPA's aquifer exemption (AE) decision, background information concerning the AE request, and the basis for the AE decision.

Regulatory Agency: South Dakota Department of Environment and Natural Resources (DENR)

Date of Aquifer Exemption Request: September 18, 2014

Substantial or Non-Substantial Program Revision: Non-Substantial

Basis for Substantial or Non-Substantial Determination: Although EPA must approve all revisions to EPA-approved state Underground Injection Control (UIC) programs, the process differs depending on whether EPA treats the revision as a substantial or non-substantial program revision. EPA treated this as a non-substantial program revision because it is associated with the issuance of a site-specific Class II UIC permit action, not a state-wide programmatic change or a revision with implications for the national UIC program. The decision to treat this as a non-substantial program revision is also consistent with EPA's "Groundwater for Review and Approval of State UIC Programs and Revisions to Approved State Programs" (Guidance 34). EPA's Guidance 34, explains that the determination as to whether a program revision is substantial or non-substantial is made on a case-by-case basis, and with the exception of AEs associated with certain Class II wells or exemptions not related to action on a permit, AE requests are typically treated as non-substantial program revisions.

Operator: Zenergy Operating Company (Zenergy)

Well Class/Type: Class II Salt Water Injection Well

Well/Project Name: Gunderson 31P-30-19H/Red River B

Well/Project Permit Number: Gunderson 31P-30-19H well

Well API number: 40-063-20761

Field: Border

Tribal Reservation: N/A

Well/Project Location: SE ¼ SE ¼ of Section: 31 Township: 23N Range: 3E

County: Harding **State:** SD

DESCRIPTION OF PROPOSED AQUIFER EXEMPTION (depths are approximate values at the well bore)

Aquifer to be Exempted: Inyan Kara Formation **Top:** 4,251 feet **Bottom:** 4,572 feet

Thickness of Exempted Aquifer: Approximately 321 feet.

Lithology: Several layers of confining shale.

Water Quality – Total Dissolved Solids (TDS) in milligrams per liter (mg/l): 4,200 to 8,043

Areal Extent of Aquifer (i.e. radial distance, encompassed TSR): 1,615 feet from the wellbore. The radial extent of the exemption is recommended to be a 1,615 foot radius, though DENR requests for a 1500 foot radius. The application's Radius of Influence Calculation uses a porosity of 0.25, which is an

optimal porosity. Applying a safety factor, using a porosity of 0.20, accounts for the slightly larger recommended radius around the wellbore.

Injection Volume Limitation: The total number of barrels injected during the life of the permit shall not exceed 43,800,000 barrels of water. This, along with the areal extent of the injection, shall be enforced by the DENR.

Confining Zone(s): The upper confining zone is divided into three confining layers of shale. The Graneros Group (immediately above the Inyan Kara Formation) is between 4,081 and 4,251 feet; the Carlisle Shale is between 3,761 and 4,081 feet; and the Pierre Shale lies above with an approximate thickness of 2,800 feet. The lower confining zone is divided into two layers of shale. The Swift Shale (immediately below the Inyan Kara Formation) is between 4,572 and 4,662 feet and the Opeche Shale lies above the uppermost USDW of the lower USDWs, but below the Swift Shale and is 100 feet thick. These upper and lower confining units, like the injection formation, are continuous across the exemption area.

BACKGROUND

The U.S. Environmental Protection Agency Region 8 (EPA) Underground Injection Control (UIC) staff has reviewed the DENR's request on behalf of Zenergy regarding an AE in the Border Field located in Harding County, South Dakota, for the Gunderson 31P-30-19H well. Based on the review of the supporting information provided by the DENR, and pursuant to 40 CFR section 144.7(b)(3) and the EPA Ground Water Protection Branch (GWPB), Guidance #34, the EPA offers concurrence with the AE. The AE was requested in conjunction with a DENR permit action.

Zenergy is the operator of producing wells in the Border Field of Harding County, inclusive of the lands upon which the Gunderson 31P-30-19H well is located. This request is connected to Zenergy's request to the DENR for a permit approving the conversion of the Gunderson 31P-30-19H oil-producing well to a salt water disposal (SWD) injection well.

USDW(s): Above the injection zone (IZ) are two USDWs, the Hell Creek and Fox Hills formations. These USDWs are separated by several confining shale formations. Below the IZ are two potential USDWs, the Minnelusa and the Madison formations, which are separated from the IZ by confining shale formations.

Injectate Characteristics: The fluid to be injected will be production water primarily from two nearby oil production wells. Therefore, the water quality of the injectate will likely be variable, and can be anywhere between 19,982 and 52,685 mg/l TDS, as shown from water samples taken from these two wells.

BASIS FOR DECISION

Regulatory Criteria under which the exemption is requested

40 CFR Section 146.4(a): The formation is not currently used as a drinking water supply for at least a ½ mile radius, which exceeds the calculated 1,615 foot approved exemption. No producing, injection, or abandoned wells are within the ½ mile area of review (AOR). According to the South Dakota water well completion reports, there are no active or abandoned water wells within the AOR.

40 CFR Section 146.4(b)(2): The formation is not likely to be used in the future as a source of drinking water because of depth (over 4,200 feet). The AE is approximately 26 miles northwest of the nearest public water supply system in Buffalo, South Dakota, which is served by the Hell Creek and Fox Hills aquifers. Water from the Fox Hills formation is readily available in the area of the proposed injection well. Given the availability of an adequate, shallower, better quality aquifer it is likely that it would be

economically or technologically impractical to construct and operate (including treatment) a drinking water well in the proposed injection formation. The estimated cost to drill a well to the Inyan Kara formation depth of 4,250 feet is \$233,750, while drilling to the Fox Hills aquifer at only 400 feet costs \$10,000 (DENR estimates furnished with application). Also of note the population of Harding County decreased 47% between 1960 and 2010 (DENR provided statistics). Even with a slight increase in population estimates show that by 2020 there would be 7,716 acre-feet of recoverable Fox Hills water per person in Harding County, compared to the average individual American's needs of 75 gallons per day (DENR provided statistics). Based on this information there is a sufficient quantity of water available in the Fox Hills aquifer to easily serve the current and future population of Harding County without the development of the exempted portion of the injection zone.

40 CFR Section 146.4(c): The TDS is between 3,000 and 10,000 mg/l and it is not reasonably expected to supply a public water system. Between 2006 and 2013 four water samples were taken from the same Inyan Kara formation from two nearby wells. These samples showed the formation water to have the following TDS values:

- 2/22/06 NBRRU M-21 (9.1 miles to the SE): 6,702 mg/l
- 2/23/06 NBRRU M-21 (9.1 miles to the SE): 7,318 mg/l
- 3/02/06 NBRRU M-21 (9.1 miles to the SE): 8,043 mg/l
- 5/02/13 SBRRU 32-33A (14.25 miles to the SE): 4,200 mg/l

The DENR, as part of the conditions of the UIC permit, will require Zenergy to collect an Inyan Kara water sample for analysis from the Gunderson 31P-30-19H well. This zone is not reasonably expected to supply a public water system due the economic and technological impracticality of drilling to this depth, and to the availability of an adequate, shallower, better quality aquifer (refer to 40 CFR Section 146.4(b)(2) above).