U.S. EPA Region 8

Underground Injection Control Program

AQUIFER EXEMPTION RECORD OF DECISION

This Draft 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: U.S. EPA Region 8

Date of Aquifer Exemption Application Request: September 21, 2020

Operator: Slawson Exploration Company, Inc.

Well Class/Type: Class II Salt Water Disposal (SWD)

Well/Project Name: Big Bend 3-6 SWD

Well/Project Permit/Docket Number: ND22361-11336

Well API number: 33-061-04676

Field: Big Bend Field

Tribal Reservation: Ft. Berthold Reservation

Well/Project Surface Location: Section 6 Township 151N Range 92W

Footage Calls: 250 feet from N line; 200 feet from W line

County: Mountrail **State**: North Dakota

Latitude: 47.933690º **Longitude:** -102.513281º

Substantial or Non-Substantial Exemption:

The action before EPA is not a state program revision, but rather an approval of an AE in a federally administered program. The process is treated similarly and requires EPA to determine whether the proposed AE is a major or minor (i.e., substantial or non-substantial) exemption. The process is discussed in a Federal Register Notice Preamble at 48 Fed. Reg. 40098, 40108 (September 2, 1983); see also 49 Fed. Reg. 20138, 20143 (May 11, 1984). EPA has determined this proposed AE is a minor exemption because it is associated with the issuance of a site-specific UIC Class II permit action, not a state-wide programmatic change or a revision with implications for the state-wide or national UIC

program. The decision to treat this AE as a minor exemption is also consistent with the corresponding state program revision process detailed in EPA Guidance 34: Guidance for Review and Approval of State Underground Injection Control (UIC) Programs and Revisions to Approved State Programs. Guidance 34 explains that the determination as to whether an exemption is substantial or non-substantial is made on a case-by-case basis, and with the exception of AEs associated with certain Class I wells or exemptions not related to action on a permit, AE requests are typically treated as minor actions/non-substantial decisions.

PROJECT BACKGROUND INFORMATION

The Big Bend 3-6 SWD well will dispose of produced Bakken and Three Forks Formation waters from the New Town peninsula area, which is located south of New Town, North Dakota. Most of the water will be piped to the well, with the remaining water trucked in. Slawson stated on the application that the Big Bend 3-6 SWD well will reduce truck traffic on the roads to prevent air pollution and simultaneously increase road safety. Slawson's goal is to pipe as much water as possible to the Big Bend 3-6 SWD well, minimizing water truck and hauling traffic.

DESCRIPTION OF PROPOSED AQUIFER EXEMPTION

(depths are approximate values at the well bore):

The requested aquifer exemption is for the Inyan Kara Formation (also referred to as the Dakota or Dakota Sandstone). The lnyan Kara is commonly utilized in North Dakota as an injection interval for Class II fluids.

Aquifer(s) to be Exempted

Formation: Inyan Kara Formation (Dakota Group) *Top:* 4,892 feet true vertical depth (TVD)
Bottom: 5,348 feet TVD

Lithology: Sandstone

Total Surface Area of Aquifer to be Exempted*:*

The radius of the AE is 2,904 feet or 0.55 miles from the well bore. This translates to an injection volume of 146,000,000 bbls (proposed life-span injection volume of 20 years), net injection-zone thickness of 183 feet, and porosity of 0.19.

DEMONSTRATION THAT THE INJECTATE WILL REMAIN IN THE EXEMPTED PORTION OF THE AQUIFER

The net sand thickness was estimated as 183 feet of clean sands within the Inyan Kara at this location. The average porosity value for the clean sands in the injection zone was estimated by the operator as 19% on the basis of neutron- and density-porosity logs, which indicate the Inyan Kara in the vicinity of the subject well generally has a porosity value between 19% and 25%.

Based on the estimates above, the Big Bend 3-6 SWD can inject no more than 146,000,000 bbls of produced water (to fill the pore space) into the Inyan Kara Formation to ensure that fluids remain within the area proposed for exemption. Additionally, upper and lower confining zones have been identified and verified by analyzing the gamma-ray logs associated with the cement bond logs to confine the fluids within the injection zone. Should this aquifer exemption be approved, the permit will be modified to enforce a limit on the volume of injected fluids noted above.

WATER QUALITY DATA OF THE AQUIFER PROPOSED FOR EXEMPTION

Aquifer Water Quality – TDS (mg/L): Ranged from 5,085 to 5,443

Source of WQ Data: On August 24, 2020, Slawson collected five water samples from the Inyan Kara Formation (Dakota Group) at the Big Bend 3-6 SWD well. The samples were analyzed by Astro-Chem Lab, Inc.

Confining Zones

Upper: Belle Fourche, Greenhorn, Carlile, Niobrara, and Pierre Shales *Lithology:* Shale

Top: 2,000 feet TVD *Bottom:* 4,892 feet TVD *Thickness:*2,892 feet

Lower: Jurassic Swift *Lithology:* Shale

Top: 5,349 feet TVD

Above the Dakota Group is the Colorado Group, which is 1,216 feet thick, consisting of the Belle Fourche Shale (228 feet), Greenhorn Shale (170 feet), Carlile Shale (243 feet) and Niobrara Shale (255 feet). Also, above the Colorado Group is the Montana Group consisting of the Pierre Shale, which is 1,666 feet thick at the Big Bend 3-6 SWD well.

Below the injection zone, the lower confining zone consists of the Jurassic Swift Formation. This lower confining unit consists primarily of impermeable shales. Thickness and bottom depths are not available

since the well did not penetrate the entire formation, which keeps the confining zone uncompromised. The thickness of the Swift Formation is approximately 430 feet thick based on wells in the area.

IDENTIFICATION OF OTHER USDWS IN THE AREA

The principal sources of drinking water in the area of the proposed aquifer exemption are the New Town aquifer and the Sanish/White Shield aquifer which are USDWs that are between 0 and 237 feet below the ground surface. Additionally, other USDWs within the region include the Fort Union Group (which is also used to supply domestic water wells), the Sentinel Butte, Hell Creek and Fox Hill aquifers. These units are found between 237 feet and 1,688 feet below the ground surface.

Water resources of the New Town peninsula and Fort Berthold Indian Reservation occur as readily-available ground water in bedrock and buried-valley aquifers and as surface water in Lake Sakakawea. Figure shows the water resources for the peninsula.

Resource	Mean TDS (mg/L)	Approximate peninsula (Volume Ac-Ft)
Sentinel Butte Formation	1,300	1,250,500
Tongue River Formation	2,110	1,925,500
Fox Hills/Hell Creek Formation	1,530	4,091,600
New Town Aquifer	1,390	127,500
Sanish Aquifer	1,350	240,000
Total New Town peninsula water available (Ac-Ft) 7,635,100 (Reference USGS Report 98-4098 pgs. 1, 10, 18, 23, 37, 39).		

Figure 1 – Total New Town Peninsula Water Available

DISTANCE FROM THE PROPOSED EXEMPTED AQUIFER TO PUBLIC WATER SUPPLIES

A survey was conducted using a one-half (½) mile buffer zone outside the exempted area, and no water wells that tap the aquifer to be exempted are within the area. The proposed aquifer exemption is approximately three miles south of the nearest public water supply for the city of New Town, ND. The New Town city water supply consists of three (3) groundwater wells penetrating the New Town Aquifer. Figure 4 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’

Figure 2 – New Town City Groundwater Supply Wells

INJECTATE INFORMATION

The injectate is water produced from oil-gas wells proximate to the Big Bend 3-6 SWD injection well. Both the Bakken and Three Forks Formation waters contain high concentrations of chlorides, sodium and some calcium, making the physical characteristics of the two waters very similar with total dissolved solids (TDS) up to 344,000 PPM as published in the Catalog of North Dakota Water Chemistries. These waters have no secondary use and therefore are disposed of in Class II SWD wells.

ESTIMATED COSTS TO DEVELOP THE PROPOSED EXEMPTED AQUIFER AS A WATER SUPPLY

The primary factor controlling the cost of developing the proposed exempted aquifer as a water supply source is depth and water quality. The top of the Inyan Kara at the proposed location is approximately 4,892 feet below land surface with the base of the formation at approximately 5,348 feet below land surface. In contrast, the better-quality Fox Hills and Hell Creek Formations are available between approximately 1,000 and 1,635' below land surface with several other acceptable formations at shallower depths.

A verbal estimate[1] provided by Backman Drilling (701-734-6667) located in Wilton, ND indicated a cost for 5" cased domestic wells as $31.00/foot. Agri Industries Inc. (Williston, ND) also provided verbal information for 10” cased industrial wells producing 100-200 gallon per minute. A 200' well was approximately $40,000, a 900' Ft. Union well was around $60,000 and a 1600' Fox Hills well was approximately $150,000. Dennis Water Well Service located in New Town, ND (701.627.2390) provided a verbal quote of $280,000 to drill a Fox Hills well. These costs do not include location construction or surface equipment, and 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[1]
New Town	200'	$ 40,000
Ft. Union	900'	$ 60,000
Fox Hills	1,805'	$280,000
Inyan Kara	5,444'	$1,085,900

Figure 3 – Estimated Well Cost Depth Comparison

Drilling costs varies by depth, size of hole, and contractor. The estimated total depth and 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 of water for drinking water purposes economically or technologically impractical.

[1] Domestic well only, other wells are commercial with larger casing sizes for larger production volumes. Conversations held February 2014.

BASIS FOR PROPOSED DECISION

Regulatory Criteria under which the aquifer exemption is requested.

1. **146.4 (a)** The exempted aquifer does not currently serve as a source of drinking water.
2. **146.4 (b) (2)** It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical.

PROPOSED CONCLUSION AND DECISION

Based on review of the entire record, EPA finds that exemption criteria 40 CFR §§ 146.4(a) and 146.4(b)(2) have been met, and EPA proposes to approve exemption of portions of the Inyan Kara Formation as a minor aquifer exemption.

12/11/2020

X DRAFT

Signed by: SARAH BAHRMAN

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