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

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

August 2006

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

Enclosure

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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

1.0 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). In accordance with License Condition 74 of Source Materials License SUA-56, by letter dated October 29, 1999, WNI submitted a Site Closure Plan that requested amendments to 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, 2002d), March 7, 2003 (WNI, 2003), May 24, 2004 (WNI, 2004), February 10, 2005 (WNI, 2005a), March 3, 2005 (WNI, 2005b), March 20, 2006 (Shaver, 2006), and July 31, 2006 (MFG, 2006a). NRC staff prepared a draft environmental assessment (EA) on May 2, 2006, and received comments from Federal and state agencies. This final EA, prepared to document the NRC staff's evaluation and conclusions, addresses those draft EA comments.

1.1 Background

The site is located in southeast Fremont County, Wyoming, south of the Sweetwater River, at the head of two alluvium-filled valleys (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 (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 a 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, 1999a).

WNI used acid leach, ion exchange, and solvent extraction to process approximately 7.7 million tons of uranium ore from 1957 to 1981. The mill 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 uranium prices. 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 location of the former mill.

Process waste in the form of tailings solids and acidic liquids were discharged to the unlined tailings impoundments that were operated from 1957 until 1981. These impoundments were designed in 1957, when the original AEC license (R-205) was issued. Tailings pond design criteria favored the elimination of process effluent by seepage into the ground, maximizing tailings storage while decreasing water storage and handling requirements. Three primary tailings disposal areas were used during the operational life of the mill, the Old, Alternate, and New tailings impoundments. Approximately 7.7 million tons of tailings were deposited in these impoundments.

Because WNI utilized infiltration to help dewater tailings, seepage from the tailings impoundments contaminated ground water in underlying aquifers. As a result, several corrective actions were 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 impoundment seepage and discharge it back to this impoundment (WNI, 1999a). In addition, a formal Corrective Action Program (CAP) was implemented in 1990, as required by Source Materials License SUA-56, Condition No. 74, which WNI currently implements.

1.2 Need for the Proposed Action

The current CAP has minimized the amount of seepage emanating from the tailings impoundments. However, it has not been effective at addressing ground water contamination that passed through the SW and NW valleys prior to the CAP or any contamination that may have passed the extraction wells during the CAP. Continuing current CAP operations would allow ground water contamination to exist and migrate for extended time periods, posing a risk to human health and the environment. Therefore, a different strategy is required to protect public health and the environment.

1.3 The Proposed Action - ACLs With Institutional Controls

The proposed action is the establishment of 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 long-term surveillance boundary (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 presented on a LTSB map prepared by WNI (MFG, 2006b) (Figure 3).

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) (Figure 4).

4) Purchase properties within the LTSB and prohibit domestic ground water use or establish ICs for those properties that cannot be purchased.

5) Establish surface water and ground water trigger limits at the POE or in ground water wells that would require actions on the part of the licensee.

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)	0.61	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 the proposed action is to remove the drinking water exposure pathway on private or government-owned properties within the LTSB and protect ground water and surface water beyond the LTSB for the 1000-yr compliance period. 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 (Figure 4). Through ground water flow and contaminant transport modeling, WNI demonstrated that the ACLs would result in levels that meet water quality standards at the POE or are consistent with NRC-approved background concentrations.

Human health and environmental protection would be accomplished through the institutional elimination of human ground water consumption within the LTSB and monitoring to detect conditions that may impact ground water and surface water quality beyond the LTSB. In anticipation of the ACL approval, WNI has obtained the ICs, by purchasing or otherwise establishing, durable and enforceable restrictions on domestic ground water use on all properties within the proposed LTSB. As described, ICs would 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 Regulatory Environment

1.4.1 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, as amended. 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.

1.4.2 Basis of NRC Review

NRC staff has assessed the potential environmental impacts associated with this request for a license amendment to modify the GPSs, and documented the results of the assessment in this EA. 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), which has cost approximately $18 million to-date including investigation costs. 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

WNI developed a series of alternatives to the proposed action for protecting ground water at the site and adjacent areas, consisting of a combination of active and passive strategies. All the active remedial alternatives are variations of ground water extraction, injection, and treatment. ICs are the passive aspect of each active alternative.

2.2.1 Hydraulic Diversion With Institutional Controls

Hydraulic diversion would consist of creating a barrier using approximately 16 injection wells located near the mouth of the SW valley. Hydraulic diversion has the benefit of physically isolating native ground water from contaminated ground water minimizing the amount of contamination that migrates beyond 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 south 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 1.63 kilometers (km) or 1 mile (1 mi) upgradient of the SW valley mouth. Approximately 1,874 liters per minute (Lpm) or 500 gallons per minute (500 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 protect human health and the environment at the POE.

Costs associated with this alternative address installation and operation of the hydraulic diversion system. Economic costs for this alternative are approximately $18 million. The major noneconomic cost for this alternative is the long-term use of water resources. Of the 1,874 Lpm (500 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 through contact with contaminated ground water and discharge to the Sweetwater River.

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 protect human health and the environment at the POEs. This alternative would remove some residual contamination, consequently, reducing the amount of contamination that might migrate downgradient. This alternative would also isolate native ground water from contaminated ground water while the system in operating. 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 SW valley. Extracted ground water would bedischarged 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 in 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 protect public health and the environment 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. Water treatment could reduce the size of the ponds required for storage and treatment. Noneconomic costs include the potential 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. Similar to the above alternative, this alternative would remove residual ground water contamination reducing quantity of contamination that might migrate downstream. This alternative would also provide long-term containment of residual contamination after the initial extraction and treatment phase is completed. 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 to remove contaminants.

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 in the upper valley. After SW valley focused pumping cleanup is completed, the 19 SW valley extraction wells and 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 protect human health and the environment 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 the 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 (not quantified anywhere in this EA), because ground water contamination would continue to migrate from the site. This action also does not provide any human health or environmental protection because no ICs would be established to remove the ground water exposure pathway.

The remaining alternatives are combinations of active remediation/containment 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.

Other technologies such as permeable reactive barriers or bioremediation were considered but not reviewed in detail by WNI. Although use of these technologies could provide a pollutant reduction benefit, the cost would likely be in the tens of millions of dollars. Furthermore, these alternatives would likely still not meet the need for protection human health and the environment. Therefore, WNI's lack of consideration of these technologies does not, of itself, alter the basic conclusion that active remediation would not provide a remedial benefit commensurate with the associated costs.

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 (approximately 2 miles west of the Split Rock site) was founded and grew to accommodate a population of industrial site workers. A 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) of Wyoming. The plateau is a southeasterly ridge of high elevations that 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. Site surface drainage is generally in a southwesterly direction toward Jeffrey City and northward to the Sweetwater River. Figure 5 contains a topographic map of the site.

A map showing the local geology is included as Figure 6. During the Miocene Epoch (5 to 24 million years (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.

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, pebbles 5 mm 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. Grains are pale yellow, fine to medium, 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 pebbles up to 50 mm (2.0 in) in diameter. Finer gravel and sand are dominantly quartz.

- 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. Interbeds of gravel, clay, and calcareous sandstone are common.

- 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 sandstone, siltstone, and claystone are common. Sandstones are similar to those found in the Upper Split Rock unit.

- 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.

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 floodplain lakes adjacent to the river. These lakes are north of the river and are essentially unconnected to the hydrologic systems south of the river (WNI, 1999a). 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 the Pathfinder Reservoir, approximately 64.4 km (40 mi) downstream of the site. The Sweetwater River is utilized for fishing, 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 1.6 km (1 mile) 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 floodplain aquifer along its reach during periods of seasonal high flow, typically from May to August. A review of recent monitoring data 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 0.03 mg/L.

Near the site, the river is classified as Class 2AB surface waters. Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally. Unless it is shown otherwise, these waters are presumed to have sufficient water quality and quantity to support drinking water supplies and are protected for that use. Class 2AB waters are also protected for nongame fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture and scenic value uses (Wyoming Department of Environmental Quality (WDEQ), 2006).

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 Sweetwater River cut and meandered across the Split Rock formation. Most residents of Jeffrey City derive their water supply from the town wells drilled into the Split Rock aquifer. 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 and the Sweetwater River to the north. The Green Mountains provide the primary recharge to the regional ground water system, and the Sweetwater River 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. 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. South of the Sweetwater River, ground water generally flows north, except near the site where 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 and within the LTSB 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 (WNI, 1999a). In addition, drainage of the tailings has historically input up to 5,300 Lpm (1,400 gpm) to the ground water system. Since tailings and water disposal in the tailings impoundments ceased in 1986, tailings drainage has greatly diminished, and the ground water mound beneath the tailings has largely dissipated. Current tailings seepage rates are 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 site, ground water flows from higher elevations surrounding the New Tailings Impoundment, down the NW and SW valleys, and then merges with regional flow (Figure 7). 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 northeast and one to the east. Areas with higher granite basement elevations 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 northeast of the site 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

3.3.2.3 Models and Contaminant Migration

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) (Figures 8 and 9).

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.

3.3.3 Corrective Actions

Corrective actions involved extracting ground water from four wells located in areas of elevated uranium concentrations; two wells were located in each valley. 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). In February 1992, the pumping duration was reduced to approximately 6 months per year (April through October), although the system was still required to pump the same volume of water annually. Extracted water was discharged to an evaporation pond and misting system that operated over the unreclaimed portion of the tailings impoundments. 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 (WNI, 1999a).

One CAP well 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 one CAP well located at the mouth of the NW valley. This well 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. In May 2006, WNI added three wells to the CAP because reduced well efficiencies from the two remaining wells impacted well yields to the point where WNI could not achieve the required pumping volume (WNI, 2006a). Since 1990, WNI has extracted 1.74 billion liters (460 million gallons) of contaminated ground water.

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 (WNI, 1999a). In addition, existing CAP pumping from both valleys does not capture ground water that has already passed the CAP pumping wells.

WNI contends that further corrective action would be extremely costly and would not provide an incremental amount of protection. 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 floodplain aquifer 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)	0.015	0.011	0.45
Radium-226 & -228 (pCi/L)	5.30	4.7	4
Natural Uranium (mg/L)	0.13	0.044	0.064
Nitrate (mg/l)	3.99	0.88	0.20

Source: WNI, 1999a

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. Future ground water use within the LTSB would include livestock watering and agriculture, except in the tailings disposal area or in the immediate area of the NW and SW valleys. No domestic ground water uses would be allowed within the LTSB, as WNI has either purchased or secured ICs over ground water on all properties within the LTSB to prevent such uses. Ground water beyond the LTSB will likely continue to be used for drinking water and livestock watering.

NRC staff reviewed the effects of using ground water within the LTSB for agricultural and livestock purposes. Of particular interest are the effects of ACL constituents on livestock, effects on humans consuming livestock, and the effects on humans consuming crops grown within the LTSB. Regarding uranium, the calculated daily intake of 250 mg is not sufficient to cause harm to cattle. Furthermore, the dose to humans from consuming cattle and crops raised within the LTSB is not likely to impact human health (WNI, 2003). NRC concurs with this assessment and presents its findings in the Technical Evaluation Report accompanying the license amendment.

It should be noted that according to the background data collected by WNI, ground water in the LTSB generally does not meet WDEQ’s Class II agriculture standards for manganese. Currently, the McIntosh property (west of the site) is the only property the WNI granted access to ground water for agricultural and/or livestock watering purposes. This property is close to well SWAB-22, and the latest data from this well indicates that manganese concentrations are below the Class II agriculture standards (WNI, 2006b). Therefore, this water is suitable for agriculture. It is also important to note that although the actual ACLs do not meet WDEQ ground water standards for livestock and agriculture near the mouths of the NW and SW valleys, ground water quality in other areas within the LTSB would comply with WDEQ's Class II and Class III (livestock) ground water standards.

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*).

According to the U.S. Fish and Wildlife Service (FWS), Ute ladies'-tresses (*Spiranthes diluvialis*) is the only endangered and threatened floral species near the site. Endangered and threatened faunal include black-footed ferret (*Mustela nigripes*), bald eagle (*Haliaeetus leucocephalus*), and Platte River species (FWS, 2006).

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 (°C/°F)	Avg[1] Min. Temp (°C/°F)	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

According to the Wyoming State Historic Preservation Office (WSHPO), several historic properties are located in the vicinity of the Split Rock site. They include the Oregon Trail (FR736) and three eligible prehistoric sites (FR2862, FR2864, and FR413). However, the western portion of the LTSB has not been surveyed, to date (WSHPO, 2006).

3.8 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 access to 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 and the loss of some land for residential development.

4.2 Surface Water

Ground water contamination from the site currently seeps into the Sweetwater River resulting in small contributions of sulfate, TDS, and uranium. Potential receptors are 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 contributed by the site minimally affects surface water concentrations. Therefore, the small contaminant contributions do not change the use of the Sweetwater River, and this impact is considered small. 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 WNI's model projections, seepage from the tailings impoundments 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 (see Section 6.0). Therefore, in the unlikely event that seepage concentrations increase in the river, sampling should detect surface water contamination prior to any adverse environmental impacts.

NRC staff is also including surface water trigger concentrations for the ACL parameters in the license (Table 5). WNI's license conditions will require certain actions be taken in the event that surface water concentrations of ACL parameters exceed the trigger values at the downstream LTSB. Trigger values are either background, Class 2AB surface water standards, or MCLs, whichever are greater.

Table 5

Surface Water Trigger Values

Contaminant	Surface Water Trigger Value
Manganese (mg/L)	0.05
Molybdenum (mg/L)	0.18
Ammonia (mg/L)	0.5[1]
Radium-226 & -228 (pCi/L)	5.00
Natural Uranium (mg/L)	0.03[2]
Nitrate (mg/l)	10

1. Same as ground water trigger level
2. Uranium MCL

4.3 Ground Water

Under WNI's proposed action, existing ground water contamination would continue to migrate and degrade ambient water quality but only within some portions of the LTSB upgradient of the POE. As previously stated, WNI's ground water models indicate that uranium concentrations of 0.1 mg/l would be present over much of the LTSB south of the site during the 1000-yr compliance period. 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 (Section 3.3.3), 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. Furthermore, the concentrations of ACL constituents at the POE would either comply with WDEQ/EPA standards or would be consistent with NRC-approved background concentrations. Therefore, ACLs are considered appropriate to protect human health and the environment.

NRC staff is also including ground water trigger concentrations for the ACL parameters in the license (Table 6). WNI's license conditions will require certain actions be taken in the event that ground water concentrations of ACL parameters exceed the trigger values at the downstream LTSB. Trigger values are either background, MCLs, or EPA Risk-Based Concentrations (RBCs), where MCLs are not available.

Table 6
Ground Water Trigger Values

Contaminant	Split Rock Aquifer Trigger Value	Floodplain Aquifer Trigger Value
Manganese (mg/L)	0.73	2.39

Molybdenum (mg/L)	0.18	0.18
Ammonia (mg/L)	0.5	0.5
Radium-226 & -228 (pCi/L)	5.0	5.0
Natural Uranium (mg/L)	0.03/0.3[1]	0.03
Nitrate (mg/l)	10	10

1. SWAB-32 trigger value.

Because SWAB-32 is located at the edge of a uranium mineralized zone near the former Red Mule development, uranium concentrations exceed the trigger value currently. Therefore, a different trigger value of 0.3 mg/l will apply to SWAB-32. The latest uranium concentration in this well is 0.136 mg/l. Contaminant transport modeling indicates that the uranium concentration could increase by 0.1 mg/l, as contaminant ground water migrates to this well. Allowing for variations in contaminant concentrations, 0.3 mg/l is a reasonable trigger value for this well.

A stated in Section 3.3.5, NRC-approved background manganese concentrations exceed the WDEQ Class II agriculture standards. However, specific data from well SWAB-22 indicates that manganese concentrations are below the standards at this location (near the McIntosh property). At this point in time, this property is the only property for which WNI has granted permission to use for agriculture. However, this would not preclude other properties from being used for agriculture, should WNI or DOE (after license termination) grant such permission.

4.4 Ecological Impacts

Habitat for the endangered and threatened species presented in Section 3.4 does not exist within the boundaries of the mill tailings site. Furthermore, no land surface disturbance or surface water hydrologic changes will occur between within the LTSB. Ecological impacts would be also not likely occur as a result of residual ground water or surface water contamination remaining after implementing the proposed action. A comprehensive evaluation of the environmental impact by seepage from the NW Valley was conducted in 1995 (WNI, 1999a). 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 (WNI, 1999a). Ground water flow rates and concentrations in the upper valleys, and, therefore, loading to the river have demonstrably decreased. Therefore, impacts to any endangered or threatened species are not likely to occur, as a result of the proposed action.

4.5 Meteorology, Climatology, and Air Quality

Meteorology, climatology, and air quality are not expected to be impacted by the implementation of the proposed action.

4.6 Socioeconomic Impacts

One potential impact of the proposed action is the loss of potential commerce in an already fragile economy due to purchasing private residences by WNI. 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 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

Approving this action would cause ground water contamination to migrate into waters not previously contaminated. 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 (WNI, 1999b). 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. ICs established by WNI would restrict contaminated water from being consumed, thereby preventing exposure to humans within the LTSB. Therefore, ICs effectively mitigate potential public health impacts of contamination remaining in the ground water as a result of the proposed action. Furthermore, ground water and surface water trigger levels have been established, the exceedance of which would require a response by the licensee.

This approach has been implemented in other ground water remediation programs such as the underground storage tank program 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 or surface water contamination before it reaches potential receptors, to track the movement and concentrations of the ground water contaminant plume, and to account for uncertainty with the proposed ground water flow and transport models. Table 7 presents the monitoring program and Figure 3 presents the monitoring locations. The U.S. DOE will undertake an NRC-approved ground water monitoring program after license termination.

Table 7
Surface Water and Ground Water
Compliance Monitoring Network

Monitoring Wells/Sample location	Parameters
JJ-1R, SWAB-1, SWAB-2, SWAB-4, SWAB-12, SWAB-22, SWAB-29, SWAB-31, SWAB-32, WN-39B, WN-41B, WN-42A, Upstream SW-A, SW-B, SW-C, Downstream	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.
WELL 1, WELL 4R, WELL 5, WN-21	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.

7.0 AGENCIES CONSULTED

The Wyoming Department of Environmental Quality (WDEQ) has been consulted on this proposed action since the application was first submitted in 1999. Multiple meetings between NRC staff 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 purposed 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, FWS, Wyoming State Engineers Office, DOE, WSHPO, and the Bureau of Land Management. NRC staff received comments from the DOE, WSHPO, FWS, and WDEQ. Appendix A presents the comments and NRC staff’s responses.

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.

1. Potential access to the seepage-impacted ground water is prevented by including impacted aquifers within the LTSB, property acquisition and the use of ICs (mitigation measures), and the establishment of ground water and surface water trigger values.

2. 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

William von Till, Hydrogeologist, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards, NRC

10.0 LIST OF REFERENCES

MFG, Inc., 2006a, E-mail Communication From Lou Miller to Stephen J. Cohen, March 27, 2006 [ADAMS Accession No. ML060090475].

MFG, Inc., 2006b, Map of Long-Term Surveillance Boundary, August 1, 2006 [ADAMS Accession No.].

Shaver, H.W., 2006, Letter to Gary Janosko transmitting the Deed and Title Policy Demonstrating Acquisition of Jamerman Property, March 20, 2006 [ADAMS Accession Number ML060930593].

U.S. Census Bureau, http://www.census.gov/main/www/cen2000.html, 2006.

U.S. Fish and Wildlife Service, 2006, Letter to Gary Janosko Transmitting Comments Regarding the Draft Environmental Assessment, July 3, 2006 [ADAMS Accession No. ML061990423].

U.S. Geological Survey, http://waterdata.usgs.gov/nwis/sw/, 2006.

U.S. Nuclear Regulatory Commission, Final Environmental Statement Related to Western Nuclear, Inc., Split Rock Mill, February 1980 [ADAMS Accession No. ML032650890].

U.S. Nuclear Regulatory Commission, 2003a, NUREG-1620, Rev. 1, Standard Review Plan for the Review of a Reclamation Plan for Mill Tailing Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978, June 2003.

U.S. Nuclear Regulatory Commission, 2003b, NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs, August 2003.

Western Nuclear, Inc., 1999a, Site Ground Water Characterization and Evaluation, 1999 [ADAMS Accession Nos. ML003672396, ML003672400, ML003672396].

Western Nuclear, Inc., 1999b, Baseline Risk Assessment, Appendix I to Site Closure Plan, December 31, 1999 [ADAMS Accession No. ML003672619].

Western Nuclear, Inc., 2000a, Letter From Lawrence J. Corte to Thomas H. Essig Regarding the Site Closure Plan for Western Nuclear, Inc., January 17, 2000 [ADAMS Accession No. ML003676128].

Western Nuclear, Inc., 2000b, Letter From Harley W. Shaver to Thomas H. Essig regarding Site Closure Plan for Split Rock Site, February 27, 2000 [ADAMS Accession No. ML003686985].

Western Nuclear, Inc., 2000c, Letter From Anthony J. Thompson to Thomas H. Essig Regarding Site Closure Plan for Western Nuclear, Inc., Split Rock Site, February 28, 2000 [ADAMS Accession No. ML003687478].

Western Nuclear, Inc., 2001, Supplement to October 29, 1999, Split Rock Site Closure Report, February 1, 2001 [ADAMS Accession No. ML010380246].

Western Nuclear, Inc., 2002a, WNI Response to NRC Request of September 6, 2001, for Additional Information on Site Closure Plan for the Split Rock, Wyoming, Site, May 28, 2002 [ADAMS Accession No. ML021710273].

Western Nuclear, Inc., 2002b, Supplemental Data Collection, Program Trip Report, May 28, 2002 [ADAMS Accession No. ML021710422].

Western Nuclear, Inc., 2002c, WNI Response to NRC Request of September 6, 2001, for Additional Information on Site Closure Plan for the Split Rock, Wyoming, Site, July 23, 2002 [ADAMS Accession No. ML022110059].

Western Nuclear, Inc., 2002d, Letter From Lawrence J. Corte to Bill von Till Regarding Responses to Questions Raised on August 21, 2002, Telephone Conference, September 9, 2002 [ADAMS Accession No. ML022560163].

Western Nuclear, Inc., 2003, Supplemental Ground Water Monitoring Report, March 7, 2003 [ADAMS Accession No. ML030760336].

Western Nuclear, Inc., 2004, Letter to Robert A. Nelson Regarding Risk Assessment of Ground Water for Agricultural Uses, May, 24, 2004 [ADAMS Accession No. ML041490156]

Western Nuclear, Inc., 2005a, Letter from Lawrence J. Corte to Gary Janosko Regarding Efforts to Purchase Properties within Long-Term Surveillance Boundary, February 10, 2005 [ADAMS Accession No. ML051220100].

Western Nuclear, Inc., 2005b, Response to Request for Additional Information, March 2, 2005 [ADAMS Accession No. ML050690064].

Western Nuclear, Inc., 2005c, Ground Water Monitoring Report, Split Rock Mill Site, Ground Water and Surface Water Monitoring Results, July 26, 2005 [ADAMS Accession No. ML052220552].

Western Nuclear, Inc., 2005d, Ground Water Monitoring Report, Split Rock Mill Site, Ground Water and Surface Water Monitoring Results, February 23, 2005 [ADAMS Accession No. ML050700396].

Western Nuclear, Inc., 2006a, Letter to Gary Janosko Regarding the Addition of Three Wells to the CAP, May 9, 2006 [ADAMS Accession No. ML061390138].

Western Nuclear, Inc., 2006b, Ground Water Monitoring Report, Split Rock Mill Site, Ground Water and Surface Water Monitoring Results, April 18, 2006 [ADAMS Accession No. ML061220275].

Western Regional Climatic Center, http://www.wrcc.dri.edu/CLIMATEDATA.html, 2006.

Wyoming State Historic Preservation Office, 2006, Letter to Gary S. Janosko Transmitting Comments on Draft Environmental Assessment, May 24, 2006 [ADAMS Accession No. ML061560219].

Wyoming Department of Environmental Quality, 2005, Water Quality Rules and Regulations, Chapter 8, Wyoming Ground Water Quality Standards, April 26, 2005.

Wyoming Department of Environmental Quality, 2006, Water Quality Rules and Regulations, Chapter 1, Wyoming Surface Water Quality Standards, http://soswy.state.wy.us/Rule_Search_Main.asp.

APPENDIX A

AGENCY COMMENTS REGARDING DRAFT ENVIRONMENTAL ASSESSMENT AND NRC STAFF RESPONSES

AGENCY	COMMENT	RESPONSE
Wyoming SHPO	A search of our records on May 24, 2006 indicates that the entire area has not been previously surveyed for cultural resources. Additionally, this search indicates that several historic properties are known to exist in the vicinity. However, what is not clear from the documentation submitted to our office is whether or not the proposed project will take place entirely within areas disturbed by previous mining activities. If the project Area-of-Potential Effect (APE) is entirely within previous disturbance, no further work will be required under Section 106 of the National Historic Preservation Act (NHPA). However, if the project APE extends into undisturbed areas, additional consultation with our office will be required.	This project does not involve any land disturbance, either surface or subsurface beyond that which has already been disturbed. Although some eligible prehistoric sites are located near the facility, these sites will not be disturbed or impacted. Therefore, no further consultation is required. The EA has been revised to reflect this discussion.
U.S. DOE	Please delete the fourth sentence in paragraph 1 on page 23, "This monitoring program would eventually be undertaken by the DOE after license termination." Overall, the proposed modeling program is more extensive than the compliance monitoring program we will develop with your approval when the modeling verification monitoring is completed by Western Nuclear, Inc.	This sentence in question has been revised to state the following, "The U.S. DOE will undertake an NRC-approved ground water monitoring program after license termination."
U.S. FWS	The EA, last paragraph in Section 3.4, provides a list of endangered and threatened species that may occur in Fremont County, Wyoming, that is no longer valid. The Service is providing the following list of threatened and endangered species that may occur within or near the project area. We recommend that the EA included an analysis of potential effects to these species.	NRC staff incorporated the new list of endangered and threatened species in the final EA. Potential effects were assessed; however, because this action does not involve any land disturbance or surface water withdrawal/discharge, no effects to the listed species are expected. The EA has been revised to reflect this response.

Wyoming DEQ	Deficiencies in Evaluation of Potential Remedies. Potential remedies evaluated in the 1999 plans appeared to be an “all or nothing” approach. We believe that accepting “natural flushing” (NRC terminology for uncontrolled migration) as a final remedy over such a long period of time (in this case 1000 years) requires the highest degree of scrutiny, analysis, and certainty, and should never be accepted unless provisions are made to ensure periodic and regular assessment of emerging remedial technologies, and reconsideration of economic factors applied to the remedy cost/benefit analyses. Little, if any, consideration was given to targeting remediation of “hot spots”, or evaulating interim measures that could minimize the spread of site derived contamination into unaffected portions of the aquifer.	NRC staff disagrees with this comment. WNI provided an extensive review of alternative remedial technologies including some passive technologies. However, due to the state of the passive technologies and site geologic and hydrogeologic constraints, WNI, and NRC staff concurred, that the passive remedial alternatives were not feasible for this site. Regarding hot spot targeting, that is precisely the type of remediation WNI proposed. Almost 30 years passed between mill startup and the initiation of the first remedial actions. Therefore, seepage, and consequently site contaminants, were able to migrate offsite and downgradient. The scope of the original CAP, therefore, was limited to minimizing further offsite contamination and capturing contamination before it migrated beyond the mouths of the NW and SW valleys. In light of these and other considerations, NRC staff determined that approving the ACLs and preventing ground water consumption within the LTSB is a prudent action.
Wyoming DEQ	The EA is not clear on which ground water protection standards apply to the Point of Compliance (POC) wells, or what the maximum allowable contaminant concentrations are proposed for the point of exposure (POE). Of particular concern, the EA does not provide any details on what, if any, measures (e.g. corrective action) will be taken if contaminant concentrations are exceeded at POC or POE monitoring wells.	Tables have been added to the final EA that specify surface water and ground water POE trigger values. These values are either background or WDEQ/EPA standards, whichever is higher. These values will be made part of WNI’s license. Particular action to be taken in the event of a confirmed exceedance could be increased monitoring or active corrective actions, if necessary. NRC staff will determine the type of action required based on the risk posed to human health and the environment.

Wyoming DEQ	The EA states that "Livestock and agricultural groundwater (sic) uses will not be restricted within the LTSB." However, the proposed alternate concentration limit (ACL) for manganese (225 mg/l) for the NW valley and 35 mg/l for the SW valley) is well above the Wyoming agricultural use/suitability standard of 0.2 mg/l. This water should not be used for livestock watering.	WDEQ's application of the manganese ACL in this situation is not appropriate. ACLs are values at the POC that would result in contaminant concentrations at the POE that are protective of human health and the environment. Therefore, ground water concentrations would naturally be lower beyond the POC. According to WNI, the only property to be used for agriculture is the McIntosh property west of the site. This property is, at most, on the fringe of the contamination migration pathway and is currently monitored by SWAB-22. A review of current data from SWAB-22 indicates that ground water quality meets the Class II and Class III Agricultural standards. Because of its location, it will likely continue to meet these standards for the compliance period. However, if water quality in SWAB-22 degrades, warning can be provided to the users of the McIntosh property.
Wyoming DEQ	We are unclear as to why an ACL is listed for nitrate, but not nitrite, in Table 1 since a potential contaminant exposure pathway discussed in the EA is to livestock. The Wyoming ground water use/suitability standard for livestock consumption is based on nitrite concentrations (10 mg/l).	Nitrate is the particular parameter associated with the 11e.(2) byproduct material at the site. Therefore, this parameter is the focus of ground water sampling and establishment of the ACLs. However, WNI analyzes samples for nitrate/nitrite concentrations. If total nitrate/nitrite does not exceed 10 mg/l, by default nitrite will not exceed mg/l.

ENVIRONMENTAL ASSESSMENT FIGURES