

**Additional Notes Bullet #2 from NRC Status Table 11/13/14:**

NRC staff requested quarterly water quality data for the Arikaree and Brule monitoring wells.

**Response (03/16/15):**

Revisions have been made to the following:

Section 2.9.3.3

Tables 2.9-8, 2.9-9, 2.9-10, and 2.9-11

Figure 2.7-8

Appendix J – Groundwater analytical Lab Results

Additional new items:

Tables 2.9-42 and 2.9-43



### 2.9.3.3 Groundwater Quality Data ~~for~~ for Arikaree Group, Brule, and Chadron Formations

Four quarterly sampling events were conducted, beginning the fourth quarter of 2013 through the third quarter of 2014, at ten Arikaree Group monitoring wells (AOW-1, AOW-3, AOW-4, AOW-5, AOW-6, AOW-7, AOW-8, AOW-9, AOW-10, AOW-11). The analytical results are shown in **Tables 2.9-42 and 2.9-43.**

Four quarterly sampling events were conducted, beginning the fourth quarter of 2013 through the third quarter of 2014, at eleven Brule Formation monitoring wells (BOW-2010-1, BOW-2010-2, BOW-2010-3, BOW-2010-4A, BOW-2010-5, BOW-2010-6, BOW-2010-7, and BOW-2010-8, BOW-9, BOW-10, and BOW-11). The analytical results are shown in **Tables 2.9-4 and 2.9-8,** and **Table 2.9-9.**

~~Bi-weekly~~ Four quarterly sampling events were conducted from the fourth quarter of 2011 through the third quarter 2012 ~~sampling events were conducted in March and April 2011 at eleven~~ ten monitoring wells completed in the basal sandstone of the Chadron Formation (Monitor-1, Monitor-2, Monitor-4A, Monitor-5, Monitor-6, Monitor-7, Monitor-8, Monitor-9, Monitor-10, and Monitor-11, and CPW-2010-1). ~~In addition, four quarterly sampling events were conducted for these wells in November 2011, and February, June and August 2012.~~ The analytical results are reported in **Tables 2.9-10 and 2.9-11,** ~~with the summary of the data presented in Table 2.9-4.~~

~~Groundwater analytical laboratory reports are provided in Appendix J. Tables 2.9-8 and 2.9-10 presents the groundwater sampling results for non-radiological analytes for the Brule and basal sandstone of the Chadron formations. TDS concentrations for the Brule Formation ranged from 200 to 537 mg/L, whereas TDS for the basal sandstone of the Chadron Formation ranged from 778 to 1,420 mg/L. Alkalinity for the Brule Formation ranged from 125 to 217 mg/L, while alkalinity in the basal sandstone of the Chadron Formation was consistently detected above 245 mg/L at all sampling locations. Conductivity for the Brule Formation was detected up to 763 µmhos/cm, while conductivity for the basal sandstone of the Chadron Formation was detected above 1,340 µmhos/cm at all sampling locations. Major ion concentrations for the Brule Formation ranged from 423 to 775 mg/L, while concentrations for the basal sandstone of the Chadron Formation ranged from 1,319 to 2,227 mg/L. In general, concentrations of TDS, specific conductance, and major ions in the basal sandstone of the Chadron Formation appear to be an order of magnitude larger than those observed in the Brule Formation at the MEA. Similar trends in relative concentrations for the MEA were observed in water quality sampling at the TCEA and NTEA for these two water-bearing zones. Groundwater analytical laboratory reports are provided in Appendix J.~~

The groundwater analytical laboratory analysis results for the Arikaree Group, the Brule Formation and the Basal Sandstone of the Chadron Formation are provided in Appendix J. A summary of the data is presented in Table 2.9-4. ~~groundwater sampling results for radionuclides of the Brule and basal sandstone of the Chadron formations are presented in Table 2.9-9 and 2.9-11, respectively~~ Groundwater analytical laboratory reports are provided in **Appendix J.**

~~Dissolved concentrations of selected radionuclides appear to be largely absent from the Brule Formation, with the exceptions of uranium and radium 226. For the CBR Brule monitor wells, suspended uranium concentrations ranged from <0.0003 to 0.0017 mg/L (average of 0.00025~~



~~mg/L) and dissolved uranium concentrations ranged from 0.002 to 0.0095 mg/L (average of 0.0052 mg/L). For the basal sandstone of the Chadron Formation monitor wells, suspended uranium concentrations ranged from <0.0003 to 0.0843 mg/L (average of 0.00246 mg/L), and dissolved uranium levels ranged from <0.0003 to 0.084 mg/L (average of 0.00828 mg/L).~~

~~Suspended uranium activity for the Brule monitor wells ranged from <2.0E-10 to 1.2E-09 uCi/mL (average of 1.59E-10 uCi/mL), and dissolved uranium activity ranged from 1.3E-09 to 6.4E-09 uCi/mL (Average of 3.8E-09 uCi/mL). For the basal sandstone of the Chadron Formation monitor wells, suspended uranium activity levels ranged from <2.0E-10 to 6.2 uCi/mL (average of 0.151 uCi/mL) and dissolved uranium levels ranged from <2.0E-10 to 6.2 uCi/mL (average of 3.87E-10 uCi/mL).~~

~~For the Brule Formation monitor wells, suspended radium-226 values ranged from <0.1 to 0.6 pCi/L (average of 0.14 pCi/L) and dissolved radium-226 ranged from <0.1 to 0.66 pCi/L (average 0.22 pCi/L). For the basal sandstone of the Chadron Formation monitor wells, suspended radium-226 values ranged from <0.1 to 45 pCi/L (average of 1.82 pCi/L) and dissolved radium-226 values ranged from <0.1 to 390 pCi/L (average of 30 pCi/L).~~

~~The concentrations of dissolved thorium-230 for the Brule Formation were below the reporting limit (RL) at all locations, whereas dissolved thorium-230 for the basal sandstone of the Chadron Formation ranged up to 1.7 pCi/L; however, the majority of the sample results were below <0.1 and <0.2 pCi/L. As expected, suspended radionuclides were significantly higher in the wells of the basal sandstone of the Chadron Formation than those of the Brule Formation.~~

~~To date, water quality sampling indicates that the Brule Formation and the basal sandstone of the Chadron Formation have unique geochemical signatures within the MEA.~~

#### Quality of Groundwater Measurements

~~The accuracy of monitoring data is critical to ensure that the water monitoring program precisely reflects water quality. In addition to recommending the use of approved analytical methods for water quality measurements (contained in 40 CFR 136), the NRC also specifies analytical quality requirements in RG 4.14.~~

~~The private laboratory employed by CBR, Energy Laboratories, Inc. (ELI), reported the lower limits of detection for the surface and groundwater analyses as Minimum Detectable Concentrations/Lower Limits of Detection (MDC/LLD) values. ELI stated in a letter dated April 23, 2012 (ELI 2012; **Appendix Q**) that the reported MDC/LLD values for the MEA samples were in compliance with RG 4.14, Section 5 "LLD".~~



Radionuclide	MDC/LLD for Water	
	µCi/ml	pCi/L
Natural Uranium	$2 \times 10^{-10}$	0.2
Thorium-230	$2 \times 10^{-10}$	0.2
Radium-226	$2 \times 10^{-10}$	0.2
Polonium-210	$1 \times 10^{-9}$	1.0
Lead-210	$1 \times 10^{-9}$	1.0

Source: ELI 2012 (Appendix Q)

Note: For analytes reported in two significant figures, MDC/LLD values rounded off to only one significant figure (e.g., 1.3 pCi/L = 1 pCi/L).

~~ELI met the criteria of the guidance suggested by the NRC when reasonably achievable by available conventional laboratory methodology. If for some reason the MDC/LLD was not met on the original analysis, the samples were recounted or re-analyzed until RG 4.14 MDC/LLDs were achieved. See Appendix Q for additional discussions by ELI of MDC/LLD reporting.~~

~~MDC levels for surface and groundwater radiological analytes are presented in the respective data tables of this document as well as in the individual Analytical Summary Reports of Appendix J.~~

#### 2.9.4 Baseline Surface Water Monitoring

Surface water sampling in RG 4.14 calls for sampling of surface water passing through the project site or offsite surface waters that may be subject to drainage from potentially contaminated areas or that could be affected by a “tailings impoundment failure. Grab samples are to be collected monthly with samples analyzed for suspended and dissolved natural uranium, radium-226, and thorium-230.

in RG 4.14 also requires surface water sampling from each large onsite body of water or offsite impoundments that may be subject to direct surface drainage from potentially contaminated areas that could be affected by a tailings impoundment failure. Grab samples are to be collected quarterly with samples analyzed for suspended and dissolved natural uranium, radium-226, and thorium-230. Semiannually, samples should be analyzed for suspended and dissolved lead-210 and polonium-210.

Lack of water flow in ephemeral drainages in the MEA has prevented collection of surface water samples. Water samples were collected from the Niobrara River, which flows east to west to the south of the MEA license boundary (Figure 2.7-4). The results of this sampling program are discussed below. Historical water flow and water quality data were obtain from NDNR, NDEQ, and USGS databases (see discussions below). Water level measurements of the Box Butte Reservoir were obtained from the USBR (see discussions below).