DRAFT
ENVIRONMENTAL ASSESSMENT
FOR AMENDMENT TO SOURCE MATERIALS LICENSE SUA-56
FOR GROUND WATER ALTERNATE CONCENTRATION LIMITS

WESTERN NUCLEAR, INC.
SPLIT ROCK URANIUM MILL TAILINGS SITE
JEFFREY CITY, FREMONT COUNTY, WYOMING

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Source Materials License SUA-56
Docket No. 40-1162

PREPARED BY

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
DIVISION OF FUEL CYCLE SAFETY AND SAFEGUARDS

DRAFT ENVIRONMENTAL ASSESSMENT FOR GROUND WATER ALTERNATE CONCENTRATION LIMITS WESTERN NUCLEAR, INC., SPLIT ROCK URANIUM MILL TAILINGS SITE JEFFREY CITY, FREMONT COUNTY, WYOMING

1. INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) is considering Western Nuclear Incorporated's (WNI's) (the licensee's) request to revise ground water protection standards (GPSs) at its Split Rock, Wyoming, uranium mill tailings site (site). By letter dated October 29, 1999, WNI submitted a Site Closure Plan that requested amendments to WNI's Source Materials License SUA-56 (WNI, 1999). This request contained a number of proposed amendments to the license regarding all aspects of site reclamation and decommissioning; the main proposed amendment was to revise GPSs from background to alternate concentration limits (ACLs). WNI also proposed institutional controls (ICs) for offsite residential properties and an alternate water supply. WNI submitted supplements to its original application dated January 17, 2000 (WNI, 2000a), February 22, 2000 (WNI, 2000b), February 28, 2000 (WNI, 2000c), February 1, 2001 (WNI, 2001), May 28, 2002 (WNI, 2002a,b), July 23, 2002 (WNI, 2002c), September 9, 2002 (WNI, 2002c), March 7, 2003 (WNI, 2003a), May 24, 2004 (WNI, 2004), February 10, 2005 (WNI, 2005a), March 3, 2005 (WNI, 2005b), and March 20, 2006 (WNI, 2006). NRC staff has reviewed WNI's submittals and supplements and is preparing this draft environmental assessment (EA) to document its evaluation and conclusions.

1.1 Background

The site is located in southeast Fremont County adjacent to the Sweetwater River, at the head of two alluvium-filled valleys (see Figure 1). Original site features included the mill complex, main office, Old, New, and Alternate Tailings Impoundments, sewage lagoon, waste trench, and northwest (NW) valley seepage pond (see Figure 2). WNI began installation of its Split Rock site ore processing mill in 1956. The site was originally selected in conjunction with the Atomic Energy Commission (AEC) and was approved on the basis of its (1) proximity to U.S. Highway 287, (2) favorable location for future town, (3) centralized location of the site between ore bodies to the north and south, and (4) favorable hydrogeologic conditions for rapid tailings water infiltration.

WNI used an acid-leach, ion-exchange, and solvent-extraction process to mill approximately 7.7 million tons of uranium ore from 1957 to 1981. The facility was designed originally to process 400 tons of ore per day; however, in 1961, due to heightened uranium demand, milling capacity was increased to 845 tons per day. By 1967, milling capacity had increased to approximately 1,200 tons per day to accommodate contracts with both private industry and the AEC. After a series of expansions in the 1970s, the mill was processing 1,700 tons of ore per day. On

June 19, 1981, WNI announced that the mill would be placed on standby, because of diminishing demand and depressed prices for uranium. The mill remained on standby until 1986. At this time, NRC staff amended the license to terminate use of the tailings impoundments for disposal, and WNI was required to submit a tailings reclamation plan. WNI decontaminated and decommissioned the mill in the summer of 1988. Mill components were dismantled and buried in the areas designated as the mill burial site, which is located primarily beneath the former mill site.

Process waste in the form of tailings solids and acidic liquids were discharged to the unlined tailings impoundments that were operated from 1957 tol 1981. These impoundments were designed in 1957, when the original AEC license (R-205) was issued. Tailings pond design criteria favored a disposal pond that eliminated process effluent through seepage, maximizing tailings storage while decreasing water storage and handling requirements. At peak production, tailings waste was approximately 5 parts process effluent to 1 part solids. Three primary tailings disposal areas were used during the operational life of the mill; these are the Old, Alternate, and New tailings impoundments. Approximately 7.7 million tons of tailings were deposited in these impoundments. Because the uranium assay was approximately 0.1 percent and only uranium was extracted, tailings volume was approximately equal to the ore volume (MFG, 2006).

Because WNI utilized infiltration, in part, to dewater tailings, seepage from the tailings impoundments contaminated ground water in underlying aquifers. As a result, several corrective actions have been performed throughout the operational and reclamation history of the site. For example, WNI installed a toe drain below the new tailings impoundment embankment to collect ground water and impoundment seepage and discharge it to this impoundment. In addition, a formal Corrective Action Program (CAP) was implemented in 1990, as required by Source Materials License SUA-56, Condition No. 74, Amendment No. 74, which WNI currently implements.

1.2 Need for the Proposed Action

The current CAP has been effective at minimizing the seepage quantity emanating from the tailings impoundments; however, it has not been effective at capturing ground water contamination that passed the extraction wells. Continuing CAP operations would allow ground water contamination to exist for extended time periods, posing a health risk to human receptors. As discussed in Section 2.0, other corrective action alternatives would be costly without achieving complete ground water restoration, unless passive remediation strategies were utilized in combination with active remediation strategies. For example, ground water flow and contaminant transport modeling indicated that ground water contamination could affect the Red Mule community located east of the site. This would likely be the case regardless of the remedial strategy utilized because costs would be too great to contain and remediate ground water throughout the area within the entire long-term surveillance boundary (LTSB). Therefore, a different strategy is required to provide a long-term solution to address offsite contamination and protect human health and the environment.

1.3 The Proposed Action - ACLs With Institutional Controls

The proposed action is a modification of License Condition 74 to Source Materials License SUA-56 approving ACLs for the following hazardous and nonhazardous constituents at the site: uranium, radium-226 and -228, manganese, molybdenum, ammonia, and nitrate. The licensee will also establish ICs restricting domestic ground water use within the LTSB. Livestock and agricultural ground water uses would not be restricted within the LTSB. The license amendment would require the following actions:

1) Replace the current GPSs with ACLs for the aforementioned hazardous and nonhazardous constituents. Table 1 presents the proposed ACLs.

2) Establish the point of exposure (POE) location at the LTSB, as stated in the Supplemental Ground Water Modeling Report dated March 7, 2003 (WNI, 2003).

3) Conduct surface water and ground water sampling at the point of compliance (POC), POE, and at selected wells between POE and POC (WNI, 2005b).

Table 1
Proposed ACL Concentrations

Contaminant	NW Valley	SW Valley	Current GPSs
Manganese (mg/L)	225	35	None
Molybdenum (mg/L)	0.66	0.22	None
Ammonia (mg/L)	6.61	0.84	None
Radium-226 & -228 (pCi/L)	7.2	19.9	5
Natural Uranium (mg/L)	4.8	3.4	0.16
Nitrate (mg/l)	317	70.7	None

The primary purpose of this strategy is to remove the drinking water exposure pathway on private or government-owned properties within the LTSB. To obtain the institutional control, WNI has purchased, or otherwise established, durable and enforceable restrictions of ground water use on all properties within the proposed LTSB. WNI expended approximately $630,000 for these purposes. ICs allow natural processes (i.e., advection, dispersion, retardation) to attenuate, disperse, and dilute site-derived constituents to meet protective standards at the POEs with no active treatment or mitigation measures. POEs consist of the LTSB and the Sweetwater River for ecological and human exposures.

1.4 ACL Development

Typically, ACLs are developed by determining a protective concentration for each hazardous constituent at the POE for human and/or ecological receptors. The proposed action (ACLs with ICs) would minimize potential human and ecological exposures to byproduct materials in ground water in the following manner. Contaminated ground water originating from the NW valley would be diluted in the Sweetwater River to the extent that site-derived contaminant loads would only minimally increase contaminant concentrations in the Sweetwater River. Additionally, because ground water from the southwest (SW) valley does not emerge as surface water, no potential human or ecological receptors exist south of the site.

Because human and ecological receptors would be protected as long as the future concentrations are less than the historic concentrations, ACLs were determined for each of the POC wells based on maximum historic concentrations seen in the valleys. WNI accomplished this by determining the maximum values for each of the six identified constituents that have been observed in either the proposed POC wells (Well 5 and Well WN-21) or the wells closest to the edge of the tailings (Well 4 and Well WN-B).

1.5 Regulatory Environment

1.5.1 Federal and State Authorities

NRC source material licenses are issued under Title 10, Code of Federal Regulations, Part 40 (10 CFR Part 40). In addition, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), as amended, requires persons who conduct uranium source material operations to obtain a byproduct material license to own, use, or possess tailings and wastes generated by the operations. This EA has been prepared in accordance with 10 CFR Part 51, Licensing and Regulatory Policy and Procedures for Environmental Protection, which implements NRC's environmental protection program under the National Environmental Policy Act (NEPA) of 1969. In accordance with 10 CFR Part 51, an EA serves the following purposes: (a) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI); (b) facilitate preparation of an EIS when one is necessary; and c) demonstrate the NRC's compliance with NEPA when an EIS is not necessary. Evidence presented herein includes a detailed description of the proposed action, impacts of the proposed action, and impacts of alternatives to the proposed action, including the no-action alternative. In undertaking this project, the licensee committed to complying with all applicable Federal and State regulations.

Under 10 CFR Part 40, Appendix A, Criterion 5B, NRC can grant ACLs for ground water at uranium mill tailings sites provided that the new limits are protective of human health and the environment. ACLs must also meet the as low as is reasonably achievable (ALARA) criterion found in Criterion 5B(6). WNI has proposed ACLs it considers protective of human health and the environment based on ground water flow modeling, fate and transport modeling, and exposure and risk assessments.

1.5.2 Basis of NRC Review

NRC staff has assessed the environmental impacts associated with this request for a license amendment to modify the GPSs, and documented the results of the assessment in this report. NRC staff performed this assessment in accordance with the requirements of 10 CFR Part 51.

In conducting the assessment, the staff considered the following:

- information in the ACL application and supporting documentation
- information in modeling reports and NRC staff review reports
- information in land use and environmental monitoring reports
- personal communications with WNI staff and representatives, the State of Wyoming, and Federal agencies
- information from NRC staff site visits and inspections
- 10 CFR 40, Appendix A, NUREG-1620, Rev. 1 (NRC, 2003a), and NUREG-1748 (NRC, 2003b)

2.0 ALTERNATIVES TO PROPOSED ACTION

2.1 No-Action Alternative

The no-action alternative would be to deny the proposal for ACLs and require WNI to continue the current active ground water corrective action (see Section 3.3.3). This alternative poses some problems. Unless the ground water corrective action plan is modified, contaminated ground water would continue to migrate towards water supply wells in the Red Mule community. Furthermore, without durable and enforceable ICs, a potential exists for human exposure through the consumption of contaminated ground water. Therefore, the no-action alternative does not meet the stated need of providing protection of affected human receptors.

2.2 Ground Water Remedial Alternatives

The licensee reviewed numerous types of alternatives to remediate ground water including the following: natural attenuation, interceptor trenches, injection/extraction wells, forced gradient flushing, slurry cutoff walls, grout curtains, sheet pile cutoffs, hydraulic diversion wells, precipitate clogging barriers, and permeable reaction walls. WNI provides an analysis of these remedial alternatives that indicated the alternatives discussed below are the preferred alternatives for this site. Primary justifications for eliminating remedial alternatives were as follows:

- Contamination is too deep for physical barriers
- Unconsolidated aquifers contain fine particles, which reduce the effectiveness of grout curtains and permeable reactive walls.
- Costs for some barrier types were excessive.

WNI's final list of remedial alternatives for protecting ground water at the site and adjacent areas, consists of a combination of active and passive strategies. All the active remedial alternatives are variations of ground water extraction and treatment. ICs are the passive aspect of each active alternative.

2.2.1 Hydraulic Diversion With Institutional Controls

The hydraulic diversion would consist of approximately 16 injection wells located near the mouth of the SW valley. Injection into these wells would create a ground water mound that would force half of the water from the hydraulic diversion to flow to the north. The other half of the injected water would flow away from the hydraulic diversion to rejoin the regional ground water flow without contacting site-derived constituents. Hydraulic diversion supply would be drawn from a new well installed approximately 1.61 kilometers (km) or 1 mile (1 mi) south (upgradient) of the control area. Approximately 1,874 liters per minute (Lpm) or 500 gallons per minute (gpm) of injection would be required to accomplish hydraulic diversion. This system would operate long-term and require periodic replacement and ongoing maintenance. ICs would be required to meet protective standards at the POEs *in-lieu* of active ground water remediation in these areas.

Costs associated with this alternative address installation and operation of the hydraulic diversion system. Economic costs for this alternative are approximately $18 million. Environmental impacts would be minimal. The major noneconomic cost for this alternative is the long-term use of water resources. This alternative requires 1,874 Lpm (500 gpm) that would be obtained from pumping a supplemental water supply potentially located to the south of the site. Of the 1,874 Lpm (gpm), roughly one-half would become mixed with the site-derived waters. The other half would remain unimpacted and flow back into the regional flow pattern. As a result, billions of liters of ground water would be lost from the local ground water system.

2.2.2 Southwest Valley Focused Pumping With Institutional Controls

This alternative incorporates active treatment and targeted pumping of a selected area in the SW valley and ICs to meet protective standards at the POEs. SW valley focused pumping would consist of pumping 7,031 Lpm (1,876 gpm) from 29 wells and injecting 6,372 Lpm (1,700 gpm) of clean ground water into 34 wells located in the focused pumping area of the SW valley.

Injection water would be drawn from a new supply well installed approximately 1.63 km (1 mile) south of the control area. Extracted ground water would be discharged to lined evaporation ponds; approximately 405 hectares (ha) or 1,000 acres of evaporation ponds would be required.

SW valley focused pumping would be terminated once ground water concentrations in the area were reduced to within 20% of the anticipated long-term steady-state uranium concentrations from the upper valley. Following termination of focused pumping, all corrective action facilities (wells, evaporation ponds, etc.) would be reclaimed; long-term steady-state flow, ground water quality, and seepage conditions would equilibrate. ICs would be required to meet protective standards at the POEs.

Costs associated with this alternative are related to the forced pumping and evaporation systems. The total economic cost of this alternative is approximately $108 million. WNI did not appear to investigate the treatment and reinjection of treated water to enhance contaminant removal. Noneconomic costs include the environmental impacts associated with constructing the injection and recovery system and lined evaporation ponds that would cover approximately 405 ha (1,000 acres). Evaporation pond construction would involve the initial construction activities such as removal of topsoil and building berms and access roads. This entire 405-ha (1,000-acre) area would be removed from use for livestock and wildlife for the 25-year operational period.

2.2.3 Long-Term Containment Pumping With Institutional Controls

This alternative incorporates immediate and long-term containment pumping of the NW valley and cleanup of an area outside the SW valley beyond the area influenced by containment pumping. The initial SW valley pumping would consist of pumping 3,598 Lpm (960 gpm) from 19 wells and injecting 2,998 Lpm (800 gpm) into 16 wells located in areas of elevated uranium concentrations in the SW valley. Containment pumping in the NW valley would consist of pumping 5 wells at a combined rate of 375 Lpm (100 gpm). Pumped water would be processed through a conventional water treatment plant using pH adjustment and reverse osmosis membrane technology.

Initial SW valley pumping would be terminated after approximately 25 years, once ground water concentrations in the area are reduced to within 20% of the anticipated long-term steady-state uranium concentrations from the upper valley. After SW valley focused pumping cleanup is completed, the 19 SW valley extraction wells and all 16 injection wells in the SW valley would be abandoned. Three SW valley pumping wells in the valley mouth would then be pumped at a combined rate of 150 Lpm (40 gpm), while the 5 NW valley wells would continue to be pumped at a combined rate of 375 Lpm (100 gpm) to provide long-term containment of both valleys. At that time, the treatment facility capacity requirements would decrease resulting in decommissioning and reclamation of a large portion of the treatment facility. ICs would be required to meet protective standards at the POEs.

An estimated 8.1 ha (20 acres) of evaporation ponds would be required to evaporate the brine from the treatment facility given the long-term containment pumping rates. An estimated 56.7 ha (140 acres) of sludge disposal cells would be required to accommodate the solid treatment waste generated over the 1,000-year design life.

Costs associated with this potential alternative are for the construction and long-term operation of a pumping and treatment system. The economic costs of this alternative are estimated to be approximately $117 million. Noneconomic costs include the potential environmental impacts associated with constructing the wells, the water treatment plant, and for the lined evaporation and sludge disposal ponds. This alternative would also remove approximately 4,741 Lpm (1,265 gpm) for 25 years and 131 Lpm (35 gpm) of water in long-term by evaporation.

2.3 Assessment of Alternatives

Alternatives were assessed based on the relative costs and benefits for each alternative. The no-action alternative does not provide any benefit despite the continued cost of pumping, because ground water contamination would continue to migrate from the site. This action also does not provide any human health protection because no ICs would be established to remove the ground water exposure pathway.

The remaining alternatives are a combination of active remediation and ICs. The primary difference between the active remediation alternatives is the amount of property that would require ICs. Forced pumping would keep the largest area clean (approximately 1,538 ha (3,800 acres)); however, the cost is approximately $108 million. Considering the low concentrations of uranium, the effectiveness measured as mass of contaminant per dollar spent would be quite low. Although focused ground water extraction near the downgradient edge of the tailings impoundment cover could reduce the extent of contamination, the costs of such a plan would provide little improved benefit over natural attenuation. Therefore, the active ground water remediation options were not considered viable.

3.0 AFFECTED ENVIRONMENT

3.1 Land Use

The Split Rock site is located in a remote and sparsely populated portion of Wyoming. Land uses prior to the uranium boom included ranching and livestock grazing. After establishment of local mines and the Split Rock mill, the mill town of Jeffrey City was founded and grew to accommodate a population of industrial site workers. Maximum population of approximately 3,000 residents occurred during the 1970s. Since mine closure and mill decommissioning, local population has declined to approximately 100 residents, and activities in the area focus mainly on ranching. Land immediately surrounding Jeffrey City and the Split Rock site is mostly privately owned. Recreational land uses include fishing in the Sweetwater River and seasonal game hunting.

3.2 Geology and Topography

The site is located within an area of exhumed peaks (peaks exposed by erosion) of the Granite Mountains, in the west-central portion of the Sweetwater Plateau (also called the Sweetwater uplift). The plateau is a southeasterly ridge of high elevations which essentially separates the Wind River and Great Divide basins of the Wyoming Basin physiographic province. Plateau topography is gently rolling alpine meadows interrupted by moderate- to high-relief granite peaks. Regionally, elevations range from approximately 1,890 meters (m) or 6,200 feet (ft) near the Sweetwater River to over 2,745 m (9,000 ft) in the high peaks of Green Mountain south of the mill. Site elevation is approximately 1,928 m (6,320 ft), and it lies at the base of a saddle between two other adjacent tracts of granite peaks approximately 1.6 km (1 mi) south of the Sweetwater River. The elevation of the saddle, which forms the head of the drainage area (including the mill site), is approximately 1,965 m (6,446 ft). Site surface drainage is generally in a southwesterly direction toward Jeffrey City, then northward to the Sweetwater River. Figure 3 contains a topographic map of the site.

Structurally, the Sweetwater Plateau is a fault block that was uplifted during the Laramide orogeny tectonic event (50 to 70 million years (MY) ago) and then subsided in the middle Miocene Epoch (15 MY ago). This subsidence was responsible for the eastward trend of the normal faults forming the Beaver Divide on the northern edge of the plateau. In the site vicinity, the Precambrian granitic rocks are exposed as a result of erosion of the overlying Eocene Epoch (38 to 55 MY ago) sediments. Eocene Epoch sediments are loose to medium-strength sandy subsurface materials, overlie the granite bedrock, and are approximately 76 m (250 ft) thick.

A map showing the local geology is included as Figure 4. During the Miocene Epoch (5 to 24 MY ago), the southern portion of the Granite Mountains began to subside into the Split Rock Syncline. Simultaneously, an enormous volume of tuffaceous sandstone was deposited across most of Wyoming. These deposits became what is known as the Split Rock Formation in central Wyoming.

During the early to middle Pliocene Epoch (3.5 to 5 MY ago), the Split Rock Syncline continued to sag, forming Moonstone Lake. In and adjacent to the lake, more than 305 m (1,000 ft) of tuffaceous strata comprising the Moonstone Formation were deposited. Some of the beds in the Moonstone Formation were unusually rich in uranium and thorium and are believed to be source rocks for part of the uranium present in the Gas Hills and Crooks Gap uranium districts. Many zones are locally radioactive and contain more than 0.01 percent uranium. A regional uplift event began in the late Pliocene Epoch (2 to 3 MY ago), beginning the present cycle of erosion in most of central Wyoming. Only about 305 m (1,000 ft) of the buried crest of the mountains was exhumed.

Geologic units at the site are as follows:

- Sweetwater River Alluvium - Limited to Sweetwater River floodplain, up to 7.6 m (25 ft) thick. Typically a fining upward sequence of gravel, sand, silt, and clay. Lower gravels typically contain well-rounded, low-sphericity schistose and gneissic pebbles 5mm to 10 mm (0.2 to 0.4 in) in diameter with some up to 50 mm (2.0 in) in diameter . Finer gravel and sand are dominantly quartz. Sands are typically poorly sorted. Silt- and clay-dominated zones are limited to the upper 1.5 to 3.0 m (5 to 10 ft) of the unit.

- Eolian Deposits - Limited in extent and discontinuous, up to 15.2 m (50 ft) thick. Occur as mostly stabilized sand dunes near granite outcrops and south of the mill site. Pale yellow fine to medium, well-sorted, well-rounded and frosted, moderately spherical, quartz sand.

- Alluvium - Present in all but granite outcrop and Sweetwater River floodplain areas, up to 5.5 m (18 ft) thick. Occurs as terrace deposits and alluvial wash from uplands. Gravels, sands, and clays occur in both coarsening upward and fining upward sequences. Gravels contain granitic and mafic pebbles up to 50 mm (2.0 in) in diameter. Finer gravel and sand are dominantly quartz. Frequent zones of oxidized iron staining are observed bounding sand layers. Clays are typically silty, stiff, and gray.

- Upper Split Rock Unit - Present in all but granite outcrop areas, up to 610 m (2000 ft) thick. Typically a brown, poorly indurated, fine to medium grained, well-sorted, silty sandstone. Sand grains are dominantly quartz with small amounts of magnetite; some are frosted and hematite coated. Interbeds of gravel, clay, and well-indurated calcareous sandstone are common. Gravel is subangular to rounded and consists chiefly of quartz, granite fragments, and metamorphic rock fragments.

- Lower Split Rock Unit (LSR) - Present in lower valley areas between granite outcrops, up to 91.5 m (300 ft) thick. Typically a poorly cemented clayey and sandy conglomerate or gravel composed of weathered granite granules and pebbles up to 35 mm (1.4 in) in diameter. Interbeds of sand/sandstone, silt/siltstone, and clay/claystone are common. Sand/sandstones are similar to those found in the Upper Split Rock unit; some well indurated calcareous zones ore present.

- White River Formation - Very limited in extent, up to 19.8 m (65 ft) thick. Occurs as isolated erosional remnants in structural low areas in the Precambrian surface beneath the Sweetwater River floodplain. Consists of yellow, light gray, light olive gray, and grayish orange interbedded sandstones, sandy claystones, and silty/clayey sandstones.

- Precambrian Granite - Underlies entire area, undetermined thickness. The granite composed primarily of clear to gray quartz, white potassium feldspar, and minor amounts of block hornblende. The granite is typically weathered in the uppermost 1.5 m (5 ft) and is yellowish brown in color. Some mafic dikes and metasedimentary dikes are present within the granite. Dikes in outcrop are typically preferentially eroded and form crevices and valleys.

3.3 Water Resources

3.3.1 Surface Water

Several streams, lakes, and ponds, and numerous dry washes can be found within 16 km (10 mi) of the site. Approximately 1.6 km (1 mi) north of the site are the Sweetwater River (the only perennial stream in the site vicinity) and several flood-plain lakes adjacent to the river. These lakes are across the river from the site and are essentially unconnected to the hydrologic systems south of the river. South of the site are several perennial streams that become intermittent in the lower reaches. Only a few of these streams are named (Crooks Creek, Sheep Creek, O'Brien Creek, and Pipeline Creek).

The Sweetwater River is the major surface drainage system in the Sweetwater Plateau. It is a tributary of the North Platte River, originates in the Wind River Mountains (west of the site), and flows generally from west to east, past the Split Rock site to Pathfinder Reservoir approximately 64.4 km (40 mi) downstream of the site. The Sweetwater River is utilized for fishing, and irrigation and stock watering through direct pumping or diversion ditches, thereby increasing the variability of Its flow regime. Surface water users within 8 km (5 miles) of the site are the McIntosh, Grieves, Jamerman, and Welch ranches. Grieves ranch is the closest to the site, located approximately 3.5 km (2.2 miles) northwest of the site, on the north bank of the Sweetwater River. The average peak daily flow is 1,459 cubic feet per second (cfs) (USGS, 2006).

The Sweetwater River is the primary discharge point for ground water originating from the NW valley and for regional ground water flow. However, it acts as a recharge mechanism to the shallow floodplain alluvial aquifer along its reach during periods of seasonal high flow, typically from May to August. A review of recent monitoring data indicates that indicates that the site may be contributing sulfate, TDS, and uranium to surface water (WNI, 2005c&d). However, these increases are minimal and do not impact surface water use. For example, the maximum uranium surface water concentration since 2004 is 0.013 mg/L, which is well below the U.S. Environmental Protection Agency's (EPA's) maximum contaminant level (MCL) of 0.03mg/L. In the Split Rock site area, the river is classified as Class II waters in the State of Wyoming and provides recreational fishing and wildlife habitat.

3.3.2 Ground Water

Ground water flow and contaminant transport of site-derived constituents primarily involves the Upper and Lower Split Rock saturated units, collectively called the Split Rock aquifer, and the Sweetwater River Alluvium, called the floodplain aquifer. The floodplain aquifer is hydrologically connected to the underlying Split Rock aquifer and was formed where the river cut and meandered across the Split Rock aquifer, which fills the alluvial basins between the Green Mountains to the south and the Granite Mountains.

Pre-Decisional Information: This information is limited to use by the Wyoming Department of Environmental Quality, U.S. Environmental Protection Agency, U.S. Department of Energy, Wyoming State Historic Preservation Office, U.S. Department of Interior, and U.S. Fish and Wildlife Service and their staff. This information shall not be disclosed without prior NRC permission.

Most residents of Jeffrey City derive their water supply from the town wells drilled into the Split Rock aquifer, although several residents near Jeffrey City have private water supply wells. The Jeffrey City municipal wells presently supply approximately 379 Lpm (100 gpm), though pumping only occurs periodically to fill the storage tanks. These wells are located west of the site and are, therefore, upgradient of the site and unaffected by site-derived contamination.

3.3.2.1 Regional Ground Water Flow

Regional hydrologic boundaries are the Green Mountains to the south, which provide the primary recharge to the regional ground water system and the Sweetwater River to the north, which acts as the primary hydrologic sink for the regional ground water system. The granitic basement is the lower hydrologic boundary to the ground water system. Regional ground water flow, when forced up against the granite basement, moves upward, creating upward vertical gradients. North of the Sweetwater River, ground water flows south; however, flow is inhibited by granite outcrops, and some soda lakes form where ground water discharges to the surface. In the vicinity of the Split Rock site, the regional flow gradient is approximately 0.003 to the east.

3.3.2.2 Local Ground Water Flow

Local ground water at the Split Rock site area is recharged from direct precipitation on the valley floor and from precipitation runoff from the surrounding granite hillsides. Approximately 1.52 centimeters (cm) or 0.6 inches (in) per year of precipitation infiltrates the valley floor to deep recharge, while approximately 15.2 cm (6 in) per year of runoff from the surrounding granite hillsides recharge the alluvial aquifer. In addition, drainage of the tailings has historically input up to 5,300 Lpm (1,400 gpm) to the upper valley ground water system. Since tailings and water disposal in the tailings impoundments ceased in 1986, tailings drainage and consolidation have greatly diminished, and the elevated ground water levels beneath the tailings caused by tailings drainage have largely dissipated. Tailings seepage rates are presently estimated to be approximately 568 Lpm (150 gpm) and are expected to reach long-term, steady-state rates of less than 19 Lpm (5 gpm) in the next 30 years.

At the Split Rock site, ground water flows from higher elevations surrounding the New Tailings Impoundment, down the NW and SW valleys, and then merges with regional flow (see Figure 5). Ground water flows northwest out of the NW valley and merges with northeastward regional flow. Ground water flows southwest out of the SW valley, meets regional flow, and diverges into two flow paths around the granite outcrops, one to the north and one to the east. Lateral areas with structurally high granite beneath the Sweetwater River floodplain causes ground water to discharge from the Split Rock aquifer into the floodplain aquifer. A significant lateral constriction in the Split Rock aquifer and the Sweetwater River alluvium occurs near well WN-19 and at the point where the river passes through the granite outcrop at the Three Crossings Diversion Dam. Table 2 presents the hydraulic properties of the hydrologic units at the site.

Table 2
Hydraulic Properties of Hydrologic Units

Unit	Transmissivity (ft^2/day)	Storativity	Hydraulic Conductivity (ft/day)
Upper Split Rock	2,337	0.021	19.0
Lower Split Rock	1,153	0.003	6.6
Floodplain	4,185	0.21	248
Alluvial Deposits	710	0.005	9.8

3.3.3 Corrective Actions

Corrective actions involved extracting ground water from four wells located in areas of elevated uranium concentrations. In the NW valley, the CAP wells were Wells 4E and 5E; in the SW valley, the CAP wells were WN-B and Well 9E. Initially, pumping was also performed at the NW valley seepage pond. However, by early 1990, the NW valley seepage pond was nearly dry, and pumping from the pond was decreased to 151 Lpm (40 gpm). Pumping from the NW valley seepage pond ceased entirely in August 1990 (WNI, 1993), and seepage has not reappeared in the pond area since that time.

The CAP well system was designed to capture the annual pumping volume objective of 179 to 250 million liters (47.3 to 66 million gallons) of water per year. Beginning in January 1990, the wells operated year-round at combined flow rates of 221 to 813 Lpm (59 to 217 gpm) (WNI, 1993, 1994, 1995). In February 1992, the pumping duration was reduced to about 6 months per year (April through October), although the system was still required to pump the same volume of water annually (WNI, 1993). Pumping rates at the CAP wells were increased to meet the annual pumping volume objective (WNI, 1993). Extracted water was discharged to an evaporation pond and misting system that operated over the unreclaimed portion of the tailings impoundment (WNI, 1993). The misting system, originally located on the New Tailings Impoundment, was moved to the area of the Old and Alternate Tailings Impoundments in 1991 to facilitate surface reclamation.

Well 9E was abandoned in 1995 to allow for completion of the reclamation cover in the SW valley. The remaining wells continued to be operated at a combined flow rate of 750 Lpm (200 gpm) during April through October of each year. In May 1997, the NRC approved cessation of pumping from Well 5E**.** Pumping from this well, located at the mouth of the NW valley, drew a large amount of clean water from the regional aquifer and was deemed inefficient for the CAP. At this time, final reclamation of the tailings eliminated the surface area over which the CAP pumping was spray evaporated. Therefore, the NRC approved a temporary reduction in the CAP pumping rate to that which could be evaporated using the available surface area of the CAP ponds, approximately 22.5 to 56 million liters (6 to 15 million gallons) per year. Currently, WN-B (SW valley) and Well 4E (NW valley) continue to remove the required pumping volume of 22.5 to 56 million liters (6 to 15 million gallons) during the April through October pumping season (WNI, 1997). Conservative evaluation of the effectiveness of the existing CAP indicates that CAP pumping in the NW valley captures approximately 5 percent of the annual ground water flow down the NW valley while SW valley CAP pumping captures approximately 19 percent of the annual SW valley ground water flow. In addition, existing CAP pumping from both valleys does not capture ground water that has already passed the CAP pumping wells.

WNI has made an extensive effort to characterize the site with the installation of numerous monitoring wells, borings, soil samples, and surface water samples. With this information, WNI has completed a ground water flow and transport model to simulate ground water flow conditions over 1000 years (see Figures 6 and 7). Since 1990, WNI has extracted 1.74 billion liters (460 million gallons) of contaminated water. WNI contends that further corrective action would be extremely costly and would not provide an incremental amount of protection. Their site characterization has demonstrated that the existing ground water pumping has had little effect in preventing the migration of contamination. As required in ACL applications, WNI has outlined alternate technical corrective action strategies but concludes that the substantial cost ($18 to $114 million) would not provide additional protection. The recommended ACL approach is similar to the EPA's natural attenuation approach and is used in many ground water contamination sites all across the country.

3.3.4 Background Water Quality

To assess background water quality in the Split Rock aquifer, WNI collected water quality data for site drinking water wells, private wells, and monitoring wells. All wells are either upgradient or distantly cross-gradient from the site. To obtain appropriate alluvium background water quality data, WNI installed wells and minipiezometers in areas not expected to be impacted by site-derived contamination. Background data were collected from November 1995 to December 1997, except for the site drinking water wells that have been sampled beginning in 1981.

Background water quality for the Sweetwater River was assessed using data from WNI station S-7 near McIntosh Ranch, approximately 4.8 km (3 mi) west of the site. Water quality samples have been collected there since 1963. Data collected prior to 1982 exhibited greater variability than the later data; therefore, pre-1982 data were not used in the background calculations. Table 3 presents background ground water concentrations for the alluvial and Split Rock aquifers, respectively.

Table 3
Background Concentrations of ACL Parameters

Contaminant	Split Rock Aquifer	Alluvial Aquifer	Sweetwater River
Manganese (mg/L)	0.53	2.39	0.40
Molybdenum (mg/L)	0.10	0.10	0.10
Ammonia (mg/L)	0.70	0.16	0.45
Radium-226 & -228 (pCi/L)	5.30	4.7	4
Natural Uranium (mg/L)	0.1264	0.044	0.064
Nitrate (mg/L)	2.33	0.88	0.20

3.3.5 Current and Future Water Uses

Ground water near the facility is used for drinking water and livestock watering. The Sweetwater River is used for recreation, fishing, and livestock watering. Future uses of the Sweetwater River will likely remain the same. However domestic ground water use within the LTSB will cease. WNI has either purchased or secured ICs over ground water on all properties within the LTSB, preventing future ground water use. Ground water beyond the LTSB will likely continue to be used for drinking water and livestock watering.

3.4 Ecology

Information regarding terrestrial and aquatic ecology is presented in the final environmental statement for the site (NRC, 1980). Information from this document is summarized below. The most common vegetation is a sagebrush-grassland community dominated by silver sagebrush (*Artemesia cana*). In lowland areas containing more saline soils, silver sagebrush occurs with shadscale (*Atriplex confertifolia*). A pine juniper community occurs in the Granite Mountains near the site; dominant species are the limber pine (*Pinus flexilla*) and the Rocky Mountain juniper (*Juniperus scopulorum*).

Wildlife species at and surrounding the site include bats, rodents, ground squirrels, and rabbits (desert cottontails (*Sylvilagus audoboni*)), white-tailed jackrabbits (*Lepus townsendii*), and two important predators, the coyote (*Canis latrans*) and the badger (*Taxidea taxus*). Game animals found in the area include pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), desert cottontail, beaver (*Caster canadensis*), and bobcat (*Lynx rufus*). Bird species in the area include the horned lark (*Eremophila alpestris*), Brewer's sparrow (*Spizella* *breweri*), sage sparrow (*Amphispiza belli*), sage thrasher (*Oreoscoptes montanus*), rock wren (*Salpinctes obscletus*), mountain bluebird (*Sialia currucoides*). Game species include the sage grouse (*Centrocercus urophasianus*), mallard (*Anas platyrhynchos*), and mourning dove (*Zenaida macroura*). Reptiles and amphibians likely to be found near the site include the bullsnake (*Pituophis melanoleucus*), western rattlesnake (*Crotalus viridis*), western terrestrial garter snake (*Thamnophis elagans*), tiger salamander (*Ambystoma tigrinum*), and the Great Basin spadefoot (*Scaphiopus intermontanus*). Turtles known to inhabit the mill ponds in 1980 are probably no longer present since the habitat is gone due to reclamation activities. Such turtle species included the common snapping turtle (*chelydra serpentina*) and the western painted turtle (*Chrysemys picta*).

Endangered and threatened floral species in Fremont County include box pussytoes (*Antenneria arcuata*), Porter's sagebrush (*Artemisia porteri*), sword Townsendia (*Townsendia spathulata*), Fremont's bladderpod (*Lesquerella fremontii*), and Payson's beardtongue (*Penstemon paysoniorum*). Endangered and threatened fauna include black-footed ferret (*Mustela nigripes*), American peregrine falcon (*Falco peregrinus anatum*), and the whooping crane (*Grus americanus*).

3.5 Meteorology, Climatology, and Air Quality

Climate data were obtained from Jeffrey City, Wyoming, except for wind and evaporation data, which were obtained from Rawlins, Wyoming (WRCC, 2006). Rawlins, Wyoming, is approximately 114 km (70 mi) south of the site and is the closest weather station from which wind and evaporation data could be obtained. The climate of central Wyoming is semiarid with a mean total precipitation 26.2 cm (10.3 in); more than 40 percent occurs in April, May, and June. Evaporation (approximately 138 cm (55 in) per year) far exceeds precipitation. Snow has occurred in every month except July and August, and the highest average snowfalls occur in April and November. Table 4 is a summary of the site climate data.

Table 4
Site Climatic Data

Month	Avg[1] Max Temp (ºC/ºF)	Avg[1] Min. Temp (ºC/ºF)	Precip.[1] (cm/in)	Snowfall[1] (cm/in)	Wind[2] Speed (kpg/mph)	Prevailing [2] Direction	Pan Evaporation[2] (cm/in)
Jan	-0.72/ 30.7	-13.1/ 8.5	0.89/0.35	12.2/5.0	25.6/15.7	SW	2.8/1.1
Feb	1.1/33.9	-12.1/ 10.3	1.1/0.43	17.0/6.7	24.5/15.0	SW	3.8/1.5
Mar	6.36/ 43.4	-7.5/ 18.5	2.1/0.82	21.3/8.4	24.0/14.7	SW	7.1/2.8
Apr	12.6/ 54.7	-3.1/ 26.5	3.3/1.30	24.6/9.7	23.6/14.5	WSW	10.9/4.3
May	18.1/ 64.5	1.6/34.9	5.3/2.08	10.4/4.1	21.8/13.4	WSW	16.3/6.4
Jun	23.9/ 75.1	5.9/42.6	2.8/1.10	0.5/0.2	21.0/12.9	WSW	20.3/8.0
Jul	29.3/ 84.7	9.5/49.1	2.3/0.91	0/0	18.6/11.4	SW	25.1/9.9
Aug	28.3/ 82.9	8.9/48.1	1.7/0.66	0/0	17.9/11.0	SW	23.1/9.1
Sep	22.1/ 71.8	3.4/38.2	2.0/0.80	2.8/1.1	19.4/11.9	SW	14.2/5.6
Oct	15.2/ 59.4	-1.9/ 28.5	2.1/0.82	13.7/5.4	21.8/13.4	WSW	9.1/3.6
Nov	4.3/39.8	-8.7/ 16.4	1.6/0.63	24.9/9.8	23.0/14.1	SW	2.8/1.1
Dec	-0.44/ 31.2	-12.4/ 9.6	1.0/0.41	15.7/6.2	24.9/15.3	SW	2.8/1.1
Avg/ Total	13.3/ 56.0	-2.4/ 27.6	26.2/10.3	143.1/56. 6	22.2/13.6	SW	138.3/54.8

Source: Western Regional Climatic Center, 2006
1. Data from Jeffrey City, Wyoming 2. Data from Rawlins, Wyoming

3.6 Socioeconomic Conditions

The area surrounding the Split Rock mill is sparsely populated. Jeffrey City was far more populated when the mining/milling industry in this area was at its peak, however, presently the population for Jeffrey City is 106 with 45 occupied housing units according to 2000 Census data (Bureau of Census, 2000). Out of 112 total housing units 67 are vacant. There are no current plans that would indicate a population increase in the near future. The largest population center within 80 km (50 miles) of the mill site is Riverton, 64 km (40 miles) northwest with a 2000 estimated population of 9,310. Riverton is also the closest town with supplies of basic needs and services.

3.7 Historical and Cultural Resources

A recent search was conducted in the National Register of Historic Places. The closest resource on the list is called "Pioneer Ranches/Farms in Fremont County, Wyoming, ca. 1865-1895." None of the features listed in the registry are located within the proposed LTSB for the WNI site.

3.8 Public and Occupational Health

This licensing action does not involve any activities that would involve workers. Public health was assessed through extensive ground water sampling, ground water flow modeling, and contaminant fate and transport modeling. Ground water flow models were used to predict the direction of contaminant migration. For this purpose, the licensee used MODFLOW-2000, which is a finite difference 3-dimensional ground water flow model. Results of the model indicate that ground water flows down the northwest valley into the Sweetwater River and down the southwest valley and around the south side of the Granite peaks. From this point, ground water flows easterly toward the Red Mule development.

Ground water contaminant migration was assessed using MT3DMS, which takes output from MODFLOW-2000, to calculate contaminant migration distances, directions, and concentrations. Contaminants modeled by the licensee included uranium and sulfate, which migrate rapidly compared to other contaminants of concern. MT3DMS model results indicate that uranium concentrations of 0.1 mg/L would begin to impact the Red Mule area approximately 500 years after deactivating the remediation system. Sulfate contamination would dissipate after 200 years except in the area immediately downgradient of the tailings impoundment in the SW valley (WNI, 2003) (see Figures 6 and 7).

Some areas of elevated uranium and other metals exist naturally in the ground water in the area surrounding the site. In the Red Mule community, several water wells exhibit uranium concentrations as high as 0.3 mg/L (10 times the uranium MCL). NRC staff examined the possibility that elevated uranium concentrations in the Red Mule area originated from site activities. However, detailed evidence, including geochemical data, radionuclide ratios, fate and transport modeling, and characterization data, indicates that these elevated levels are not from site activities but are from natural rock and soils. This part of Wyoming is known for elevated levels of metals and uranium in the rock and soils, which is the reason uranium mining occurred in this area.

Although natural uranium ground water concentrations near the Red Mule community exceed the current uranium drinking water standard, modeling predictions indicate that uranium concentrations may rise slightly due to contamination from the site. WNI's current estimate indicates that uranium ground water concentrations would increase by 0.1 mg/L in the Red Mule area. However, with the institutional control restrictions, exposure to humans will be prevented and maximum uranium ground water concentrations are not sufficiently high to cause environmental impacts. It should be stressed that the primary potential risk of uranium in ground water is drinking water ingestion by humans and not livestock, agriculture, or environmental risk.

3.9 Transportation

U. S. Highway 287 serves as a major transportation route from Jeffrey City east to Casper (through State Highway 220), south to Rawlins, west to Lander, Jackson, and Yellowstone Park, and north to Riverton (through State Highway 789).

4.0 ENVIRONMENTAL IMPACTS

4.1 Land Use

Implementing the proposed action would result in the loss of ground water for potable purposes within the LTSB. Because the licensee has either purchased private residences or gained institutional control over domestic ground water use on private land within the LTSB, such property would no longer be used for residential development. Access to much of the land would be maintained, except for the area containing the reclaimed impoundments and mill area that would be enclosed by a fence. Therefore, hunting and fishing within the LTSB would be permitted. Implementing ICs would be a small land use impact because of loss of domestic ground water use within the LTSB.

4.2 Surface Water

Ground water contamination from the site currently seeps into the Sweetwater River. Although contaminant concentrations dilute the site contributes sulfate, TDS, and uranium to surface water. Potential receptors include ecological and human by contact during recreational activities and potential consumption of fish. However, surface water dilutes ground water influent to the point where contamination by site contamination minimally affects surface water concentrations. However, impacts are small and do not change the use of the Sweetwater

River. For example, as stated in Section 3.3.1, the maximum surface water uranium concentration since 2004 is 0.013 mg/L, well below the MCL of 0.03 mg/L.

According to model projections, the seepage will diminish over time; consequently, stream loading of site-derived contamination will likely diminish over time. To account for uncertainty of the model and to assure the protection of the Sweetwater River, a surface water sampling program is included in WNI's proposal. Therefore, in the unlikely event that seepage concentrations increase in the river, sampling should detect surface water contamination prior to any adverse environmental impacts.

4.3 Ground Water

If this action is approved, ground water contamination would continue to migrate and degrade water quality but only within areas of restricted use. As previously stated, ground water models show that uranium concentrations of 0.1 mg/L would be present over much of the LTSB. The loss of this resource is a moderate impact, since approximately 3,800 acres of ground water could be affected by migrating ground water contamination and the use of ICs. However, the only restriction on ground water use is for domestic purposes. As discussed in Section 3.8, livestock and agricultural uses would not be impacted. Although impacts to ground water have and will occur, these impacts will mitigated by the use of ICs to restrict domestic usage.

Current ground water constituent concentrations are ALARA, considering practicable corrective actions taken to date, costs of continuing corrective actions versus the potential benefit, and potential offsite impacts. Concentrations of certain constituents do not meet current GPSs, and continued corrective actions would not likely improve ground water quality substantively. Therefore, ACLs are considered appropriate to protect human health and the environment and close the site permanently.

4.4 Ecological Impacts

Ecological impacts would be small as a result of the residual ground water contamination remaining after implementing the proposed action. Regarding ecological impacts from surface water contamination, a comprehensive evaluation of the environmental impact by seepage from the NW valley was conducted in 1995 (WNI, 1999). Subsequent analyses indicated that maximum contaminant loading to the river occurred in approximately 1995 and was in response to the peak ground water flow rates from the valleys caused by the maximum liquid levels in the tailings impoundments in 1986. Ground water flow rates and concentrations in the upper valleys, and, therefore, loading to the river have demonstrably decreased. As long as concentrations of the hazardous constituents remain at or below historic levels, all of the environmental receptors will remain protected. A review of recent surface water

If the concentrations were to increase significantly over time, ecological receptors would still remain protected because the loading to the river is a function of the concentrations and the flow rate out the valley. The maximum loading to the river occurred in 1995 and was reflective of both maximum concentrations and maximum flow rates. The maximum ground water flow rate out the NW valley was approximately 4,498 Lpm (1,200 gpm) and the peak tailing seepage rate was 3,748 Lpm (1,000 gpm). Conditions in the Sweetwater River remained protective during these conditions. The current flow rate is approximately 787 Lpm (210 gpm) (567 Lpm (150 gpm) from tailings seepage) and the long-term flow rate is expected to be approximately 375 Lpm (100 gpm) (19 Lpm (5 gpm) from seepage). Since the long-term ground water flow rate is approximately 1/10 the maximum historical NW valley flow rate and tailing long-term tailings seepage rates will be 1/20 of historical peak seepage rates, the long-term concentrations could be 10 to 20 times greater than historic levels and still be protective. This is further shown by modeling presented by WNI (WNI, 2003), which demonstrates that within approximately 50 years ground water concentrations of uranium, for instance, will approach background upgradient of the Sweetwater River.

As discussed in Section 3.3.1, a review of surface water data indicates that the site does contribute small contaminant loads to the Sweetwater River. However, these loads barely alter water quality and do not change the use of the Sweetwater River. This appears to corroborate WNI's modeling. Section 3.8 addresses uptake of contaminants by plants and subsequent cattle ingestion. Resulting contaminant uptake and ingestion would not result in expsosures in excess of established standards; therefore, this impact is considered small.

4.5 Meteorology, Climatology, and Air Quality

No adverse meteorological, climatological, or air quality impacts are expected by the implementation of the proposed action.

4.6 Socioeconomic

One potential impact of the proposed action is the loss of potential commerce in an already fragile economy due to purchasing private residences. However, of the 12 properties purchased, only 2 were occupied at the time of acquisition. Therefore, economic impact of losing potential consumers in this area is small, especially because the economy of Jeffrey City is currently depressed due to the closure of the Split Rock mill. Furthermore, Internet searches indicate that stores for basic needs and services are found in Riverton, which is 45 miles from Jeffrey City (Yahoo, 2006). Therefore, the loss of a few Red Mule consumers is a small economic impact.

4.7 Historical and Cultural Resources

No adverse impacts to historic and cultural resources are expected because the proposed action does not involve any surface disturbance.

4.8 Public and Occupational Health

As discussed in Section 3.0, potential human exposure pathways are ingestion of contaminated ground water, ingestion of water and fish from the Sweetwater River, and ingestion of cattle that grazed within the LTSB. The contaminated ground water ingestion pathway would be eliminated by ICs as discussed previously and in Section 5.0. Fish and water ingestion from the Sweetwater River would be not impact human health because, as discussed in Section 3.8, contaminant loading from the site is minimal. Furthermore, contaminant concentrations do not exceed MCLs or class of use standards. Human uptake of uranium from cattle ingestion would be negligible because uranium concentrations in grass are relatively low and humans only eat small portions of a particular animal. Mitigation measures are presented in Section 5.0.

4.9 Transportation

No adverse impacts to historic and cultural resources are expected because the proposed action does not involve any surface disturbance.

5.0 MITIGATION MEASURES

Figure 8 presents the LTSB and the properties within which WNI purchased or otherwise secured institutional control over ground water use. Using ICs to restrict exposure to contaminated ground water would be implemented as part of the proposed action. The risk assessment for this action has concluded that the primary potential exposure pathway is through human ingestion of, or contact with, contaminated ground water. If the potential for ingestion or contact were restricted, the exposure pathway would be eliminated, thereby, preventing risk to human health from radionuclides and heavy metals. Therefore, land acquisition and ICs effectively mitigate potential public health impacts of contamination remaining in the ground water as a result of the proposed action.

Approving this action would cause ground water contamination to migrate into waters not previously contaminated. The ICs, however, would restrict contaminated water from being consumed, thereby preventing exposure to humans. Additional active corrective action would not produce an incremental protection of human health and the environment relative to the costs. This approach has been implemented in other ground water remediation programs such as underground storage tanks under the Resource Conservation and Recovery Act of 1976, as amended, and superfund sites under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended. The EPA, Department of Defense, and Department of Energy (DOE) all have guidance on the use of ICs as a means of reducing risk from ground water contamination.

6.0 MONITORING

As part of the NRC's basis for approving the ACLs, a comprehensive ground water and surface water monitoring program would be implemented. The purpose of this program is to detect ground water contamination before it reaches potential receptors, to track the movement and concentrations of the ground water contaminant plume, to account for uncertainty with the proposed ground water flow and transport models, and to assess the quantity and impacts of surface water contaminant loading. Table 5 presents the monitoring program and Figure 9 presents the monitoring locations. This monitoring program would eventually be undertaken by the DOE after license termination.

Table 5
Surface Water and Ground Water
Compliance Monitoring Network

Monitoring Wells/Sample location	Parameters
JJ-1R	Semiannual Sampling - uranium (natural), sulfate, water quality parameters pH and conductivity, and water levels. Annual Sampling - aluminum, ammonia, antimony, arsenic, beryllium, cadmium, chloride, fluoride, lead, manganese, molybdenum, nickel, nitrate, pH, radium-226 and -228, selenium, sulfate, thallium, thorium-230, total dissolved solids, uranium (natural), water quality parameters pH and conductivity, and water levels.
SWAB-1	
SWAB-2	
SWAB-4	
SWAB-12	
SWAB-22	
SWAB-29	
SWAB-31	
SWAB-32	
WN-39B	
WN-41B	
WN-42A	
Upstream Surface Water	

Monitoring Wells/Sample location	Parameters
SW-A	
SW-B	
SW-C	
Downstream Surface Water	
WELL 1	Semiannual Sampling - aluminum, ammonia, antimony, arsenic, beryllium, cadmium, chloride, fluoride, lead, manganese, molybdenum, nickel, nitrate, radium-226 and -228, selenium, sulfate, thallium, thorium-230, TDS, uranium (natural), water quality parameters pH and conductivity, and water levels.
WELL 4R	
WELL 5	
WN-21	

7.0 AGENCIES CONSULTED

The Wyoming Department of Environmental Quality (WDEQ) and the DOE have been consulted on this proposed action since the application was first submitted in 1999. Multiple meetings between NRC staff and both DOE and WDEQ have been held to discuss issues relating to the proposal. DOE has been consulted on this proposed action since the application was first submitted in 1999. The purpose of DOE's involvement is to address any issues with the monitoring network and the LTSB before DOE acquires the site after license termination. Multiple meetings between NRC staff and DOE have been held to discuss issues relating to the proposal. Requests for comments have been sent to EPA Headquarters and Region 8, U.S. Fish and Wildlife Service, Wyoming State Engineers Office, DOE, the Wyoming State Historic Preservation Office, and the Bureau of Land Management.

8.0 CONCLUSIONS

Based on the information presented above, NRC staff has determined that impacts associated with the proposed action are not significant and does not warrant the preparation of an Environmental Impact Statement. Accordingly, it has been determined that a finding of no significant impact (FONSI) is appropriate. The following statements support a FONSI and summarize the conclusions of the EA.

9. Potential access to the seepage-impacted ground water is prevented by including impacted aquifers within the LTSB and by property acquisition and the use of ICs (mitigation measures).

10. Discharges to the Sweetwater River are not sufficient to impact human health and the environment.

3. Ground water fate and transport modeling conducted by WNI indicates that revising the ground water standards to ACLs would cause no degradation to the use of ground water or surface water outside the LTSB, as a result of mill-related activities.

4. Only potable ground water use is impacted within the LTSB; ground water may still be used for livestock watering and irrigation.

5. An acceptable compliance ground water monitoring program will be implemented to adequately monitor the future movements of the ground water plume and assure that no significant environmental impacts will occur and that the ACLs will not be exceeded.

9.0 List of Preparers

Stephen J. Cohen, Project Manager, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards, NRC

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