UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
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http://www.epa.gov/region08

Ref: 8P-W-UIC

Don Smith
Slawson Exploration CO, Inc.
1675 Broadway, Suite 1600
Denver, Colorado 80202-4714

RE: Public Notice for Proposed Aquifer Exemption and Related Draft Major Permit Modification
Formation: Inyan Kara of the Dakota Group
Well: Big Bend 1-5 SWD
UIC Permit No: ND22184-08837
Fort Berthold Indian Reservation
Mountrail County, North Dakota

Dear Mr. Smith:

The purpose of this letter is to notify you that the U.S. Environmental Protection Agency Region 8 (EPA) is preparing to public notice draft decisions to approve your application for an aquifer exemption for the Inyan Kara Formation of the Dakota Group and a related draft major permit modification pertaining to the Big Bend 1-5 salt water disposal (SWD) well located in the Big Bend Field. Your aquifer exemption application was received by the EPA on February 13, 2014.

The EPA has made a draft decision that an aquifer exemption should be granted for the Inyan Kara Formation of the Dakota Group for the Big Bend 1-5 SWD injection well based on the following criteria:

1) The aquifers do not currently serve as sources of drinking water (40 CFR 146.4(a)),
2) The aquifers cannot now and will not in the future serve as sources of drinking water because of depth making recovery of water for drinking water purposes economically impractical (40 CFR 146.4(b)(2)); and
3) The total dissolved solids (TDS) content of the aquifers is more than 3,000 and less than 10,000 mg/l and the aquifers are not reasonably expected to supply a public water system (40 CFR 146.4(c)).

The specific extent of the proposed aquifer exemption will be within 1900 feet of the Big Bend 1-5 SWD well located in the SENW, Section 5 T151N R92W. The approved injection zone includes the Inyan Kara Formation of the Dakota Group from the depth of 4,845 to 5,261 feet. The total dissolved solids (TDS) of the Inyan Kara Formation was found to be a range from 6,510 to 9,170 mg/L after 715 swab volumes (bbls).

Immediately above the injection zone and within the Dakota Group are the Skull Creek Shale and Mowry Shale (368 feet thick). Above the Dakota Group is the Colorado Group (899 feet thick), consisting of the Belle Fourche Shale (211 feet), Greenhorn Shale (188 feet), Carlile Shale (234 feet), and Niobrara Shale (266 feet). Also, above the Colorado Group is the Montana Group consisting of the Pierre Shale, which is 1899 feet thick in the Big Bend 1-5 SWD well area. USDWs in the Big Bend Field located above the injection zone are protected by approximately 3,000 feet of impermeable shale as listed above.

The upper confining zone consists of the Mowry Formation shale in the depth interval 4,488-4,845 feet below ground surface. The lower confining zone consists of the Swift Formation from 5,261-5,707 feet below ground surface. The confining zones and cement through these zones have been determined by the EPA to be adequate to prevent the movement of fluid from the injection zone to any known or potential underground sources of drinking water (USDWs) above or below the injection zone. A cement bond log was reviewed to determine adequate cement exists behind pipe through the confining zones. To determine that the confining zones are continuous, (18) gamma ray logs were reviewed along the north-south and east-west trending axis.

The Missouri River/Lake Sakakawea is the primary source of drinking water for most of the Reservation. The lake holds a permanent pool of 4,980,000 Ac-Ft with a top range of 23,821,000 Ac-Ft with a useable volume up to 18,841,000 Ac-ft. Lake Sakakawea currently provides drinking water for Four Bears, Mandaree, Parshall, Twin Buttes and White Shield.

The principal USDWs in the area of the proposed aquifer exemption are the New Town Aquifer and Sanish Aquifer. The list below shows the approximate depth and TDS of other common water sources that are available.

Name	Depth	TDS mg/L
Coleharbor Formation	0’	
Bullion Creek Formation	23’	2,110
Cannonball Formation	558’	
Hell Creek Formation	1,043’	1,530
Fox Hills Formation	1,413’	1,530

The nearest USDW to the proposed injection zone is the Fox Hills Formation. In this area, the Fox Hills Formation is approximately 290 feet thick with the top of the formation located at 1,413 feet below ground surface. The amount of separation between the injection zone and the Fox Hills Formation is 3,315 feet. The Hell Creek and Fox Hills formations are connected hydrologically and are therefore considered to be a single aquifer. This combined aquifer underlies the entire Reservation and ranges from 100 to 350 feet in thickness.

Based on the North Dakota State Water Commission public records, there are no drinking or stock wells completed into the Inyan Kara Formation in Townships 150N, 151N and 152N for Ranges 91W, 92W, and 93W. The deepest well on the New Town Peninsula is 960 feet deep and located at NESE Township 151N Range 93W Section 3. The nearest wells are approximately 3.5 miles north of the Big Bend 1-5 SWD and serves as public water supply or the city of New Town, ND. The New Town city water supply consists of three (3) ground water wells penetrating the New Town Aquifer.

The information below provides additional information about New Town's groundwater sources:

Well ID	Aquifer	Depth
152-092-19AA	New Town	175'
152-092-19AAA	New Town	173'
152-092-20BBb	New Town	184'

The estimated costs to develop the proposed exempted aquifer as a water supply source including any treatment costs and costs to develop alternative water supplies is discussed below. It includes costs for well construction, transportation, and water treatment for each source.

The primary factor controlling the cost of developing the proposed exempted aquifer as a water supply source is depth and water quality. As shown above, the Inyan Kara is found at approximately 4,898 feet below land surface, with a total depth of 5,444 feet below ground surface. In contrast, the better quality Fox Hills/ Hell Creek formation is available at approximately 1,413 feet below land surface and an approximate total depth of 1,710 feet, with several other acceptable formations at shallower depths.

In your application, you reported the following information regarding cost analysis. Slawson recently drilled, cased, and partially perforated the Big Bend 1-5 SWD for a cost of $1,085,900. These costs represented do not include location construction or surface equipment, as it is assumed that these additional costs would be the same for each formation.

Aquifer	Depth (TD)	Estimated TD well cost
Unnamed	200'	$ 6,200
New Town	200'	$ 40,000
Ft. Union	900'	$ 60,000
Fox Hills	1,805'	$280,000
Inyan Kara	5,444'	$1,085,900

As can be observed above, drilling cost varies by depth, size of hole, and contractor. The estimated total depth drilling cost to drill an Inyan Kara water supply well exceeds the cost of drilling a Fox Hills water supply well by an estimated $805,900, with additional savings and shallower depths. Therefore, based on cost, the quantity, and quality of the water available in the Fox Hills/Hell Creek aquifers and other supplies located at shallower depths, the proposed exempted aquifer is situated at a depth which makes recovery for USDW purposes economically impractical.

In an action related to the aquifer exemptions, as a major permit modification, the EPA has made a draft decision to modify Appendix C of the underground injection control (UIC) permit for the Big Bend 1-5 SWD well to include a limitation on the volume of injectate that may be injected into the well during its operational life. The EPA plans to limit the total maximum volume of injectate that may be injected in the well to 71,500,000 barrels. This is based on conservative EPA estimates for overall average injection zone porosity of 20% for the Inyan Kara Formation. The actual porosity over the 177 feet of perforated intervals was determined to be 21.58%. As actual porosity values for the injection zone may vary away from the wellbore (out to a distance of 1,900 feet), this conservative approach (using reduced values for porosity) will help ensure that injectate will remain in the exempted portions of Inyan Kara Formation.

The EPA draft decision and associated Addendum to the Statement of Basis, which provides additional information, are enclosed. In accordance with 40 CFR Part 124, the EPA plans to issue a public notice announcement pertaining to the draft decision for the proposed aquifer exemption and draft major permit modification in the Minot Daily News and New Town News newspapers soon. A copy of the Public Notice is also enclosed. The EPA will accept comments from the public on the proposed actions for 30-days. The EPA will address any significant comments received during the public comment period. If no significant comments are received, the EPA plans to finalize its approval of the aquifer exemption and related permit modification in accordance with 40 CFR Part 124 and 40 CFR Sections 144.7(b), and144.39.

If you have questions or concerns, please contact Craig Boomgaard of my staff at (303) 312-6794.

Sincerely,

Douglas Minter
Acting UIC Program Unit Chief
Office of Partnerships and Regulatory Assistance

Enclosures:

1) Public Notice
2) Draft Aquifer Exemption Form
3) Draft Major Permit Modification to Appendix C
4) Addendum to the Statement of Basis

cc:

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cc: Cover Letter Only
Tex Hall. Chairman
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