

## STATEMENT OF BASIS FOR AQUIFER EXEMPTION

### Smith-Highlands-Reynolds Ranch In-Situ Recovery Project Converse County, Wyoming UIC Permit No. 14-293 July 20, 2015

#### General Information

History: Cameco Resources is requesting to combine Underground Injection Control (UIC) permit 09-054 (Smith-Highlands) with UIC permits 04-611 (Reynolds Ranch) and 99-347 (Smith Ranch), and to amend as necessary the U.S. Environmental Protection Agency (EPA) aquifer exemptions for each well to be consistent with updated Areas of Review as described in this document. The Smith Ranch In-Situ Recovery (ISR) Project (facility) holds an active permit to mine from the Wyoming Department of Environmental Quality (WDEQ) Land Quality Division (Permit No. 633).

Location: A location map for the project area illustrating the Smith Ranch mining area and the existing Class I injection wells (**Figure 1**) is attached.

Proposed Action: The applicant is requesting from the Water Quality Division (WQD) Underground Injection Control (UIC) Program to modify and renew the Class I permit for the combined facilities for disposal of non-hazardous wastes. Wastes to be injected include liquid waste generated by in-situ leaching of uranium and from groundwater restoration within mined units.

Description of the Discharge Zone: The discharge zones comprise the Teckla member of the Lewis formation and the Teapot and Parkman members of the Mesaverde formation. Perforations will range from 7,811-9,915 feet below ground surface.

Confining Zone: The discharge zone is confined above by the Lewis Shale which is approximately 525 feet thick. The discharge zone is confined below by the Cody (Steele) Shale which is approximately 440 feet thick. Maps showing the thickness of the upper and lower confining units are found in **Exhibits No. 20 and 21 of Appendix D** (July 5, 2009 permit renewal of no. 99-347).

Life of Permit: 10 Years. (Modification/Renewal Permit)

Area of Review (AOR): The area of review for these wells is based on the radius of the cone of influence since this is the largest of the radius of emplaced waste and the minimum radius (see **Table 1**). A map showing the extent of the AORs with relation to the wells (**Figure 2**) is attached. The basis for determining the AORs are found in Wyoming Water Quality Rules and Regulations, Chapter 13, Section 5(b)(iv). The AORs for this facility are based on a twenty (20) year life of the facility.

#### **Table 1 (Areas of Review for the Disposal Wells)**

Well Name	Radius of Emplaced Waste Cylinder (feet (ft))	Radius of Cone of Influence (ft)	Minimum Radius of Area of Review (ft)
<b>SR DDW #1</b>	1,184	7,762	<b>1,320</b>
<b>SR DDW #2</b>	1,440	15,343	<b>1,440</b>
<b>RR DDW #1</b>	1,426	5,284	<b>1,426</b>
<b>Morton 1-20</b>	1,026	0	<b>1,320</b>
<b>Vollman 33-27</b>	1,271	13,515	<b>1,320</b>
<b>SRHUP #6</b>	959	11,411	<b>1,320</b>
<b>SRHUP #7</b>	1,701	7,344	<b>1,701</b>
<b>SRHUP #8</b>	1,495	11,840	<b>1,495</b>
<b>SRHUP #9</b>	1,069	11,251	<b>1,320</b>
<b>SRHUP #10</b>	555	6,123	<b>1,320</b>

**Table 5** of permit no. 14-293 documents all wells penetrating the receiving zones within the AORs. The WQD-UIC believes no wellbore conditions represent a pathway for injected fluids to impact an underground source of drinking water.

Evaluation of Water Quality within the Discharge Zone: Water quality estimates for the discharge zones were obtained from sixty-five (65) wells throughout the Powder River Basin, representing the Lewis formation (Teckla member) and Mesaverde formation (Teapot, and Parkman members). The data are presented in **Exhibit O-3** (August 30<sup>th</sup>, 2012 response to WDEQ’s comments) and indicate that total dissolved solids (TDS) concentrations for the TTP are consistently above 3,000 milligrams per liter (mg/L) in the Powder River Basin.

**Teckla Ss:** TDS concentrations in the Teckla Ss are expected to be greater than 3,000 mg/L but may be less than 10,000 mg/L. Two (2) data points (**SR DDW #2** and **RR DDW #1**) are presented in **Exhibit O-3** (August 30<sup>th</sup>, 2012 response to WDEQ’s comments) which are located within the surrounding eight (8) township area near the facility. Their respective TDS values were 6,210 mg/L and 1,460 mg/L. The low TDS value from **RR DDW #1** was determined to have resulted from dilution of the sample by well completion fluids rather than a pure formation water sample. The nearest TDS values from the US Geological Survey (USGS) Produced Water database (PWD) and from the Wyoming Oil and Gas Conservation Commission (WOGCC) are from two locations approximately 21 miles east of the project which indicate concentrations between 6,044 mg/L (API No. 49-009-20840) and 18,882 mg/L (API No. 49-009-21352). The TDS for the facility wells obtained from well completion or workover reports (Petrotek 2014, Schlumberger 2010, 2011) is as follows: **SRHUP #6** (not perforated/sampled), **SRHUP #7** (8,820 mg/L), **SRHUP #9** (not perforated/sampled), **SRHUP #10** (not perforated/sampled), **Vollman 33-27** (perforated – not sampled), **Morton 1-20** (8,200 mg/L), **SR DDW #1** (perforated – not sampled), **SR DDW #2** (6,210 mg/L).

**Teapot Ss:** TDS concentrations are expected to be greater than 3,000 mg/L but may be less than 10,000 mg/L within the area of the facility. The next nearest sample collected was found in the WOGCC database (API No. 49-009-22655) approximately 3 miles to the east of the Smith Ranch injectors, and indicates a TDS concentration of 14,001 mg/L. The next nearest samples

are over 15 miles away to the east-southeast and all of these samples, indicate TDS above 10,000 mg/L (ranging from 12,100 to 15,000 mg/L). The TDS for the facility wells obtained from well completion or workover reports (Petrotek 2014, Schlumberger 2010, 2011) is as follows: **SRHUP #6** (4,950 mg/L), **SRHUP #7** (15,000 mg/L), **SRHUP #9** (3,370 mg/L), **SRHUP #10** (4,900 mg/L), **Vollman 33-27** (Teapot-Parkman composite 4,120 mg/L), **Morton 1-20** (perforated – not sampled), **SR DDW #1** and **SR DDW #2** (perforated – adulterated samples), **RR DDW #1** (4,930 mg/L)

**Parkman Ss:** TDS concentrations are expected to be greater than 3,000 mg/L but may be less than 10,000 mg/L within the area of the facility. The USGS PWD and the WOGCC records show that the closest water quality data for the Parkman Ss is within 3.5 miles north of the **SR DDW #2** and indicates TDS values between 4,272 mg/L and 22,523 mg/L (API No.s 49-009-20050, 49-009-22060, 49-009-21144, 49-009-21190, 49-009-21483). The TDS for the facility wells obtained from well completion or workover reports (Petrotek 2014, Schlumberger 2010, 2011) is as follows: **SRHUP #6** (4,090 mg/L), **SRHUP #7** (4,700 mg/L), **SRHUP #9** (7,080 mg/L), **SRHUP #10** (6,270 mg/L), **Vollman 33-27** (Teapot-Parkman composite 4,120 mg/L). **Morton 1-20** (perforated – not sampled), **SR DDW #1** (perforated – not sampled), **SR DDW #2** (4,280 mg/L), **RR DDW #1** (5,660 mg/L)

Current or potential mineral, hydrocarbon or geothermal producing on a commercial scale: The Teckla, Teapot and Parkman Sandstones contain hydrocarbons although these formations are not produced from on a commercial scale within the AORs of any of the injection wells associated with the facility. WOGCC records indicate hydrocarbon production from the Parkman Ss approximately 2.5 miles northwest of the SR DDW #2 according to the well with API No. 49-009-22060, as well as approximately 5 miles east according to well with API No. 49-009-21948. WOGCC records also indicate hydrocarbon production from the Teapot according to wells with API Nos. 49-009-21617, 49-009-21593, 49-009-21735, however these are approximately 15 miles to the east. A small amount of past production from the Teckla is shown from wells with API Nos. 49-009-21352, 49-009-20458, which are approximately 22 and 26 miles to the east, respectively.

WDEQ Groundwater Classification: Groundwater in the Lewis formation (Teckla member) and Mesaverde formation (Teapot and Parkman members) within the AOR of each injection well has previously been classified as Class VI (Unusable/Unsuitable) in accordance with Water Quality Rules and Regulations (WQRR), Chapter 8. These classifications were made based upon the following criteria:

- Permit 99-347 (Smith Ranch):

“The groundwater in this formation contains between 3,000 and 10,000 mg/L of Total Dissolved Solids, but cannot be reasonably expected to provide a source of drinking water because of its extreme depth of burial;

and/or

The groundwater in this formation is situated at such depth that recovery of this water and treatment for drinking water purposes is not practical.”

- Permit 04-611 (Reynolds Ranch):

“This classification was made because the groundwater in this formation is situated at such depth that recovery of this water and treatment for drinking water is impractical.”

- Permit 09-054 (Smith-Highlands Ranch):

1. “Regional Total Dissolved Solids (TDS) concentrations within the Teckla, Teapot, and Parkman are 12,463 mg/l, 15,552 mg/l, and 14,631 mg/l respectively.
2. The formations contain oil and gas as well as Benzene, Toluene, Ethylbenzene and Xylene 9BTEX) based on their presence within adjacent, previously permitted Class I wells, as well as the proximity to oil and gas production.
3. The formations are situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical.”

Proposed Aquifer Exemptions: Based upon updated Areas of Review for each well, aquifer exemptions will be amended in accordance with those updates as follows for the Teckla, Teapot, and Parkman members of the Lewis and Mesaverde formations:

The Class VI designation extends 1,320 feet in all directions from **SR DDW #1**, 1,440 feet in all directions from **SR DDW #2**, 1,426 feet in all directions from **RR DDW #1**, 1,320 feet in all directions from **Morton 1-20**, 1,320 feet in all directions from **Vollman 33-27**, 1,320 feet in all directions from **SRHUP #6**, 1,701 feet in all directions from **SRHUP #7**, 1,495 feet in all directions from **SRHUP #8**, 1,320 feet in all directions from **SRHUP #9**, and 1,320 feet in all directions for **SRHUP #10**.

A previous unauthorized discharge occurred at **SR DDW #2** out of the previously authorized perforations into the Teckla member of the Lewis formation (see permit no. 99-347). Based on this discharge, the Permittee has elected seal the perforations within the Teckla member and restrict discharges to the Teapot and Parkman members of the Mesaverde formation.

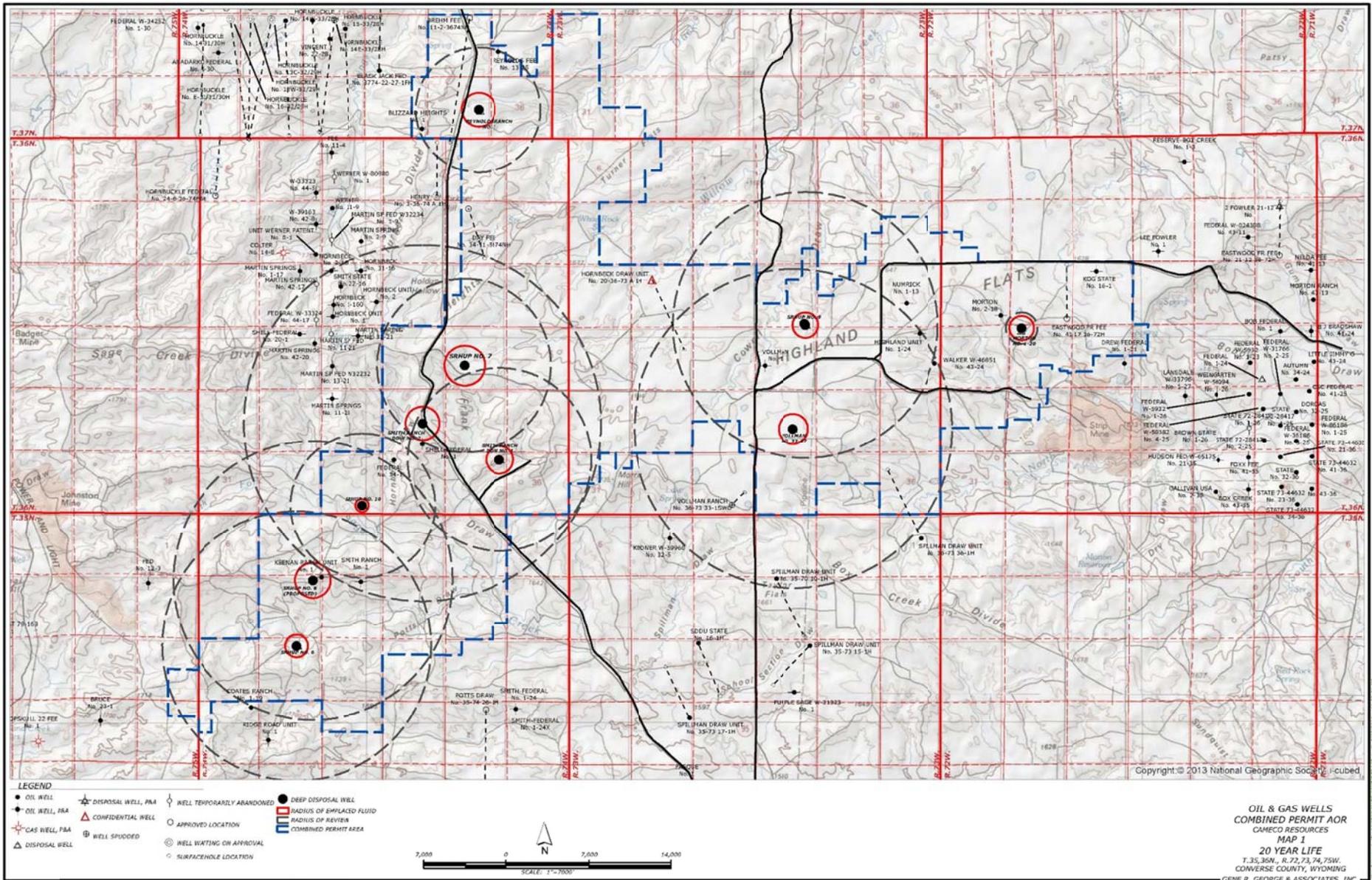


Figure 1 (Site Map and 20 Year Facility Life Cycle AORs)

## References

- Lewis, B.D. and Hotchkiss, W.R., 1981, Thickness, percent sand, and configuration of shallow hydrogeologic units in the Powder River Basin, Montana and Wyoming: USGS, Miscellaneous Investigations Series Map I-1317, 6 plates.
- Petrotek Engineering Corporation, 2014, Drilling and Completion Report for Smith Ranch Highland Uranium Project DDW SRHUP No. 7.
- Schlumberger Water Services, 2010, Cameco Resources Smith Ranch-Highland Operations, SRHUP 6 Drilling and Completion Report, WDEQ UIC Permit 09-054.
- Schlumberger Water Services, 2010, Cameco Resources Smith Ranch-Highland Operations, SRHUP 9 Drilling and Completion Report, WDEQ UIC Permit 09-054.
- Schlumberger Water Services, 2010, Cameco Resources Smith Ranch-Highland Operations, SRHUP 10 Drilling and Completion Report, WDEQ UIC Permit 09-054.
- Schlumberger Water Services, 2010, Cameco Resources Smith Ranch-Highland Operations, MORTON 1-20 Workover Report, WDEQ UIC Permit 09-054.
- Schlumberger Water Services, 2011, Cameco Resources Smith Ranch-Highland Operations, VOLLMAN 33-27 Workover Report, WDEQ UIC Permit 09-054.