

FILE COPY



**DEPARTMENT of ENVIRONMENT  
and NATURAL RESOURCES**

PMB 2020  
JOE FOSS BUILDING  
523 EAST CAPITOL  
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

May 9, 2013

Peter MacIntyre  
Continental Resources  
20 N. Broadway  
Oklahoma City, OK 73102

Dear Mr. MacIntyre:

Re: Case No. 05-2013 – approval of permit to inject

Thank you for your application filed February 1, 2013, requesting a permit to inject into the existing SBRRU 32-33A well in Harding County, South Dakota.

The department published a Notice of Recommendation for Case No. 05-2013, recommending approval of the application. The date for intervention was April 16, 2013, and no parties petitioned the Board of Minerals and Environment for a hearing on the application by the deadline.

In order to inject production water into the SBRRU 32-33A well an EPA approved aquifer exemption was required. EPA has approved the aquifer exemption (see enclosed approval letter). However, based on the construction of the injection well, EPA recommended additional, Part II mechanical integrity testing (i.e., temperature log) be performed prior to commencing injection. Therefore, in addition to the conditions described in the enclosed Notice of Recommendation, Continental must conduct Part II mechanical integrity testing at the well prior to commencing injection activities.

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 compliance with all applicable requirements of South Dakota Codified Laws 45-9 and ARSD 74:12.

Thank you for your interest in protecting the water resources of the state.

Sincerely,

A handwritten signature in black ink, appearing to read "Steven M. Pirner", is written over a horizontal line.

Steven M. Pirner  
Secretary

Enclosures

c: Lawrence Bender, Fredrikson & Byron, P.A., Bismarck, ND



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8

1595 Wynkoop Street  
DENVER, CO 80202-1129  
Phone 800-227-8917  
<http://www.epa.gov/region08>

MAY 07 2013

Ref: 8P-W-UIC

Mr. Steven M. Pirner, Secretary  
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 Group near the Continental  
Resources, Inc. 32-33A Saltwater Disposal  
Injection well, Harding County, South Dakota,  
and Underground Injection Control (UIC)  
Program revision approval

Dear Mr. Pirner:

As requested, the U.S. Environmental Protection Agency Region 8 (EPA) Water Program office has reviewed the notices of, and supporting information for, the proposed South Dakota Department of Environment and Natural Resources (DENR) designation of the Inyan Kara Group near the Continental Resources, Inc. (Continental) 32-33A Saltwater Disposal (SWD) injection well, Harding County, South Dakota, as an exempted aquifer.

This request is connected with the Continental proposal for the 32-33A well to be used for disposal into the Inyan Kara Group of salt water produced from nearby oil production wells in the Buffalo Field. The DENR UIC permit number for this well is 733-b and the American Petroleum Institute (API) number for this well is 40-063-20094.

**APPROVAL OF PROPOSED AQUIFER EXEMPTION:** Based on review of the supporting information provided by MBOGC, 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 Group within one-quarter (1/4) mile of the Continental 32-33A SWD injection well, located at SWNE Section 33, T21N-R4E, between the approximate depths of 4,445 feet (ft.) to 4,672 ft., Harding County, South Dakota.

This approval is based in part on the information provided by DENR showing that the Inyan Kara Group in the vicinity of the proposed Continental 32-33A injection well is not presently used as a source of drinking water. Also, the Inyan Kara Group, due to the well's depth and location, is not reasonably expected to supply a public water system due primarily to the higher costs of well construction and water treatment (economically impracticable), given the availability of higher quality shallow aquifers in the

area. The specific exemption criteria that apply are listed at 40 CFR parts 146.4(a) and 146.4(b)(2)). This approval applies to the location and the injection activities described herein. Additional approvals may be required for additional injection activities.

**OVERVIEW:** The Continental 32-33A well is a former oil well (formerly owned by Koch Exploration Company) that is proposed to be converted to a UIC Class II SWD injection well. The well would be used to dispose of produced waters from the South Buffalo Red River Unit (SBRRU) of the Buffalo Field. Oil production in the area is primarily from the Red River Formation. The injection zone would be the Inyan Kara Group which is comprised of the Fall River Formation and the Lakota Formation (a.k.a., Dakota Formation). Both of these formations are predominantly sandstones.

The surface casing of this well was set at 775 ft. and cemented to surface and the top of cement outside the longstring casing is at a calculated depth of approximately 3,850 ft. in this well. However, the cement bond log shows the top of cement at approximately 4,675 ft. Therefore, it is strongly recommended that an additional demonstration of Part II Mechanical Integrity (e.g., temperature log) for the well be required by DENR to confirm that overlying USDWs, including the Fox Hills Formation, are adequately isolated from the injection zone in this well. Continental proposes to inject through perforations into the Inyan Kara Group between the depths of approximately 4,445 ft. to 4,672 ft. Water quality of the Inyan Kara Group was determined from analysis of a nearby well (SWD Well 34-32) to be approximately 4,445 mg/l total dissolved solids (TDS); therefore, the Inyan Kara Group may be considered to be an underground source of drinking water (USDW) in this area. The fluid to be injected will be primarily Red River Formation production water which may exceed 10,000 mg/l TDS.

There are no known drinking water supply wells withdrawing from the Inyan Kara Group in the vicinity of the 32-33A injection well. There is one water well within one-half (½) mile. That well is the Mike Butler water well which is approximately 2,673 ft. deep. The Fox Hills Formation is a relatively shallow USDW at a depth of approximately 400 ft. and is the primary source of drinking water in the area. The Fox Hills Formation currently provides an adequate supply of drinking water to residents in the general area. Also, the Fox Hills Formation is expected to provide an adequate supply of drinking water to residents in the general area in the future based on the relatively sparse population even with the current population growth rate of 4.9% (between 2010 and 2011). The estimated cost to drill and complete a water well in the Fox Hills Formation is approximately \$30,000. The estimated cost to drill and complete a water well in the Inyan Kara Group is approximately \$235,000. Also, the water quality of the Fox Hills Formation is better than the water quality of the Inyan Kara Group (the Fox Hills Formation has lower TDS values). As such, there would be less water treatment costs associated with the Fox Hills Formation. Therefore, given the availability of the shallower, higher quality Fox Hills Formation and due to economic considerations associated with well construction, well operation and water treatment it is unlikely that a water well would be constructed in the Inyan Kara Group.

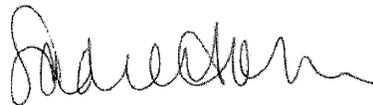
The upper confining layer includes the Graneros Group shales (hundreds of feet thick) which isolate the injection zone from the shallower aquifers. The lower confining layer includes the Morrison Formation shale (over 100 ft. thick) and other geologic strata which provide isolation beneath the injection zone. The DENR has limited the total volume of injectate to approximately 36,525,000 barrels to help ensure that the injectate remains in the exempted portion of the Inyan Kara Group. Also, the DENR has set the maximum allowable injection pressure (at least initially) as 1,300 psi. That will help ensure that the upper confining zone is not fractured by injection pressures.

On June 2, 1986, the EPA (which had primacy at the time) issued an aquifer exemption for the nearby (approximately one mile to the west southwest) Koch 34-32 SWD Well (now also owned by Continental) for the Inyan Kara Group. In that case the radius of the approved aquifer exemption was one mile. However, at the time of that approval the EPA did not establish a volume limitation. A volume limitation is useful (and is now typically used) to help ensure that the injectate will remain in the exempted portion of the aquifer. On April 16, 2013, DENR sent a letter to Continental which established a volume limitation for the 34-32 Well (in terms of barrels per day over a certain number of years of operation). That will help ensure that the injectate will remain in the exempted portions of the aquifers for the 34-32 and 32-33A Wells (which have cylindrical shapes that overlap).

The DENR recently held a public comment period on the proposed UIC permit and aquifer exemption for the 32-33A Well. The public comment period closed on April 16, 2013. No public comments were received by DENR during the public comment period.

Should you have questions or concerns, please contact Tom Aalto of my staff at (303) 312-6949.

Sincerely,



 Derrith R. Watchman-Moore  
Assistant Regional Administrator  
Office of Partnerships and Regulatory Assistance

cc: Bill Markley, DENR  
Tom Brandner, DENR  
Sheldon Hamann, DENR  
Brain Walsh, DENR  
Mike Lees, DENR  
Robert EU Smith, OGWDW

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

IN THE MATTER OF THE APPLICATION OF CONTINENTAL RESOURCES, INC., OKLAHOMA CITY, OKLAHOMA, FOR APPROVAL OF A PERMIT TO INJECT PRODUCTION WATER INTO THE EXISTING SBRRU 32-33A WELL LOCATED IN THE SW ¼ NE ¼ SECTION 33, TOWNSHIP 21 NORTH, RANGE 4 EAST, IN THE SOUTH BUFFALO RED RIVER UNIT, HARDING COUNTY, ABOUT 12 MILES NORTHWEST OF BUFFALO, SOUTH DAKOTA.

NOTICE  
OF  
RECOMMENDATION  
FOR A PERMIT TO INJECT

OIL AND GAS  
CASE NO. 5-2013

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 SBRRU 32-33A well was completed with 755 feet of 8 5/8-inch steel surface casing, cemented to protect underground sources of drinking water, and 8,585 feet of 7 7/8-inch steel production casing, cemented to protect underground sources of drinking water. The well will be converted for injection including the addition of a cement plug at 6,335 feet and perforations between 4,445 and 4,672 feet. The injection zone will be in the Inyan Kara Formation. All injection water will be produced water from the SBRRU Central Tank Battery. All wells within the one-half mile area of review are constructed such that the 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 one-quarter mile 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 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 life of the permit may not exceed 25 years;
- 3) 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;
- 4) Prior to the commencement of injection, a water compatibility analysis of the water to be injected and water from the injection formation must be completed and submitted to the department for review. If the analysis indicates the waters are incompatibility, action must be taken to prevent potential damage to the injection well or the injection formation;

- 5) The maximum injection rate may not exceed 4,000 barrels of water per day during injection operations;
- 6) The maximum surface injection pressure may not exceed 1,300 pounds per square inch during injection operations;
- 7) A mechanical integrity test must be successfully conducted prior to commencement of injection. The well casing 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;
- 8) 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;
- 9) 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 April 16, 2013, the Secretary's recommendation will be considered final and the Secretary will approve the application in accordance with that recommendation. For additional information about the application, please contact Brian Walsh, Environmental Scientist III, Ground Water Quality Program, Department of Environment and Natural Resources, 523 East Capitol Avenue, Pierre, SD 57501; 605.773.3296 or email [brian.walsh@state.sd.us](mailto:brian.walsh@state.sd.us).

March 28, 2013



Steven M. Pirner  
Secretary

Published once at the total approximate cost of \_\_\_\_\_.