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United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1910, Vol. 2

Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities

Chapters 5 through 12 and Appendices A through F

Draft Report for Comment

Office of Federal and State Materials and
Environmental Management Programs

Wyoming Department of Environmental Quality
Land Quality Division

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Prepared by:

U.S. Nuclear Regulatory Commission
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Wyoming Department of Environmental Quality
Land Quality Division

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) has prepared a Draft Generic Environmental Impact Statement (Draft GEIS) to identify and evaluate potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of *in-situ* leach (ISL) uranium recovery facilities for identified regions in the western United States. Based on discussions between uranium mining companies and the NRC staff, ISL facilities could be located in portions of Wyoming, Nebraska, South Dakota, and New Mexico. NRC is the licensing authority for ISL facilities in these states.

NRC developed this Draft GEIS using (1) knowledge gained during the past 30 years licensing and regulating ISL facilities, (2) the active participation of the State of Wyoming Department of Environmental Quality as a cooperating agency, and (3) public comments received during the scoping period for the GEIS. NRC's research indicates that the technology used for ISL uranium recovery is relatively standardized throughout the industry and therefore appropriate for a programmatic evaluation in a GEIS.

As a framework for the analyses presented in this GEIS, NRC has identified four geographic regions based on

- Past and existing uranium milling sites are located within States where NRC has regulatory authority over uranium recovery;

- Potential new sites are identified based on NRC's understanding of where the uranium recovery industry has plans to develop uranium deposits using ISL technology; and

- Locations of historical uranium deposits within portions of Wyoming, Nebraska, South Dakota, and New Mexico.

The purpose behind developing the GEIS is to improve the efficiency of NRC's environmental reviews for ISL license applications required under the National Environmental Policy Act of 1969, as amended (NEPA). NRC regulations that implement NEPA and discuss environmental reviews are found in Title 10, "Energy," of the Code of Federal Regulations (10 CFR) Part 51. The NRC staff plans to use the GEIS as a starting point for its NEPA analyses for site-specific license applications for new ISL facilities. Additionally, the NRC staff plans to use the GEIS, along with applicable previous site-specific environmental review documents, in its NEPA analysis for the restart or expansions of existing facilities.

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CONTENTS

CONTENTS (continued)

CONTENTS (continued)

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

CONTENTS (continued)

FIGURES

FIGURES (continued)

FIGURES (continued)

FIGURES (continued)

FIGURES (continued)

TABLES

TABLES (continued)

Table | Page

TABLES (continued)

TABLES (continued)

TABLES (continued)

EXECUTIVE SUMMARY

PURPOSE AND NEED

NRC prepared this Draft Generic Environmental Impact Statement (Draft GEIS) to identify and evaluate the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of *in-situ* leach (ISL) uranium recovery facilities. Based on discussions between uranium mining companies and the NRC staff, these facilities potentially could be located in portions of Wyoming, Nebraska, South Dakota, and New Mexico, which are States where NRC has regulatory authority over the licensing of uranium recovery facilities. Given that the large majority of these potential license applications would involve use of the ISL process and would be submitted over a relatively short period of time, NRC decided to prepare a GEIS to support an efficient and consistent approach to reviewing site-specific license applications for ISL facilities. The NRC staff plans to use the GEIS as a starting point for its National Environmental Policy Act (NEPA) analyses for site-specific license applications for new ISL facilities. Additionally, the NRC staff plans to use the GEIS, along with applicable previous site-specific environmental review documents, in its NEPA analysis for the restart or expansions of existing facilities.

Uranium milling techniques are designed to recover the uranium from uranium-bearing ores. Various physical and chemical processes may be used, and selection of the uranium milling technique depends on the physical and chemical characteristics of the ore deposit and the attendant cost considerations. Generally, the ISL process is used to recover uranium from low-grade ores or deeper deposits that are not economically recoverable by conventional mining and milling techniques. In this process, a leaching agent, such as oxygen with sodium carbonate, is injected through wells into the subsurface ore body to dissolve the uranium. The leach solution is pumped from there to the surface processing plant and then ion exchange separates the uranium from the solution. After additional purification and drying, the uranium in the form of U_3O_8 (also known as "yellowcake") is placed in 55-gallon drums prior to shipment offsite.

THE PROPOSED FEDERAL ACTION AND ALTERNATIVES

In States where NRC is the regulatory authority over the licensing of uranium milling (including the ISL process), NRC has a statutory obligation to assess each site-specific license application to ensure it complies with NRC regulations before issuing a license. The proposed federal action is to prepare a GEIS that identifies and evaluates the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of ISL milling facilities in portions of Wyoming, Nebraska, South Dakota, and New Mexico. As stated above, NRC intends to make use of the GEIS during subsequent site-specific ISL licensing actions.

A range of alternatives to the proposed action was evaluated for inclusion in the Draft GEIS. The No-Action alternative was included in the detailed impact analysis. In the No-Action Alternative, no ISL facilities would be licensed, and therefore constructed and operated, in the four uranium milling regions considered in this Draft GEIS. The environment in these regions would not be affected by uranium extraction, although other ongoing and future non-ISL activities would continue as planned.

Alternative methods for milling uranium were considered as possible alternatives to the ISL process. As stated previously, not all uranium deposits are suitable for ISL extraction. For example, if the uranium mineralization is above the saturated zone (i.e., all of the pore spaces in the ore-bearing rock are not filled with water) ISL techniques may not be appropriate. Likewise, if the ore is not located in a porous and permeable rock unit, it will not be accessible to the leach solution used in the ISL process. Because ISL techniques may not be appropriate in these circumstances, conventional mining (underground or open-pit/surface mining) and milling techniques (e.g., heap leaching) are possible viable alternative technologies.

Inasmuch as the suitability and practicality of using alternative milling methodologies depends upon site-specific conditions, a generic discussion of alternative milling methodologies is not appropriate. Accordingly, this Draft GEIS does not contain a detailed analysis of alternative milling methodologies. A detailed analysis of alternative milling methodologies that can be applied at a specific site will be addressed in NRC's site-specific environmental review for individual ISL license applications.

In addition, it should be noted that previous analyses have indicated that the potential environmental impacts associated with conventional uranium milling operations are significant, because the mill tailings, or waste, are a significant source of radon and radon progeny. For this reason, NRC has made a policy decision to prepare site-specific EISs for applications for a new, or restart of a former, conventional or heap leach facility, as required under 10 CFR 51.20(b)(8).

APPROACH

NRC developed this Draft GEIS, based on NRC's experience in licensing and regulating ISL facilities gained during the past 30 years. In the Draft GEIS, NRC does not consider specific facilities, but rather provides an assessment of potential environmental impacts associated with ISL facilities that might be located in four regions of the western United States. These regions are used as a framework for discussions in this Draft GEIS, and were identified based on several considerations, including:

- Past and existing uranium milling sites are located within States where NRC has regulatory authority over uranium recovery;
- Potential new sites are identified based on NRC's understanding of where the uranium recovery industry has plans to develop uranium deposits using ISL technology; and
- Locations of historical uranium deposits within portions of Wyoming, Nebraska, South Dakota, and New Mexico.

Using these criteria, four geographic regions were identified (Figure ES–1). For the purpose of this Draft GEIS, these regions are titled

- Wyoming West Uranium Milling Region;
- Wyoming East Uranium Milling Region;
- Nebraska-South Dakota-Wyoming Uranium Milling Region; and
- Northwestern New Mexico Uranium Milling Region.

The foundation of the environmental impact assessment in the Draft GEIS is based on (1) the historical operations of NRC-licensed ISL facilties and (2) the affected environment in each of the four regions. The structure of the GEIS is presented in Figure ES–2.

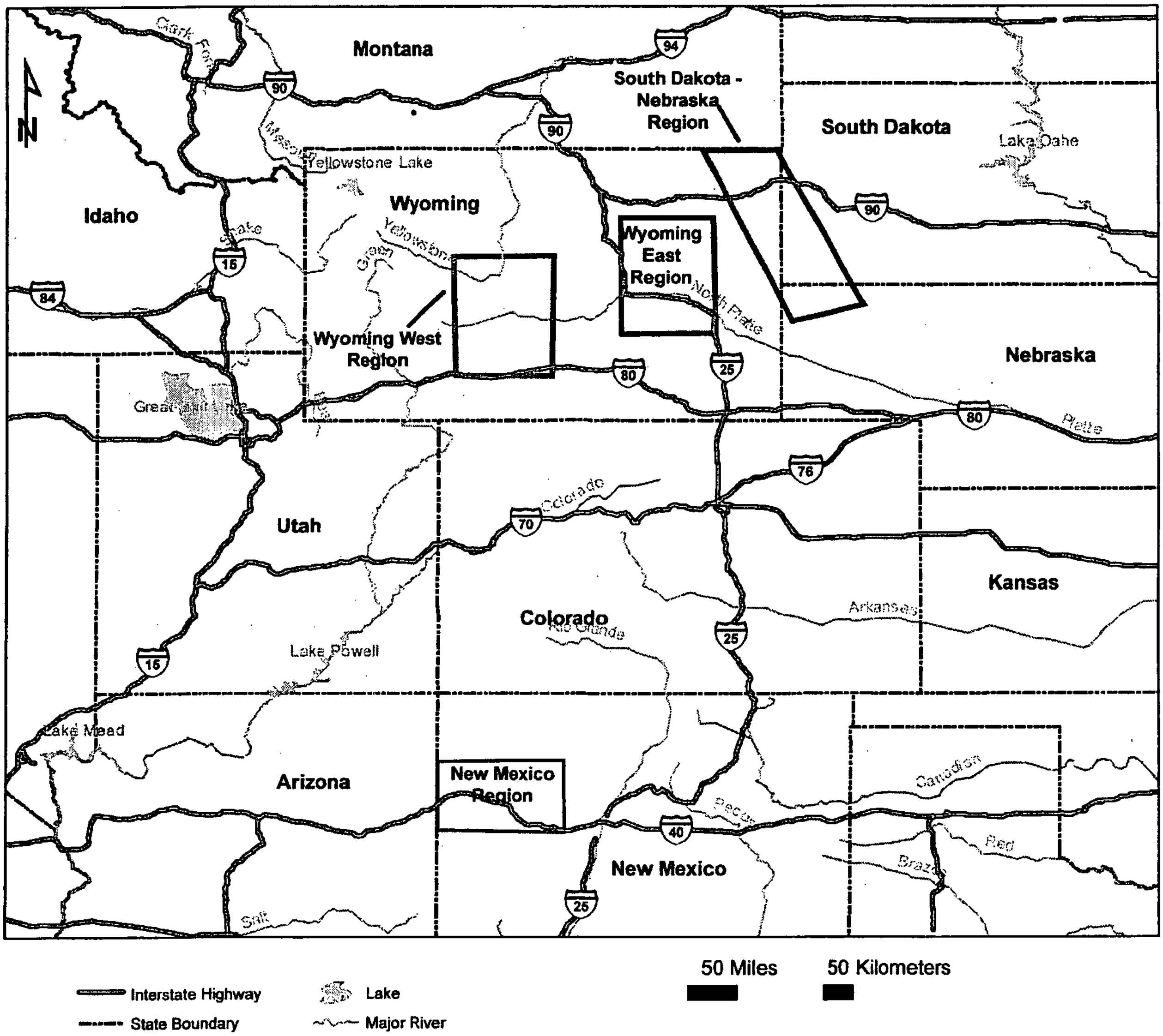

Figure ES–1. Location of Four Geographic Regions Used as a Framework for the Analyses Presented in this GEIS

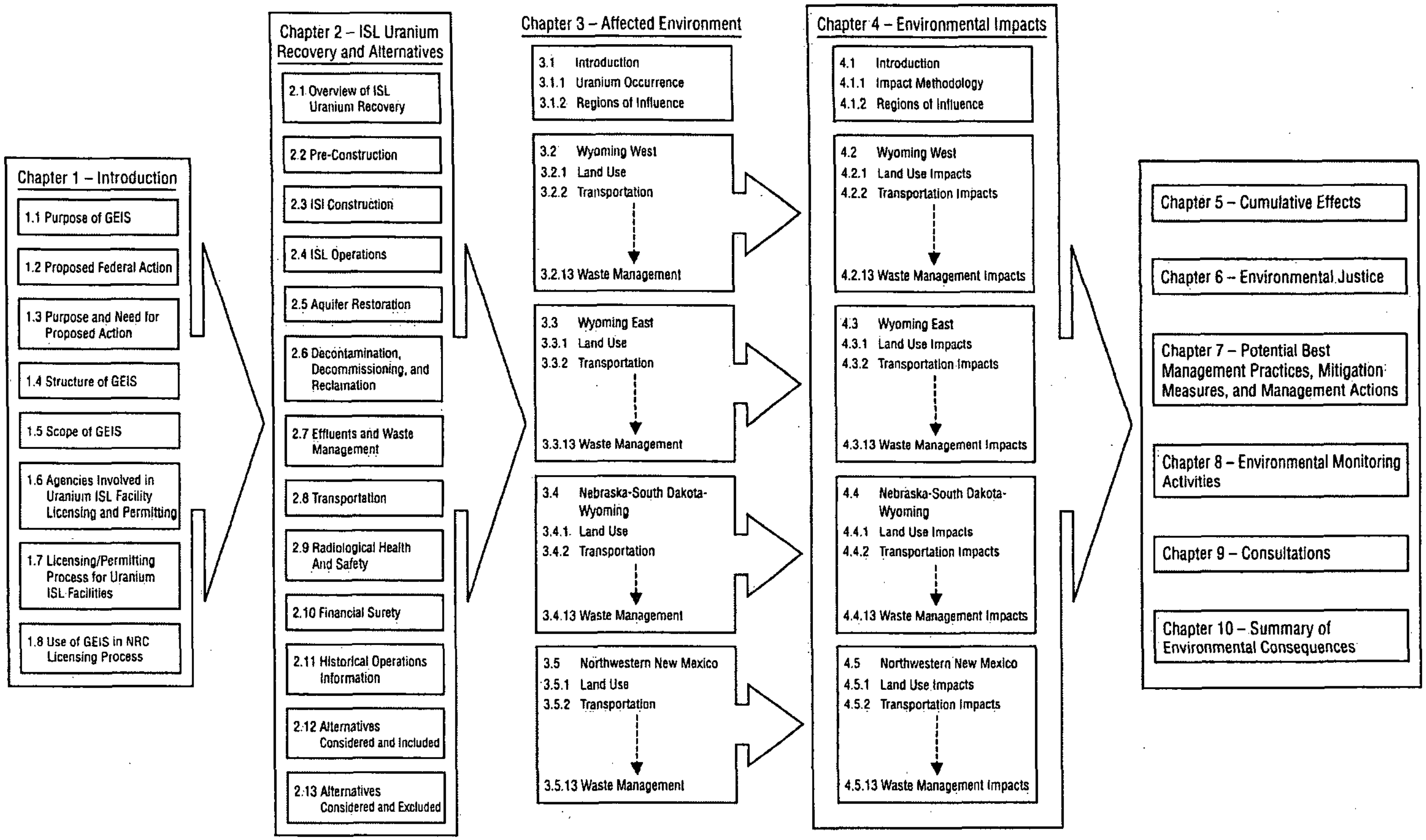

Figure ES–2. Structure of this GEIS

Chapter 2 of the Draft GEIS provides a description of the ISL process, addressing construction, operation, aquifer restoration, and decommissioning of an ISL facility. This section also discusses financial assurance, whereby the licensee or applicant establishes a bond or other financial mechanism prior to operations to ensure that sufficient funds are available to complete aquifer restoration, decommissioning, and reclamation activities.

Chapter 3 of the Draft GEIS describes the affected environment in each uranium milling region using the environmental resource areas and topics identified through public scoping comments on the GEIS and from NRC guidance to its staff found in NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs," issued by NRC in 2003.

Chapter 4 of the GEIS provides an evaluation of the potential environmental impacts of constructing, operating, aquifer restoration, and decommissioning at an ISL facility in each of the four uranium milling regions. In essence, this involves placing an ISL facility with the characteristics described in Chapter 2 of the Draft GEIS within each of the four regional areas described in Chapter 3 and describing and evaluating the potential impacts in each region separately. The potential environmental impacts are evaluated for the different stages in the ISL process: construction, operation, aquifer restoration, and decommissioning. Impacts are examined for the resource areas identified in the description of the affected environment. These resource areas are:

- Land use
- Transportation
- Geology and soils
- Water resources
- Ecology
- Air Quality
- Noise
- Historical and cultural resource
- Visual and scenic resources
- Socioeconomic
- Public and occupational health

NRC identified a number of other issues that helped in the evaluation of the potential environmental impacts of an ISL facility. These issues include:

- **Applicable Statutes, Regulations and Agencies**. Various statutes, regulations, and implementing agencies at the federal, state, tribal and local levels that have a role in regulating ISL facilities are identified and discussed.

- **Waste Management**. Potential impacts from the generation, handling, treatment, and final disposal of chemical, radiological, and municipal wastes are addressed.

- **Accidents**. Potential accident conditions are assessed in the Draft GEIS. This includes consideration of a range of possible accidents and estimation of their consequences including: well field leaks and spills, excursions, processing chemical spills, and ion exchange resin and yellowcake transportation accidents.

- **Environmental Justice**. Although not required for a GEIS, to facilitate subsequent site-specific analyses, this Draft GEIS provides a first order definition of minority and low income populations. Early consultations will be initiated with some of these populations, and the potential for disproportionately high and adverse impacts from future ISL licensing in the uranium milling regions will be evaluated.

- **Cumulative Impacts**. The Draft GEIS addresses cumulative impacts from proposed ISL facility construction, operation, ground water restoration, and decommissioning on all aspects of the affected environment, considering the impacts from past, present, and reasonably foreseeable future actions in the uranium milling regions.

- **Monitoring.** The Draft GEIS discusses various monitoring methodologies and techniques used to detect and mitigate the spread of radiological and non-radiological contaminants beyond ISL facility boundaries.

SIGNIFICANCE OF LEVELS

In the Draft GEIS, NRC has categorized the potential environmental impacts using significance levels. According to the Council on Environmental Quality, the significance of impacts is determined by examining both context and intensity (40 CFR 1508.27). Context is related to the affected region, the affected interests, and the locality, while intensity refers to the severity of the impact, which is based on a number of considerations. In this Draft GEIS, the NRC used the significance levels identified in NUREG–1748:

- SMALL Impact: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

- MODERATE Impact: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

- LARGE Impact: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

SUMMARY OF IMPACTS

As discussed previously, Chapter 4 of the Draft GEIS provides NRC's evaluation of the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning at an ISL facility in each of the four uranium milling regions. A summary of this evaluation by environmental resource area and phase of the ISL facility lifecycle is provided below.

Land Use Impacts

CONSTRUCTION—Land use impacts could occur from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions (including limitations of other mineral extraction activities, grazing activities, or recreational activities). The potential for land use conflicts could increase in areas with higher percentages of private land ownership and Native American land ownership or in areas with a complex patchwork of land ownership. Land disturbances during construction would be temporary and limited to small areas within permitted areas. Well sites, staging areas, and trenches would be reseeded and restored. Unpaved access roads would remain in use until decommissioning. Competing access to mineral rights could be either delayed for the duration of the in-situ leach (ISL) project or be intermixed with ISL operations (e.g., oil and gas exploration). Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the small size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected, but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical and cultural resources, the potential impacts would be SMALL. Due to the potential for unidentified resources to be altered or destroyed during excavation, drilling, and grading, the potential impacts to ecological, historical or cultural resources would be SMALL to LARGE, depending on local conditions.

OPERATION—The types of land use impacts for operational activities would be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not occur from conducting operational activities. Because access restriction and land disturbance related impacts would be similar to, or less than, for construction, the overall potential impacts to land use from operational activities would be SMALL.

AQUIFER RESTORATION—Due to the use of the same infrastructure, land use impacts would be similar to operations during aquifer restoration, although some operational activities would diminish—SMALL.

DECOMMISSIONING—Land use impacts would be similar to those described for construction with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Reclamation of land to preexisting conditions and uses would help mitigate potential impacts—SMALL to MODERATE during decommissioning, and SMALL once decommissioning is completed.

Transportation Impacts

CONSTRUCTION—Low magnitude traffic generated by ISL construction relative to local traffic counts would not significantly increase traffic or accidents on many of the roads in the region. Existing low traffic roads could be moderately impacted by the additional worker commuting traffic during periods of peak employment. This impact would be expected to be more pronounced in areas with relatively lower traffic counts. Moderate dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads)—SMALL to MODERATE.

OPERATION— Low magnitude traffic relative to local traffic counts on most roads would not significantly increase traffic or accidents. Existing low traffic roads could be moderately impacted by commuting traffic during periods of peak employment including dust, noise, and possible incidental wildlife or livestock kill impacts on or near site access roads. High consequences would be possible for a severe accident involving transportation of hazardous chemicals in a populated area. However, the probability of such accidents occurring would be low owing to the small number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion exchange resins, waste materials), compliance with transportation regulations would limit radiological risk for normal operations. Low radiological risk is estimated for accident conditions. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium—SMALL to MODERATE.

AQUIFER RESTORATION—The magnitude of transportation activities would be lower than for construction and operations, with the exception of workforce commuting which could have moderate impacts on, or in the vicinity of, existing low traffic roads—SMALL to MODERATE.

DECOMMISSIONING—The types of transportation activities and, therefore, the types of impacts would be similar to those discussed for construction and operations except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks would be bounded by operations yellowcake transportation risk estimates—SMALL.

Geology and Soils Impacts

CONSTRUCTION—Disturbance to soil would occur from construction (clearing, excavation, drilling, trenching, road construction); however, such disturbances would be expected to be temporary, disturbed areas would be SMALL (approximately 10 percent of the total site area), and potential impacts would be mitigated by using best management practices. A large portion of the well fields, trenches, and access roads would be restored and reseeded after construction. Excavated soils would be stockpiled, seeded, and stored onsite until needed for reclamation fill. No impacts to subsurface geological strata would be likely—SMALL.

OPERATION—Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation, use of evaporation ponds, or land application of treated waste water. However, detection and response to leaks and spills (e.g., soil cleanup), monitoring of treated waste water, and eventual survey and decommissioning of all potentially impacted soils would limit the magnitude of overall impacts to soils—SMALL.

AQUIFER RESTORATION—Impacts to geology and soils from aquifer restoration activities would be similar to impacts from operations due to use of the same infrastructure and similar activities conducted (e.g., well field operation, transfer lines, liquid effluent treatment and disposal)—SMALL.

DECOMMISSIONING—Impacts to geology and soils from decommissioning would be similar to impacts from construction. Activities to cleanup, re-contour and reclaim disturbed lands during decommissioning would mitigate long-term impacts to soils—SMALL.

Surface Water Impacts

CONSTRUCTION—Impacts to surface waters and related habitats from construction (road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment) would be mitigated through proper planning, design, construction methods, and best management practices. Some impacts directly related to the construction activities would be temporary and limited to the duration of the construction period. U.S. Army Corps of Engineers permits may be required when filling and crossing of wetlands. Temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase. Impacts from incidental spills of drilling fluids into local streams could occur, but would be temporary, due to the use of mitigation measures. Impacts from roads, parking areas, buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces proposed. Impacts from infiltration of drilling fluids into the local aquifer would be localized, small, and temporary—SMALL to MODERATE depending on site-specific characteristics.

OPERATION—Through permitting processes, federal and state agencies regulate the discharge of storm water runoff and the discharge of process water. Impacts from these discharges would be mitigated as licensees would within the conditions of their permits. Expansion of facilities or pipelines during operations would generate impacts similar to construction—SMALL to MODERATE depending on site-specific characteristics.

AQUIFER RESTORATION—Impacts from aquifer restoration would be similar to impacts from operations due to use of the same (in-place) infrastructure and similar activities conducted (e.g., well field operation, transfer lines, water treatment, storm water runoff)—SMALL to MODERATE depending on site-specific characteristics.

DECOMMISSIONING—Impacts from decommissioning would be similar to impacts from construction. Activities to clean up, re-contour and reclaim disturbed lands during decommissioning would mitigate long-term impacts to surface waters—SMALL to MODERATE depending on site-specific characteristics.

Groundwater Impacts

CONSTRUCTION—Water use impacts would be limited by the small volumes of groundwater used for routine activities such as dust suppression, mixing cements, and drilling support over short and intermittent periods. Contamination of groundwater from construction activities would be mitigated by best management practices—SMALL to LARGE, depending on site-specific conditions.

OPERATION—Potential impacts to shallow aquifers can occur from leaks or spills from surface facilities and equipment. Shallow aquifers are important sources of drinking water in some areas of the four uranium milling regions. Potential impacts to the ore-bearing and surrounding aquifers include consumptive water use and degradation of water quality (from normal production activities, off-normal excursion events, and deep well injection disposal practices). Consumptive use impacts from withdrawal of groundwater would occur because approximately 1 to 3 percent of pumped groundwater is not returned to the aquifer (e.g., process bleed). That amount of water lost could be reduced substantially by available treatment methods (e.g., reverse osmosis, brine concentration). Effects of water withdrawal on surface water would be expected to be SMALL as the ore zone normally occurs in a confined aquifer. Estimated drawdown effects vary depending on site conditions and water treatment technology applied. Excursions of lixiviant and mobilized chemical constituents could occur from failure of well seals or other operational conditions that result in incomplete recovery of lixiviant. Well seal related excursions would be detected by the groundwater monitoring system and periodic well mechanical integrity testing and impacts would be expected to be mitigated during operation or aquifer restoration. Other excursions could result in plumes of mobilized uranium and heavy metals extending beyond the mineralization zone. The magnitude of potential impacts from vertical excursions would vary depending on site-specific conditions. To reduce the likelihood and consequences of potential excursions at ISL facilities, NRC requires licensees to take preventative measures prior to starting operations including well tests, monitoring, and development of procedures that include excursion response measures and reporting requirements. Alterations of ore body aquifer chemistry would be SMALL, because the aquifer would: (1) be confined, (2) not be a potential drinking water source, and (3) be expected to be restored within statistical range of preoperational baseline water quality during the restoration period. Potential environmental impacts to confined deep aquifers below the production aquifers from deep well injection of processing wastes would be addressed by the underground injection permitting process regulated by the states—SMALL to LARGE, depending on site-specific conditions.

AQUIFER RESTORATION—Potential impacts would be from consumptive use and potential deep disposal of brine slurries after reverse osmosis, if applicable. The volume of water removed from the aquifer and related impacts would be dependent on site-specific conditions and the type of water treatment technology the facility uses. In some cases, groundwater consumptive use for the aquifer restoration has been reported to be less than groundwater use during the ISL operation and drawdowns due to aquifer restorations have been smaller than drawdown caused by ISL operations. Potential environmental impacts associated with water consumption during aquifer restorations are determined by: (1) the restoration techniques chosen, (2) the volume of water to be used, (3) the severity and extent of the contamination, and (4) the current and future use of the production and surrounding aquifers near the ISL facility or at the regional scale—SMALL to LARGE, depending on site-specific conditions.

DECOMMISSIONING—Potential impacts from decommissioning would be similar to construction (water use, spills) with an additional potential to mobilize contaminants during demolition and cleanup activities. Contamination of groundwater from decommissioning activities would be mitigated by implementation of an NRC-approved decommissioning plan and use of best management practices—SMALL.

Terrestrial Ecology Impacts

CONSTRUCTION—Potential terrestrial ecology impacts would include the removal of vegetation from the well fields, the milling site, the modification of existing vegetative communities, the loss of sensitive plants and habitats from clearing and grading, and the potential spread of invasive species and noxious weed populations. These impacts would be expected to be temporary because restoration and reseeding occur rapidly after the end of construction. Introduction of invasive species and noxious weeds would be mitigated by restoration and reseeding after construction. Shrub and tree removal and loss would take longer to restore. Construction noise could affect reproductive success of sage grouse leks by interfering with mating calls. Temporary displacement of some animal species would also occur. Critical wintering and year-long ranges are important to survival of both big game and sage grouse. Raptors breeding onsite may be impacted by construction activities or milling operations, depending on the time of year construction occurs. Wildlife habitat fragmentation, temporary displacement of animal species, and direct or indirect mortalities would be possible. Implementation of wildlife surveys and mitigation measures following established guidelines would limit impacts. The magnitude of impacts depends on whether a new facility is being licensed or an existing facility is being extended—SMALL to MODERATE, depending on site-specific habitat conditions.

OPERATION—Habitats could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. However, the State of Wyoming Game and Fish Department specifies fencing construction techniques to minimize impediments to big game movement. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation or land application of treated waste water. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil limits the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduce overall impacts—SMALL.

AQUIFER RESTORATION—Impacts include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Contamination of soils could be result from leaks and spills, and land application of treated waste water. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduce overall impacts—SMALL.

DECOMMISSIONING—During decommissioning and reclamation, there would be a temporary disturbance to land (e.g., excavating soils, buried piping, removal of structures). However, re-vegetation and re-contouring would restore habitat altered during construction and operations. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation are completed and vegetation and habitat reestablished—SMALL.

Aquatic Ecology Impacts

CONSTRUCTION—Clearing and grading activities associated with construction could result in a temporary increase in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Clearing of riparian vegetation could affect light and temperature of water. Construction impacts to wetlands would be identified and managed through U.S. Army Corps of Engineers permits, as appropriate. Construction impacts to surface waters and aquatic species would be temporary and mitigated by best management practices—SMALL.

OPERATION—Impacts could result from spills or releases into surface water. Impacts would be minimized by spill prevention, identification and response programs, and National Pollutant Discharge Elimination System (NPDES) permit requirements—SMALL.

AQUIFER RESTORATION—Activities would use existing (in-place) infrastructure, and impacts could result from spills or releases of untreated groundwater. Impacts would be minimized by spill prevention, identification, and response programs, and NPDES permit requirements—SMALL.

DECOMMISSIONING—Decommissioning and reclamation activities could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. With completion of decommissioning, re-vegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Threatened and Endangered Species Impacts

CONSTRUCTION—Numerous threatened and endangered species and state species of concern are located in the four uranium milling regions. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impact would depend on the size of a new facility or extension to an existing facility and the amount of land disturbance. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would reduce impacts—SMALL to MODERATE to LARGE—depending on site-specific habitat and presence of threatened or endangered species.

OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impact would depend on the size of a new facility or extension to an existing facility and the amount of land disturbance. Impacts could potentially result from spills or permitted effluents, but would be minimized through the use of spill prevention measures, identification and response programs, and NPDES permit requirements. Inventory of threatened or endangered species developed during site-specific reviews would identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would assist in reducing impacts—SMALL to MODERATE—depending on site-specific habitat and presence of threatened or endangered species.

AQUIFER RESTORATION—Impacts could result from individual takes due to conflicts with aquifer restoration activities (equipment, traffic). Existing (in-place) infrastructure would be used during aquifer restoration, so additional land-disturbing activities and habitat fragmentation would not be anticipated. Impacts may result from spills or releases of treated or untreated groundwater, but impacts would be minimized through the use of spill prevention measures, identification, and response programs, and NPDES permit requirements. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in reducing impacts—SMALL.

DECOMMISSIONING—Impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures are demolished and removed and the ground surface is re-contoured. Inventory of threatened or endangered species developed during site-specific environmental review of the decommissioning plan would identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in reducing impacts. With completion of decommissioning, re-vegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Air Quality Impacts

CONSTRUCTION—Fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities associated with construction would be small, short-term, and reduced through best management practices (e.g., dust suppression). For example, estimated fugitive dust emissions during ISL construction is less than 2 percent of the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and less than 1 percent for PM_{10}. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL. A Prevention of Significant Deterioration (PSD) Class I area exists in only one of the four regions (Wind Cave National Park in the Nebraska-South Dakota-Wyoming Region). Here, more stringent air quality standards would apply to a facility that impacts the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

OPERATION—Radiological impacts can result from dust releases from drying of lixiviant pipeline spills, radon releases from well system relief valves, resin transfer, or elution, and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials would be expected to be released based on operational controls and rapid response to spills. Required spill prevention, control, and response procedures would be used to minimize impacts from spills. HEPA filters and vacuum dryer designs reduce particulate emissions from operations and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program would ensure releases are within regulatory limits. Other potential non-radiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL. A PSD Class I area is located in the Nebraska-South Dakota-Wyoming Region (Wind Cave National Park). More stringent air quality standards would apply to a facility that impacts the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

AQUIFER RESTORATION—Because the same infrastructure is used, air quality impacts are expected to be similar to, or less than, during operations. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL. Where a PSD Class I area exists, such as the

Wind Cave National Park in the Nebraska-South Dakota-Wyoming Region, more stringent air quality standards would apply to a facility that impacts the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

DECOMMISSIONING—Fugitive dust, vehicle, and diesel emissions during land-disturbing activities associated with decommissioning would be similar to, or less than, those associated with construction, short-term, and reduced through best management practices (e.g., dust suppression). Potential impacts would decrease as decommissioning and reclamation of disturbed areas are completed. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL. However, where a PSD Class I area exists (Wind Cave National Park, in the Nebraska-South Dakota-Wyoming Region), more stringent air quality standards would apply to a facility that impacts the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

Noise Impacts

CONSTRUCTION—Noise generated during construction would be noticeable in proximity to operating equipment, but would be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. Traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, and compressors) would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in the well fields. Relative increases in traffic levels would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural roads through smaller communities. Noise may also adversely affect wildlife habitat and reproductive success in immediate vicinity of construction activities. Noise levels decrease with distance, and at distances more than about 300 m [1,000 ft], ambient noise levels would return to background. Wildlife avoid construction areas because of noise and human activity. All of the uranium districts are located more than 300 m [1,000 ft] from the closest community. As a result, noise impacts would be—SMALL to MODERATE.

OPERATION—Noise-generating activities in the central uranium processing facility would be indoors, reducing offsite sound levels. Well field equipment (e.g., pumps, compressors) would be contained within structures (e.g., header houses, satellite facilities) also reducing sound levels to offsite receptors. Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be expected to be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural roads through smaller communities. Most noise would be generated indoors and mitigated by regulatory compliance and best management practices. Noise from trucks and other vehicles are typically of short duration. Also, noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft. All the uranium districts are located more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.

AQUIFER RESTORATION—Noise generation is expected to be less than during construction and operations. Pumps and other well field equipment contained in buildings reduce sound levels to offsite receptors. Existing operational infrastructure would be used and traffic levels would be expected to be less than during construction and operations. There are additional sensitive areas that should be considered within some of the regions, but because of decreasing noise levels with distance, construction activities would have only SMALL and temporary noise impacts for residences, communities, or sensitive areas, especially those located more than about 300 m [1,000 ft] from specific noise generating activities. Noise usually is not discernable to offsite receptors at distances more than 300 m [1,000 ft]. All the uranium districts are located more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.

DECOMMISSIONING—Noise generated during decommissioning would be noticeable only in proximity to equipment and temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Noise levels during decommissioning would be less than during construction and would diminish as less and less equipment is used and truck traffic is reduced. Noise usually is not discernable to offsite receptors at distances more than 300 m [1,000 ft]. All the uranium districts are located more than 300 m [1,000 ft] from the closest community—SMALL.

Historical and Cultural Resources Impacts

CONSTRUCTION—Potential impacts during ISL facility construction could include loss of, or damage and temporary restrictions on access to, historical, cultural, and archaeological resources. The eligibility evaluation of cultural resources for listing in the National Register of Historic Places (NRHP) under criteria in 36 CFR 60.4(a)–(d), and/or as Traditional Cultural Properties (TCP) would be conducted as part of the site-specific review and NRC licensing procedures undertaken during the National Environmental Policy Act (NEPA) review process. The evaluation of impacts to any historic properties designated as TCPs and tribal consultations regarding cultural resources and TCPs also occurs during the site-specific licensing application and review process. To determine whether significant cultural resources would be avoided or mitigated, consultations with State Historic Preservation Offices (SHPO), other government agencies (e.g., U.S. Fish and Wildlife Service and Sate Environmental Departments), and Native American Tribes (THPO) occur as part of the site-specific review. Additionally, as needed, the NRC license applicant would be required, under conditions in its NRC license, to adhere to procedures regarding the discovery of previously undocumented cultural resources during initial construction. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE depending on site-specific conditions.

OPERATION—Because less land disturbance occurs during the operations phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during operation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL, but depending on site-specific conditions.

AQUIFER RESTORATION—Because less land disturbance occurs during the aquifer restoration phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during aquifer restoration. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL, but depending on site-specific conditions.

DECOMMISSIONING—Because less land disturbance occurs during the decommissioning phase and because decommissioning and reclamation activities would be focused on previously disturbed areas, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during decommissioning and reclamation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL, depending on site-specific conditions.

Visual and Scenic Impacts

CONSTRUCTION—Visual impacts result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Most of the four uranium milling regions are classified as Visual Resource Management (VRM) Class II through IV by the BLM. A number of VRM Class II areas surround national monuments (El Morro and El Malpais), the Chaco Culture National Historic Park, and sensitive areas managed within the Mt. Taylor district, in the Northwestern New Mexico Uranium Milling District, and would have the greatest potential for impacts to visual resources. Most of these areas, however, are located away from potential ISL facilities, at distances greater than 16 km [10 mi]. Most potential facilities are located in VRM Class III and IV areas. The general visual and scenic impacts associated with ISL facility construction would be temporary and SMALL, but from a Native American perspective, any construction activities would likely to result in adverse impacts to the landscape, particularly for facilities located in areas within view of tribal lands and areas of special significance such as Mt. Taylor. In addition, a PSD Class I area (Wind Cave National Park) is located in the Nebraska-South Dakota-Wyoming Uranium Milling Region. Nevertheless, most potential visual impacts during construction would be temporary as equipment is moved, and would be mitigated by best management practices (e.g., dust suppression). Because of the generally rolling topography of the region, most visual impacts during construction would not be visible from more than about 1 km [0.6 mi]. The visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL.

OPERATION—Visual impacts during operations would be less than those associated with construction. Most of the well field surface infrastructure has a low profile, and most piping and cables would be buried. The tallest structures include the central uranium processing facility {10 m [30 ft]} and power lines {6 m [20 ft]}. Because of the generally rolling topography of the regions, most visual impacts during operations would not be visible from more than about 1 km [0.6 mi]. Irregular layout of well field surface structures such as wellhead protection and header houses would further reduce visual contrast. Best management practices, design (e.g., painting buildings) and landscaping techniques would be used to mitigate potential visual impact. The uranium districts in the four regions are all located more than 16 km [10 mi] from the closest VRM Class II region, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL.

AQUIFER RESTORATION—Aquifer restoration activities would use in-place infrastructure. As a result, potential visual impacts would be the same as, or less than, those during operations—SMALL.

DECOMMISSIONING SMALL—Because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be the same as, or less than, those during construction. Most potential visual impacts during decommissioning would be temporary as equipment is moved, and mitigated by best management practices (e.g., dust suppression). Visual impacts would be low, because these sites are in sparsely populated areas, and impacts would diminish as decommissioning activities decrease. An approved site reclamation plan is required prior to license termination, with the goal of returning the landscape to preconstruction condition (predominantly VRM Class III and IV). Some roadside cuts and hill slope modifications, however, may persist beyond decommissioning and reclamation—SMALL.

Socioeconomic Impacts

CONSTRUCTION—Potential impacts to socioeconomics would result predominantly from employment at an ISL facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. Total peak employment would be about 200 people, including company employees and local contractors, depending on timing of construction with other stages of the ISL lifecycle. During construction of surface facilities and well fields, the general practice would be to use local contractors (drillers, construction), as available. A local multiplier of 0.7 (U.S. Bureau of the Census) is used to indicate how many ancillary jobs could be created (in this case about 140). For example, local building materials and building supplies would be used to the extent practical. Most employees would live in larger communities with access to more services. Some construction employees, however, would commute from outside the county to the ISL facility, and skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. Some of these employees would temporarily relocate to the project area and contribute to the local economy through purchasing goods and services and taxes. Because of the small relative size of the ISL workforce, net impacts would be SMALL to MODERATE.

OPERATION—Employment levels for ISL facility operations would be less than for construction, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction would diminish. Revenues would be generated from federal, state, and local taxes on the facility and the uranium produced. Employment types would be similar to construction, but the socioeconomic impacts would be less due to fewer employees—SMALL to MODERATE.

AQUIFER RESTORATION—In-place infrastructure would be used for aquifer restoration, and employment levels would be similar to those for operations—SMALL to MODERATE.
DECOMMISSIONING—A skill set similar to the construction workforce would be involved in dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/re-contouring the ground surface. Employment levels and use of local contractor support during decommissioning would be similar to that required for construction. Employment would be temporary, however, as decommissioning activities are in duration. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE.

Public and Occupational Health and Safety Impacts

CONSTRUCTION—Worker safety would be addressed by standard construction safety practices. Fugitive dust would result from construction activities and vehicle traffic, but would likely be of short duration and would not result in a radiological dose. Diesel emissions would also be of short duration and readily dispersed into the atmosphere—SMALL to MODERATE.

OPERATION—Potential occupational radiological impacts from normal operations would result from: (1) exposure to radon gas from well field, (2) ion-exchange resin transfer operations, and (3) venting during processing activities. Workers would also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation could occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20, which require licensees to implement an NRC-approved radiation protection program. (Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits.) Non-radiological worker safety matters are addressed through commonly-applied occupational health and safety regulations and practices. Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. Consequences of accidents to workers and the public are generally low, with the exception of a dryer explosion which could result in worker dose above NRC limits. The likelihood of such an accident would be low, and therefore the risk would also be low. Potential non-radiological accidents impacts include high consequence chemical release events (e.g., ammonia) for both workers and nearby populations. The likelihood, however, of such release events would be low based on historical operating experience at NRC-licensed facilities, primarily due to operators following commonly-applied chemical safety and handling protocols—SMALL to MODERATE.

AQUIFER RESTORATION—Activities involving aquifer restoration overlap with similar operational activities (e.g., operation of well fields, waste water treatment and disposal). The resultant types of impacts on public and occupational health and safety are similar to operational impacts. The absence of some operational activities (e.g., yellowcake production and drying, remote ion exchange) further limits the relative magnitude of potential worker and public health and safety hazards—SMALL.

DECOMMISSIONING—Worker and public health and safety would be addressed in a NRC-required decommissioning plan. This plan details how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning, ensuring the safety of workers and the public would be maintained and applicable safety regulations complied with—SMALL.

Waste Management Impacts

CONSTRUCTION—Relatively small scale construction activities (Section 2.3) and incremental well field development at ISL facilities would generate low volumes of construction waste—SMALL.

OPERATION—Operational wastes primarily result from liquid waste streams including process bleed, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant wash down water. State permit actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public. Waste treatments such as reverse osmosis and radon settling would be used to segregate wastes and minimize disposal volumes. Potential impacts from surface discharge and deep well injection would be limited by the conditions specified in the applicable state permit. NRC regulations address constructing, operating, and monitoring for leakage of evaporation ponds used to store and reduce volumes of liquid wastes. Potential impacts from land application of treated wastewater would be addressed by NRC review of site-specific conditions prior to approval and routine monitoring in decommissioning surveys. Offsite waste disposal impacts would be SMALL for radioactive wastes as a result of required preoperational disposal agreements. Impacts for hazardous and municipal waste would also be SMALL due to the volume of wastes generated. For remote areas with limited available disposal capacity, such wastes may need to be shipped greater distances to facilities that have capacity; however, the volume of wastes generated and magnitude of such shipments are estimated to be low—SMALL.

AQUIFER RESTORATION—Waste management activities during aquifer restoration would use the same treatment and disposal options implemented for operations. Therefore, impacts associated with aquifer restoration would be similar to operational impacts. While the amount of wastewater generated during aquifer restoration would be dependent on site-specific conditions, the potential exists for additional wastewater volume and associated treatment wastes during the restoration period. However, this would be offset to some degree by the reduction in production capacity from the removal of a well field. NRC review of future ISL facility applications would verify that sufficient water treatment and disposal capacity (and the associated agreement for disposal of byproduct material) are addressed. As a result, waste management impacts from aquifer restoration would be—SMALL.

DECOMMISSIONING—Radioactive wastes from decommissioning ISL facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment) would be disposed of as byproduct material at an NRC-licensed facility. A preoperational agreement with a licensed disposal facility to accept radioactive wastes ensures sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required decommissioning plan for NRC review prior to starting decommissioning activities. Such a plan would detail how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning to ensure how the safety of workers and the public would be maintained and applicable safety regulations complied with. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be—SMALL.

ABBREVIATIONS/ACRONYMS

BLM	U.S. Bureau of Land Management
CBSA	Core-Based Statistical Area
CEA	Cumulative Effects Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CEQ	Council on Environmental Quality
Dod	Department of Defense
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
GEIS	Generic Environmental Impact Statement
ISL	*In-situ* Leaching
MIT	Mechanical Integrity Testing
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NDEQ	Nebraska Department of Environmental Quality
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
PVC	Polyvinyl Chloride
RFFA	Reasonably Foreseeable Future Action
SHPO	State Historic Preservation Officer
TDS	Total Dissolved Solids
THPO	Tribal Historic Preservation Officer
UCL	Upper Control Limit
UIC	Underground Injection Control
UMTRCA	Uranium Mill Tailings Radiation Control Act
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
VRM	Visual Resource Management
WDEQ	Wyoming Department of Environmental Quality

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
m^3	cubic meters	0.0008107	acre-feet	acre-feet
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
Temperature (Exact Degrees)				
°C	Celsius	1.8C + 32	Fahrenheit	°F

*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM E380 (ASTM International. "Standard for Metric Practice Guide." West Conshohocken, Pennsylvania: ASTM International. Revised 2003.).

5 CUMULATIVE EFFECTS

5.1 Introduction

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations, as amended (40 CFR Parts 1500–1508) define cumulative effects as "... the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

A National Research Council study on hardrock mining on federal lands recognized the cumulative effects could become a concern due to past, current, and future activities in the vicinity of the mine under consideration. Specifically, cumulative impacts were defined as the collective impacts of several operations involving human activities, including mining, grazing, farming, timbering, water diversion or discharge, and industrial processing; they also include future impacts not immediately observable (Committee on Hardrock Mining on Federal Lands, 1999, p. 242). While this definition does not precisely match the definition in the CEQ's NEPA regulations, it does include the concept that a variety of other past, present, and future actions in the vicinity of the proposed project could cumulatively contribute to the effects on specific resources resulting from the proposed project subjected to NEPA analyses.

The study also noted that there were many uncertainties related to the cumulative effects of mineral production, including technologies such as the *in-situ* leaching (ISL) process for uranium recovery. As a result, several research needs were articulated. Examples include the need for methodologies (or models) for predicting cumulative effects from mineral recovery activities under different environmental circumstances, the need for collaborative approaches for resolving multiple and conflicting demands on common resources, and the need for the design of a long-term monitoring program and strategies which can be used to identify impact contributions from various actions, as well as the occurrence resource sustainability (Committee on Hardrock Mining on Federal Lands).

When the many activities potentially associated with an ISL project (e.g., several satellite well fields, solution-water injection wells, and associated extraction wells are drilled; extracted fluids are processed at remote locations; pipelines are built to transport liquid from these locations to a central processing plant; selected wastewaters are disposed of using deep wells; and yellowcake is shipped by truck) are considered, they could cause impacts to specific local and regional resources. In addition, ISL projects could involve relicensing or expanding existing facilities and operations, possibly with the use of new designs for new well fields or modifications in existing designs. These new or relicensed projects could be located within or near geographical areas that have been subject to uranium recovery via conventional mining and milling, oil and gas exploration and production, and other energy developments such as coal-bed methane projects. For all of these reasons, cumulative effects assessment is an important part of the licensing process for ISL projects.

Establishing the appropriate "scope" of the cumulative effects portion of an impact study is a fundamental feature of planning and conducting such a study for an ISL project. The CEQ NEPA regulations in 40 CFR Parts 1500–1508 indicate that "scope consists of the range of actions ..." to be considered in a NEPA compliance document. CEQ regulations in

40 CFR 1508.25 of the regulations identifies the following three types of actions for consideration, which all pertain to ISL projects:

- Connected actions are closely related and should be discussed in the same environmental impact statement (EIS) (or environmental assessment). The multiple activities of an ISL project illustrate connected actions. Such actions are interdependent parts of a larger action (the overall ISL project) and depend on the larger action for their justification.

- Cumulative actions, when viewed with other proposed actions, have cumulatively significant impacts and should therefore be discussed in the same NEPA compliance document. Cumulative actions could include future planned expansion of the proposed ISL facility, proposals for other new ISL projects in the same geographic areas, and relicensing of nearby existing ISL projects.

- Similar actions, when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a way to evaluate their environmental consequences together, such as common timing, or geography or impacts on common resources. Similar actions could include other local or regional energy or industrial development projects, or land usage activities, which could impact the same resources the proposed ISL project hopes to change.

In 1997, the CEQ published guidance on an approach to consider cumulative effects within the NEPA compliance process (CEQ, 1997) as described in Appendix F. This guidance contains an 11-step process, integrated within the traditional NEPA (or environmental impact assessment) process. Steps 1–4 relate to scoping (including the establishment of the scope), Steps 5–7 to describing the affected environment, and Steps 8–11 to determining the environmental consequences. These 11 steps can be applied at a general study planning level and at a detailed level for specific resources, ecosystems, and human communities, which are impacted by the original proposed action. For uranium recovery, the original action could be associated with a license application for a new ISL facility or with a relicensing action for an existing facility.

The resource areas addressed in this generic EIS (GEIS) include land use, transportation, geology and soils, surface water, groundwater, wetlands, terrestrial ecology, aquatic ecology, threatened or endangered species, air quality, noise, historical and cultural resources, visual and scenic resources, socioeconomic conditions, public health and safety, occupational health and safety, waste management, and environmental justice.

Cumulative impacts (effects) was one of the topical areas addressed in three public scoping meetings related to this GEIS (see Appendix A). In addition, impacts from ISL facilities on groundwater and surface water, ecology, historic and cultural resources, and environmental justice were also noted. Such impacts could occur from direct and indirect effects from ISL facilities, as well as cumulative effects from these facilities and other past, present, and reasonably foreseeable future actions (RFFAs) within the four defined geographic uranium milling regions.

5.2 Other Past, Present, and Reasonably Foreseeable Future Actions in the Four Regions

This section includes summary information on historical, current, and anticipated uranium recovery sites. In addition, other current and potential projects in the regions are illustrated by current draft and final EISs within the regions. Information sources for the regions are then included. Finally, "actions matrices" for each of the regions are included.

5.2.1 Uranium Recovery Sites

Table 5.2-1 includes tabulations of the cumulative history and short-term future of uranium recovery sites in the states of Wyoming, South Dakota, Nebraska, and New Mexico based on indications from industry to NRC (NRC, 2008). A total of 40 sites is included, with the sites subdivided into three types (research and development, conventional uranium milling, and ISL facilities). A total of eight research and development sites is listed, with the majority associated with activities from the late 1970s to the early 1980s. Several of these research and development sites were associated with basic information gathering on the ISL process and later converted to a license for commercial production.

Seven of the sites involve conventional mining and milling. Two of the conventional sites were initiated in the late 1970s, while one site was decommissioned in August 2006. The remaining five listed sites are associated with license applications dated from 2007 (one application) to 2009 (four applications). It should be noted that the license application for the Sweetwater site lists both a conventional mine and an ISL facility.

A total of 22 sites past and potential future sites are in Wyoming and associated with the ISL process (including the Sweetwater site which lists both the ISL process and a conventional mine). The Homestake site is decommissioned and the type of facility which was there is unknown. Out of the 22 ISL sites, nine are in the counties comprising the Wyoming West Uranium Milling Region, and 11 are in the counties that compromise the Wyoming East Uranium Milling Region. In addition, two other Wyoming sites (Aladdin and Dewey Terrace) are in the Nebraska-South Dakota-Wyoming Uranium Milling Region (which also includes the Dewey Burdock site in South Dakota and the Crow Butte, Crow Butte North Trend, and Three Crow sites in Nebraska). Six sites are listed for the Northwestern New Mexico Uranium Milling Region, with four being conventional mining and milling operations, one being an ISL site, and the other one being decommissioned or idle.

To reflect present actions and RFFAs related to uranium recovery in the four uranium milling regions analyzed in the GEIS, the following ISL sites, unless otherwise noted, are associated with 2006 or 2007 license applications, or with 2007 letters of intent to submit license applications in 2007, 2008, 2009, or 2010 (NRC, 2008).

5.2.2 EISs as Indicators of Present and RFFAs

One indicator of present and RFFAs in the four uranium milling regions is the number of draft and final EISs prepared by federal agencies within a recent time period. The informational database which was queried is the EPA EIS Database at <http://yosemite.epa.gov/oeca/webeis.nsf/viEIS01?OpenView>. The time period selected for the review was the 38-month period from January 7, 2005, through February 22, 2008. A total of 10 draft and 22 final EISs

Table 5.2-1. Past, Existing, and Potential Uranium Recovery Sites in Wyoming, South Dakota, Nebraska, and New Mexico

Site Name	County	State	Type	Company/Owner	Date	Docket No.
Moore Ranch	Campbell	WY	ISL	Energy Metals Corp.	Oct-07	40-9073
			ISL	Conoco	Mar-82	40-8473
Nichols Ranch	Campbell & Johnson	WY	ISL	Uranerz Energy Corp.	Dec-07	-
			ISL		Jun-07	40-9067
North Butte & Ruth	Campbell	WY	ISL	Power Resources Inc.	Aug-03	40-8964
					Dec-90	40-8958
Reno Creek 1	Campbell	WY	R&D	Rocky Mountain Energy Co.	Sep-78	40-8697
Reno Creek 2	Campbell	WY	ISL	International Uranium Corp.	Jul-99	40-9048
Ruby Ranch	Campbell	WY	R&D	Cameco	Jul-82	40-8793
Highland 1	Converse	WY	Conv.	Exxon Minerals	Nov-78	40-8102
					May-78	
Highland 2	Converse	WY	ISL	Power Resources Inc.	Aug-03	40-8857
					Aug-95	
					Jul-87	
Leuenberger	Converse	WY	R&D	Teton Exploration Drilling	Aug-83	40-8781
					Jan-80	40-8728
Peterson Ranch	Converse	WY	R&D	Energy Metals Corp.		40-8502
Reynolds Ranch	Converse	WY	ISL	Power Resources Inc.	Nov-06	40-8964
Smith Ranch - Highland	Converse	WY	ISL	Power Resources Inc.	Dec-07	40-8964
					Jan-92	
South Powder River Basin	Converse	WY	R&D	Powertech Uranium Corp.	Dec-87	40-8768
					Jun-81	
Aladdin	Crook	WY	ISL	Powertech Uranium Corp	2010*	
Bison Basin	Fremont	WY	ISL	Wildhorse Energy Inc	Jun-88	
					Apr-81	40-8745
JAB & Antelope	Fremont	WY	ISL	Energy Metals Corp.	May-07	40-4492
Sky	Fremont	WY	ISL	Strathmore Minerals Corp.	May-07	40-9072
Splitrock	Fremont	WY	Conv.		Aug-06	40-1152

Table 5.2-1. Past, Existing, and Potential Uranium Recovery Sites in Wyoming, South Dakota, Nebraska, and New Mexico (continued)

Site Name	County	State	Type	Company/Owner	Date	Docket No.
Allemand-Ross	Johnson	WY	ISL	Energy Metals Corp.	2009*	N/A†
Irigaray/ Christensen Ranch	Johnson	WY	ISL	COGEMA	Apr-07	40-8502
					May-88	
				Malapai Resources	Apr/Sep -78	
Nine Mile Lake	Natrona	WY	R&D	Energy Metals Corp.	May-81	40-8721
					Feb-75	40-8380
Gas Hills	Natrona & Fremont	WY	ISL	Power Resources Inc.	Jan-04	40-8857
						40-8964
Shirley Basin - Fab	Natrona	WY	ISL	Pathfinder	2009*	N/A†
Dewey Terrace	Niobrara	WY	ISL	Powertech Uranium Corp	2010*	N/A†
North Platte	Platte	WY	R&D	Uranium Resources	Oct-81	40-8786
Lost Creek	Sweetwater	WY	ISL	UR-Energy Corp.	Dec-07	40-9068
Lost Soldier	Sweetwater	WY	ISL	UR-Energy Corp.	2009*	N/A†
West Alkali Creek	Sweetwater	WY	ISL	Wildhorse Energy	2009*	N/A†
Sweetwater	Sweetwater	WY	ISL & Conv.	Wildhorse Energy	2009*	N/A†
Willow Creek	Sweetwater	WY	R&D	J&P Corp / Western Nuclear	Feb-85	40-8684
Dewey Burdock	Fall River	SD	ISL	Powertech Uranium Corp.	Aug-07	40-9075
Crow Butte	Dawes	NE	ISL	Crow Butte Resources	Nov-07	40-8943
					Dec-89	40-8943
					Oct-84	40-8829
Crow Butte North Trend	Dawes	NE	ISL	Crow Butte Resources	May-07	40-8943
Three Crow	Dawes	NE	ISL	Crow Butte Resources	2009*	N/A†
Homestake	Cibola	NM	Conv.	Homestoke Mining Co.	May-93	40-8903
Ambrosia Lake	McKinley	NM	Conv.	Rio Algom	2009*	N/A†
Church Rock	McKinley	NM	Conv.	Strathmore Minerals Corp.	Apr-07	40-8907

Table 5.2-1. Past, Existing, and Potential Uranium Recovery Sites in Wyoming, South Dakota, Nebraska, and New Mexico (continued)

Site Name	County	State	Type	Company/Owner	Date	Docket No.
Crownpoint	McKinley	NM	ISL	Hydro Resources	Feb-97	40-8968
Mt Taylor	McKinley	NM	Conv.	Rio Grande Resources	2009*	N/A†
Roca Honda	McKinley	NM	Conv.	Strathmore Minerals Corp.	2009*	N/A†

*Information on potential future uranium recovery applications is based on indications from industry summarized in: NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 1/24/2008." 2008. <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public-012408.pdf> (08 February 2008).
†N/A—not assigned, no license application as of this writing.

were identified for specific projects and counties within the four regional areas. In addition, three draft programmatic and seven final programmatic EISs were identified for large-scale actions primarily related to several states, including Wyoming, Nebraska, and South Dakota. Tables 5.2-2 through 5.2-6 include lists of the specific project-related EISs for the four regional areas. The EISs can be obtained via Internet searching and utilized in site-specific cumulative effects assessments for proposed ISL facilities.

For the Wyoming West Uranium Milling Region, Table 5.2-2 includes three draft EISs and seven final EISs. Four projects are related to gas developments, two are associated with natural gas pipelines, and one involves coal mining. These seven projects could contribute to both local and regional cumulative impacts on air quality, land usage, terrestrial plants and animals, and groundwater and surface water resources. The extent of such contributions depends on the locations of these projects in relation to other past actions and reasonably foreseeable future actions, including ISL facilities for uranium recovery. The remaining three projects listed in Table 5.5-2 involve resource management actions which are focused on reducing historical impacts from grazing practices, improving resource conditions by planning and management, and/or minimizing continuing practices with adverse impacts.

For the Wyoming East Uranium Milling Region, Table 5.2-3 includes three draft EISs and four final EISs. Three of the projects are related to leases for coal extractions (mining), and one to the development of a power plant and transmission line. However, the draft EIS on the power plant and transmission line was withdrawn. Nonetheless, it was included in Table 5.2-3 because it could be reactivated at a future date. Coal extraction projects can contribute to local and regional cumulative impacts on air quality, land usage, terrestrial plants and animals, and surface and groundwater hydrology and quality. Further, impacts on wetlands, threatened and endangered species, and cultural resources could also occur as a result of specific project locations. As noted for the Wyoming West Uranium Milling Region, the extent of contributions of these projects to cumulative effects depends on their locations in relation to other past and present actions and RFFAs, including future ISL facilities. Two of the three remaining projects involve better management of grazing practices, while the final one is focused on the management of black-tailed prairie dogs. These latter three projects should result in environmental improvements. Table 5.2-4 includes five listed "programmatic" EISs (two draft EISs and three final EISs) and five regional EISs (one draft EIS and four final EISs). These

Table 5.2-2. Draft and Final Environmental Impact Statements (EISs) Related to the Wyoming West Uranium Milling Region (in Chronological Order From January 2005 to February 2008)

Date	Statement
February 4, 2005	U.S. Forest Service, Final EIS, Upper Green River Area Rangeland Project, Proposed Site-Specific Grazing Management Practices, Bridger-Teton Forest, Sublette, Teton and Fremont Counties, WY (resource management)
July 8, 2005	Federal Energy Regulatory Commission, Final EIS, Entrega Pipeline Project, Construction and Operation New Interstate Natural Gas Pipeline System, Right-of-Way Grant Issue by BLM, Meeker Hub and Cheyenne Hub, Rio Blanco and Weld Counties, CO, and Sweetwater County, WY (gas pipeline)
August 19, 2005	Federal Energy Regulatory Commission, Final EIS, Piceance Basin Expansion Project, Construction and Operation of a New Interstate Natural Gas Pipeline System, Wamsutter Compressor Station to Interconnections and Greasewood Compressor Station, Rio Blanco County, CO, and Sweetwater County, WY (gas pipeline)
December 2, 2005	Seminoe Road Natural Gas Development Project, Proposed Coal Bed Natural Gas Development and Operation, Carbon County, WY (gas development)
November 17, 2006	U.S. Bureau of Land Management (BLM), Final EIS, Pit 14 Coal Lease-by-Application Project, Black Butte Coal Mine, Surface Mining Operations, Federal Coal Lease Application WYW160394, Sweetwater County, WY (coal mining)
December 1, 2006	BLM, Final EIS, Atlantic Rim Natural Gas Field Development Project, Proposed Natural Gas Development to 2000 Wells, 1800 to Coal Beds and 200 to Other Formations, Carbon County, WY (gas development)
June 8, 2007	BLM, Final EIS, Casper Field Office Planning Area Resource Management Plan, Implementation, Natrona, Converse, Goshen, and Platte Counties, WY (resource management)
October 12, 2007	BLM, Draft EIS, Moxa Arch Area Infill Gas Development Project, Drill, Extract, Remove, and Market Natural Gas Under Valid Existing Oil and Gas Leases, Approval, Right-of-Way Grants and U.S. Army COE Section 404 Permit(s), Lincoln, Uinta, and Sweetwater Counties, WY (gas development)
November 1, 2007	Bureau of Indian Affairs, Draft EIS, Riverton Dome Coal Bed Natural Gas and Conventional Gas Development Project, Construction of Well Pads, Roads, Pipelines, and Production Facilities, Wind River Indian Reservation, Fremont County, WY (gas development)
January 14, 2008	BLM, Final EIS, Rawlins Field Office Planning Area Resource Management Plan, Addresses the Comprehensive Analysis of Alternatives for the Planning and Management of Public Land and Resources Administered by BLM, Albany, Carbon, Laramie, and Sweetwater Counties, WY (resource management)

Table 5.2-3 Draft and Final Environmental Impact Statements (EISs) Related to the Wyoming East Uranium Milling Region (in Chronological Order From January 2005 to February 2008)

Date	Statement
February 4, 2005	U.S. Forest Service (USFS), Final EIS, Tongue Allotment Management Plan, Proposal To Continue Livestock Grazing on All or Portions of the 22 Allotments, Bighorn National Forest, Tongue and Medicine Wheel/Paintrock Ranger Districts, Johnson, Sheridan, and Bighorn Counties, WY (resource management-grazing)
April 13, 2007	U.S. Bureau of Land Management (BLM), Final EIS, Maysdorf Coal Lease by Application (LBA) Tract, Federal Coal Application WYW154432, Implementation, Campbell County, WY (coal mining)
August 17, 2007	USFS, Final EIS, Thunder Basin Analysis Area Vegetation Management, To Implement Best Management Grazing Practices and Activities, Douglas Ranger District, Medicine Bow-Routt National Forests and Thunder Basin National Grassland, Campbell, Converse, and Weston Counties, WY (resource management-grazing)
August 31, 2007	BLM, Final EIS, Eagle Butte West Coal Lease Application, Issuance of Lease for a Tract of Federal Coal, Wyoming Powder River Basin, Campbell County, WY (coal mining)
August 31, 2007	Rural Utilities Service, Draft EIS, Dry Fork Station and Hughes Transmission Line, Construct Electric Generating Facilities, Campbell and Sheridan Counties, WY; withdrawn (power plant and transmission line)
December 21, 2007	USFS, Draft EIS, Thunder Basin National Grassland Prairie Dog Management Strategy, Land and Resource Management Plan Amendment #3, Proposes To Implement a Site-Specific Strategy To Manage Black-Tailed Prairie Dog, Douglas Ranger District, Medicine Bow-Routt National Forest and Thunder Basin National Grassland, Campbell, Converse, Niobrara, and Weston Counties, WY (species management)
February 2, 2008	BLM, Draft EIS, West Antelope Coal Lease Application Federal Coal Lease Application WYW163340, Implementation, Converse and Campbell Counties, WY (coal mining)

Table 5.2-4. Draft and Final Programmatic or Large-Scale Environmental Impact Statements (EISs) Related to One or Both of the Wyoming Regional Study Areas (in Chronological Order From January 2005 to February 2007)

Date	Statement
March 30, 2006	U.S. Bureau of Land Management (BLM), Revised Final EIS, Programmatic—Proposed Revision to Grazing Regulations for the Public Lands, 42 CFR Part 4100, in the Western Portion of the United States (resource management-grazing)
May 26, 2006	Bureau of Reclamation, Final EIS, Programmatic—Platte River Recovery Implementation Program, Assessing Alternatives for the Implementation of a Basinwide, Cooperative, Endangered Species Recovery Program, Four Target Species: Whooping Crane, Interior Least Tern, Piping Plover, and Pallid Sturgeon, NE, WY, and CO (resource management-endangered species recovery)

Table 5.2-4. Draft and Final Programmatic or Large-Scale Environmental Impact Statements (EISs) Related to One or Both of the Wyoming Regional Study Areas (in Chronological Order From January 2005 to February 2007) (continued)	
Date	**Statement**
August 17, 2006	Federal Railroad Administration, Final EIS, Powder River Basin Expansion Project, Construction of New Rail Facilities, Finance Docket No. 33407 Dakota, Minnesota and Eastern Railroad, SD, WY, and MN (railroad)
March 22, 2007	Federal Energy Regulatory Commission, Final EIS, Rockies Express Western Phase Project, Construction and Operation for the Natural Gas Pipeline Facilities: Rockies Express (CP06–354–000), TransColorado (CP06–401–000), and Overthrust (CP06–423–000), CO, WY, NE, KS, MO, and NM (gas pipeline)
June 15, 2007	U.S. Forest Service, Final EIS, Northern Rockies Lynx Management Direction, Selected Alternative F, Conservation and Promote Recovery of the Canada Lynx, NFS and BLM to Amend Land Resource Management Plans for 18 National Forests (NF), MT, WY, UT, and ID (resource management-Canada lynx)
June 29, 2007	BLM, Final EIS, Programmatic—Vegetation Treatments Using Herbicides on BLM Public Lands in 17 Western States, including Alaska (resource management-herbicides)
August 24, 2007	BLM, Final EIS, Overland Pass Natural Gas Liquids Pipeline Project (OPP), Construction and Operation of 760-mile Natural Gas Liquids Pipeline, Right-of-Way Grant, KS, WY, and CO (gas pipeline)
November 16, 2007	U.S. Department of Energy, Draft EIS, PROGRAMMATIC—Designation of Energy Corridors in 11 Western States, Preferred Location of Future Oil, Gas, and Hydrogen Pipelines and Electricity Transmission and Distribution Facilities on Federal Land, AZ, CA, CO, ID, MT, NV, NM, UT, WA, and WY (energy corridors)
November 30, 2007	Federal Energy Regulatory Commission, Draft EIS, Rockies Express Pipeline Project, (REX-East) Construction and Operation of Natural Gas Pipeline Facilities, WY, NE, MO, IL, IN, and OH (gas pipeline)
December 21, 2007	BLM, Draft EIS, Programmatic EIS—Oil Shale and Tar Sands Resource Management Plan (RMP) Amendments To Address Land Use Allocations in Colorado, Utah, and Wyoming (oil shale and tar sands)

Table 5.2-5. Draft and Final Environmental Impact Statements (EISs) Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region (in Chronological Order From January 2005 to February 2007)	
Date	**Statement**
June 3, 2005	U.S. Forest Service (USFS), Final EIS, Dean Project Area, Proposes To Implement Multiple Resource Management Actions, Black Hills National Forest, Bearlodge Ranger District, Sundance, Crook County, WY (resource management)
August 12, 2005	USFS, Final EIS, Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units, Implementation, Dawes, Sioux, Blaine, Cherry, Thomas Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, SD (resource management-prairie dog)

Table 5.2-5. Draft and Final Environmental Impact Statements (EISs) Related to the Nebraska-South Dakota-Wyoming Uranium Milling Region (in Chronological Order From January 2005 to February 2007) (continued)	
Date	**Statement**
October 28, 2005	National Park Service, Draft EIS, Badlands National Park/North Unit General Management Plan, Implementation, Jackson, Pennington, and Shananon Counties, SD (resource management)
November 20, 2005	USFS, Final EIS, Deerfield Project Area, Proposes To Implement Multiple Resource Management Actions, Mystic Ranger District, Black Hills National Forest, Pennington County, SD (resource management)
November 25, 2005	USFS, Final EIS, Bugtown Gulch Mountain Pine Beetle and Fuels Projects, To Implement Multiple Resource Management Actions, Black Hills National Forest, Hell Canyon Ranger District, Custer County, SD (resource management)
January 13, 2006	USFS, Final EIS, Black Hills, National Forest Land and Resource Management Plan Phase II Amendment, Proposal To Amend the 1997 Land and Resource Management Plan, Custer, Fall River, Lawrence, Meade, and Pennington Counties, SD, and Crook and Weston Counties, WY (resource management)
February 3, 2006	USFS, Final EIS, Black-Tailed Prairie Dog Conservation and Management on the Nebraska National Forest and Associated Units, Implementation, Dawes, Sioux, Blaine, Cherry, Thomas Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, SD (resource management-prairie dog)
May 12, 2006	USFS, Final Supplemental EIS, Dean Project Area, Proposes To Implement Multiple Resource Management Actions, New Information to Disclose Direct, Indirect, and Cumulative Environmental Impacts, Black Hills National Forest, Bearlodge Ranger District, Sundance, Crook County, WY (resource management)
June 1, 2007	USFS, Final EIS, Norwood Project, Proposes To Implement Multiple Resources Management Actions, Black Hills National Forest, Hell Canyon Ranger District, Pennington County, SD, and Weston and Crook Counties, WY (resource management)
June 8, 2007	USFS, Draft EIS, Nebraska and South Dakota Black-Tailed Prairie Dog Management, To Manage Prairie Dog Colonies in an Adaptive Fashion, Nebraska National Forest and Associated Units, Including Land and Resource Management Plan Amendment 3, Dawes, Sioux, Blaine Counties, NE, and Custer, Fall River, Jackson, Pennington, Jones, Lyman, Stanley Counties, SD (resource management-prairie dog)
June 29, 2007	USFS, Final EIS, Mitchell Project Area, To Implement Multiple Resource Management Actions, Mystic Ranger District, Black Hills National Forest, Pennington County, SD (resource management)
September 14, 2007	USFS, Final EIS, Citadel Project Area, Proposes To Implement Multiple Resource Management Actions, Northern Hills Ranger District, Black Hills National Forest, Lawrence County, SD (resource management)
February 22, 2008	USFS, Draft EIS, Upper Spring Creek Project, Proposes To Implement Multiple Resource Management Actions, Mystic Ranger District, Black Hills National Forest, Pennington County, SD (resource management)

Table 5.2-6. Draft and Final Environmental Impact Statements (EISs) Related to the Northwestern New Mexico Uranium Milling Region (in Chronological Order From January 2005 to February 2007)

Date	Statement
February 2, 2005	Bureau of Indian Affairs, Final Supplemental EIS, Programmatic—Navajo Nation 10-Year Forest Management Plan, Selected Preferred Alternative Four, Chuska Mountain and Defiance Plateau Area, AZ and NM (forest management)
April 20, 2007	U.S. BLM, Draft EIS, Socorro Resource Management Plan Revision, Implementation, Socorro and Catron Counties, NM (resource management)

10 EISs are characterized by either management actions encompassing large geographical areas or proposed projects extending over large areas. For purposes of this GEIS, all 10 EISs will be considered as programmatic documents, whether or not they are labeled as such. Six of the EISs are related, either directly or indirectly, to energy development projects. Three of the six involve natural gas pipelines encompassing several states (two related to the Rockies Express and one to the Overland Pass project). Of interest herein are segments of the projects related to Wyoming (the Wyoming West and Wyoming East Uranium Milling Regions) and Nebraska (the Nebraska-South Dakota-Wyoming Uranium Milling Region). The U.S. Department of Energy draft EIS addresses energy corridors involving future oil, gas, and hydrogen pipelines and electricity transmission lines on federal lands in 11 western states, including Wyoming. In general, pipeline projects can have impacts on terrestrial resources within their specified corridors, and on aquatic resources near pipeline crossings of surface streams and rivers. The fifth energy-related project in Table 5.2-4 involves rail facilities associated with the Powder River Basin in Wyoming and South Dakota; regional coal transport could be enhanced by this project. The final energy-related project is associated with land use allocations for oil shale and tar sands development activities. Each of these six programmatic projects should be considered for inclusion, as appropriate, within any cumulative effects analyses of proposed ISL facilities in the Wyoming West and Wyoming East, Uranium Milling Regions. Further, the four resource management actions listed in Table 5.2-4 (grazing regulations, endangered species recovery programs for four listed species, lynx management, and herbicide usage) should also be considered within any cumulative effects studies of proposed ISL facilities in the three regions.

For the Nebraska-South Dakota-Wyoming Uranium Milling Region, a total of three draft EISs and 10 final EISs are identified in Table 5.2-5. All 13 EISs are related to resource management actions in the Black Hills National Forest or associated management units. Multiple actions related general resources management are addressed in 10 of the EISs. The remaining three actions are specifically associated with black-tailed prairie dog conservation and management. The actions in all 13 EISs are focused on improving natural resources conditions and reducing adverse impacts from various man-related activities.

For the Northwestern New Mexico Uranium Milling Region, Table 5.2-6 includes only one draft EIS and one final EIS issued over the study period. Both EISs are related to resource management; hence they are focused on improving natural resources conditions and reducing adverse impacts from various man-related activities.

5.3 Concurrent Actions

5.3.1 Wyoming West Uranium Milling Region

Table 5.3-1 contains a listing of six categories of actions in the State of Wyoming that could impact the resources and topics addressed in Chapters 3 and 4 (see Sections 3.2 and 4.2). The six categories (traditional land uses; wildlife/fisheries/forest management; recreation; government lands and land management; mineral extraction/energy development; and cultural resources preservation) include specific actions which illustrate the respective categories. Step 4 of the CEQ's 11-step cumulative effect process (see Appendix F) indicates that other past, present, and RFFAs that could contribute to cumulative effects on specific resources and topics should be identified. The listed actions in Table 5.3-1 are reflective of both past and continuing actions; further, the majority of the actions are expected to continue into the future. Locational information (by county) is included for several of the listed actions. Where county information is not available, it is assumed that the actions are statewide and applicable in both the Wyoming West and Wyoming East Uranium Milling Regions.

Table 5.3-1 also includes a series of codes to reflect that each listed action can impact certain resources and topics that are known to be impacted the ISL process for uranium recovery. The 12 resources and topics, and their designator codes are defined in the footnotes to the table. Further, these resources and topics provide the basic structure used in this GEIS for describing the affected environment (Chapter 3) and addressing the impacts of the four phases of an ISL project (Chapters 4 and 10). When a designator code (e.g., LU for land use) is listed for a specific action within a category, this denotes that the action would be anticipated to cause an impact on the resource or topic.

Table 5.3-2 contains a list of 21 coal mines in Wyoming. This listing and status information was procured from the following Wyoming website—<http://www.wma-minelife.com/coal/coalfrm/coaldat.htm>. A total of four surface mines and one underground mine are located in the Wyoming West Uranium Milling Region, with three in Carbon County and two in Sweetwater County. The 2006 production from these mines in the Hanna Coal Field and the Green River Coal Region ranged from about 25,580 to 4,912,960 metric tons [28,200 to 5,414,423 short tons]. Surface mining of coal can cause adverse impacts on land use, geology and soils, water resources, ecology, air quality, noise, historical and cultural resources, visual and scenic resources, socioeconomics, and waste management. The impacts of additional coal-related actions are included in Table 5.3-3.

5.3.2 Wyoming East Uranium Milling Region

Table 5.3-3 contains a listing of six categories of actions in the State of Wyoming that could impact the 12 resources and topics addressed in Chapters 3 and 4 for the Wyoming East Uranium Milling Region (see Section 3.3 and 4.3). The structure of Table 5.3-3 is the same as that for the Wyoming West Uranium Milling Region (Table 5.3-1). Where county information is not available, it is assumed that the actions are statewide and applicable in both the Wyoming West and Wyoming East Uranium Milling Regions. The listed actions in Table 5.3-3 are reflective of both past and continuing actions; further, the majority of the actions are expected to continue into the future.

Table 5.3-1. Other Actions Concurrent With Uranium Recovery in the Wyoming West Uranium Milling Region*	
Categories of Actions	**Impacts on Resource and Topics†**
Traditional Land Uses	
Livestock grazing	LU, WR, E, HC, S
Agricultural activities	LU, WR, E, HC, S
Protection of significant alluvial farmland	LU, WR, S
Irrigation	GS, WR, S
Development of new or expanded communities	LU, T, GS, WR, E, HC, S, WM
Roads and highways	LU, T, WR, E, HC, S
Indian Reservations Wind River [Northern Arapaho and Eastern Shoshone (Fremont)]	LU, WR, E, HC, VS
Wildlife/Fisheries/Forest Management	
Timber harvests (see National Forests)	LU, T, GS, WR, E, N, S
Wild horse management (Carbon, Sweetwater, Fremont)	LU, E
Protection of T/E species – critical habitat identification	LU, E
Riparian habitat preservation/enhancement	LU, WR, E
Recreation (See Information on National Forests and State Parks for Specific Location of Activities)	
Hunting, fishing, hiking	E
Camping	LU, E
Overland vehicle use (OHVs)	LU, GS, WR, E
Trail riding	LU, GS
Recreation management plans (Natrona, Converse)	LU, WR, E, HC, VS
Government Lands and Land Management	
State Parks • Sinks Canyon and Boysen State Park and Reservoir (Fremont) • Endess K. Wilkins State Park and Independence Rock State Historical Site (Natrona) • Seminoe SP & Reservoir (Carbon)	 LU, WR, E LU, E, HC LU, WR, E
National Forest/Grasslands • Shoshone National Forest (Fremont)	 LU, WR, E, HC, VS
National Wildlife Areas • Pathfinder National Wildlife Refuge (Natrona/Carbon) • Seedskadee National Wildlife Refuge (Sweetwater)	 LU, E, HC, VS LU, E, HC, VS

Table 5.3-1. Other Actions Concurrent With Uranium Recovery in the Wyoming West Uranium Milling Region* (continued)

Categories of Actions	Impacts on Resource and Topics†
Mineral Extraction/Energy Development	
Transmission lines/substations (Fremont)	LU, E
Coal related actions (Weston, Campbell, Converse, Carbon, Sweetwater)	
• Power plants	WR, E, AQ, N, HC, VS, S, WM
• Railroad development for hauling coal; past and present action, throughout coal regions	LU, T, WR, E, N, S
• Coal mines	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Mine reclamation (Carbon, Converse, probably Campbell)	GS, WR, E, AQ
• Coal Bed natural gas/methane development (Carbon, Fremont, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S
Natural gas and oil	
• Conventional oil development (Natrona, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Natural gas field development (Carbon, Sweetwater)	LU, GS, WR, E, AQ, HC, S
• Overland natural gas pipelines and compressor stations (Carbon, Sweetwater, Natrona, Fremont)	LU, T, WR, E, N, HC, S
• Oil shale and tar sands energy development (Fremont, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• CO_2-enhanced oil recovery (Natrona, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
Uranium activities	
• Permitting of new or inactive ISL facilities (Johnson, Campbell, Fremont, Sweetwater)	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Conventional mining and milling	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Reclaimed open pit mines (Converse, Carbon, Fremont)	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
Mining of other minerals	
• Trona (Sweetwater)	LU, T, GS, WR, E, AQ, N, HC, VS, S, WM

Table 5.3-1. Other Actions Concurrent With Uranium Recovery in the Wyoming West Uranium Milling Region* (continued)	
Categories of Actions	**Impacts on Resource and Topics†**
Cultural Resources Preservation	
Historic trails—crisscrossing state of Wyoming	LU, HC
Ghost towns (Fremont)	LU, HC

* The Wyoming West Uranium Milling Region includes the western parts of Natrona and Carbon Counties, the northeastern portion of Sweetwater County, and the eastern portion of Fremont County.
†The resources and topics codes include
- LU = land use
- T = transportation
- GS = geology and soils
- WR = water resources (wetlands, surface water, and groundwater)
- E = ecology (terrestrial, aquatic, and threatened/endangered species)
- AQ = air quality (non-radiological)
- N = noise
- HC = historical and cultural resources
- VS = visual and scenic resources
- S = socioeconomics
- PO = public and occupational health and safety
- WM = waste management

Table 5.3-2. Coal Mining Projects as Identified by the Wyoming Mining Association (Data Through 2006)*				
Mine Name	**Owner/Operator (If Different)**	**Location**	**Mine Type**	**Production in 2006 (Tons)**
Powder River Basin Coal				
Buckskin	Buckskin Mining Co.	Campbell Co.	Surface	22,768,303
Rawhide	Powder River Coal	Campbell Co.	Surface	17,092,993
Dry Fork	Western Fuels of WY	Campbell Co.	Surface	5,860,998
Eagle Butte	Foundation Coal West	Campbell Co.	Surface	25,355,158
KFx	KFx Fuel Partners	Campbell Co.	Surface	87,863 (just recently back in production)
Wyodak	Wyodak Resources Development	Campbell Co.	Surface	4,698,473
Caballo	Powder River	Campbell Co.	Surface	32,700,000
Belle Ayr	Foundation Coal West	Campbell Co.	Surface	24,593,035
Cordero/Rojo	Rio Tinto Energy America	Campbell Co.	Surface	39,747,620
Coal Creek		Campbell Co.		3,097,584 (No production 2000-2005)
Jacobs Run	Rio Tinto Energy America	Campbell Co.	Surface	40,000,376
Black Thunder	Thunder Basin Coal	Campbell Co.	Surface	92,517,728
North Rochelle	Triton Coal	Campbell Co.	Surface	No data since 2004
North Antelope/ Rochelle	Powder River Coal	Campbell Co.	Surface	88,527,969
Antelope	Rio Tinto Energy America	Converse Co.	Surface	33,984,178

Table 5.3-2. Coal Mining Projects as Identified by the Wyoming Mining Association (Data Through 2006)* (continued)				
Mine Name	**Owner/Operator (If Different)**	**Location**	**Mine Type**	**Production in 2006 (Tons)**
Dave Johnston	Glenrock Coal	Converse Co.	Surface	Reclaimed—no production since 2000
Seminoe #2	Arch Coal, Inc.	Carbon Co.	Surface	Final reclamation in 2006
Medicine Bow	Arch Coal, Inc.	Carbon Co.	Surface	28,212, but 0 in 2005; relatively small operation
Green River Coal Region				
Jim Bridger	Bridger Coal	Sweetwater Co.	Surface	5,414,423
Black Butte	Black Butte Coal	Sweetwater Co.	Surface	3,410,309
*SOURCE: http://www.wma-minelife.com/coal/coalfrm/coaldat.htm				

Table 5.3-3. Other Actions Related to or Conflicting With Uranium Recovery in the Wyoming East Uranium Milling Region*	
Categories of Actions	**Impacts on Resource and Topics†**
Traditional Land Uses	
Livestock grazing	LU, WR, E, HC, S
Agricultural activities	LU, WR, E, HC, S
Protection of significant alluvial farmland	LU, WR, S
Irrigation	GS, WR, S
Development of new or expanded communities	LU, T, GS, WR, E, HC, S, WM
Roads and highways	LU, T, WR, E, HC, S
Wildlife/Fisheries/Forest Management	
Timber harvests (see National Forests)	LU, T, GS, WR, E, N, S
Wild horse management (Carbon, Sweetwater, Fremont)	LU, E
Protection of T/E species – critical habitat identification	LU, E
Riparian habitat preservation/enhancement	LU, WR, E
Prairie dog management (Campbell, Converse, Weston)	LU, E
Recreation (see Information on National Forests and State Parks for Specific Location of Activities)	
Hunting, fishing, hiking	E
Camping	LU, E
Overland vehicle use (OHVs)	LU, GS, WR, E
Trail riding	LU, GS
Recreation management plans (Natrona, Converse)	LU, WR, E, HC, VS
Government Lands and Land Management	
State Parks	
• Endess K. Wilkins State Park and Independence Rock State Historical Site (Natrona)	LU, E, HC
• Seminoe SP & Reservoir (Carbon)	LU, WR, E

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Table 5.3-3. Other Actions Related to or Conflicting With Uranium Recovery in the Wyoming East Uranium Milling Region* (continued)

Categories of Actions	Impacts on Resource and Topics†
National Forest/Grasslands	
• Thunder Basin National Grasslands (Weston, Campbell, Converse)	LU, WR, E, HC, VS
• Medicine Bow National Forest (Converse, Natrona, Carbon)	LU, WR, E, HC, VS
• Bighorn National Forest (Johnson)	LU, WR, E, HC, VS
National Wildlife Areas	
• Pathfinder NWA (Natrona/Carbon)	LU, E, HC, VS
Mineral Extraction/Energy Development	
Transmission lines/substations (Fremont)	LU, E
Coal-related actions (Weston, Campbell, Converse, Carbon, Sweetwater)	
• Power plants	WR, E, AQ, N, HC, VS, S, WM
• Railroad development for hauling coal; past and present action, throughout coal regions	LU, T, WR, E, N, S
• Coal mines	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Mine reclamation (Carbon, Converse, probably Campbell)	GS, WR, E, AQ
• Coal leasing (Campbell, Converse)	LU, S
• Coal Bed natural gas/methane development (Carbon, Fremont, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S
Natural gas and oil	
• Conventional oil development (Natrona, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Natural gas field development (Carbon, Sweetwater)	LU, GS, WR, E, AQ, HC, S
• Overland natural gas pipelines and compressor stations (Carbon, Sweetwater, Natrona, Fremont)	LU, T, WR, E, N, HC, S
• Oil shale and tar sands energy development (Fremont, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• CO_2-enhanced oil recovery (Natrona, Sweetwater)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
Uranium activities	
• Permitting of new or inactive ISL facilities (Johnson, Campbell, Fremont, Sweetwater)	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Continued operation of ISL facilities (Converse)	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Conventional mining and milling	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Reclaimed open pit mines (Converse, Carbon, Fremont)	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
Mining of other minerals	
• Bentonite (Weston, Johnson, Natrona)	LU, T, GS, WR, E, AQ, N, HC, VS, S, WM

Table 5.3-3. Other Actions Related to or Conflicting With Uranium Recovery in the Wyoming East Uranium Milling Region* (continued)	
Categories of Actions	**Impacts on Resource and Topics†**
Cultural Resources Preservation	
Historic trails – crisscrossing state of Wyoming	LU, HC
Historic mines and other pioneer sites (Converse, Johnson)	LU, HC

* The Wyoming East Uranium Milling Region is composed of Converse County, the southern portion of Campbell County, the southeastern portion of Johnson County, and the eastern boundary of Natrona County. Further, the Nebraska-South Dakota-Wyoming Milling Region includes all or portions of three Wyoming counties; specifically, this region includes Crook County, the eastern half of Weston County, and the northeastern portion of Niobrara County.

†The resources and topics codes include
- LU = land use
- T = transportation
- GS = geology and soils
- WR = water resources (wetlands, surface water, and groundwater)
- E = ecology (terrestrial, aquatic, and threatened/endangered species)
- AQ = air quality (non-radiological)
- N = noise
- HC = historical and cultural resources
- VS = visual and scenic resources
- S = socioeconomics
- PO = public and occupational health and safety
- WM = waste management

As noted previously, Table 5.3-2 contains a list of coal mines in Wyoming. This listing and status information was procured from the following Wyoming website—<http://www.wma-minelife.com/coal/coalfrm/coaldat.htm>. The Wyoming East Uranium Milling Region includes 15 surface mines in the Powder River Basin, with 13 in Campbell County and two in Converse County. The 2006 coal production levels indicated that 14 mines were in operation in the Wyoming East Uranium Milling Region, with annual production levels ranging from 79,700 to about 83,916,000 metric tons [87,900 to 92,500,000 short tons]. Surface mining of coal can cause adverse impacts on land use, geology and soils, water resources, ecology, air quality, noise, historical and cultural resources, visual and scenic resources, socioeconomics, and waste management. The impacts of additional coal-related actions are included in Table 5.3-3.

5.3.3 Nebraska-South Dakota-Wyoming Uranium Milling Region

Table 5.3-4 is structured similarly to Table 5.3-1, with a listing of six categories of actions in the states of Nebraska and South Dakota that could impact the resources and topics addressed in Chapters 3 and 4 (see Sections 3.4 and 4.4). Concurrent actions in Wyoming are described in Tables 5.3-1 and 5.3-3. When the county is not identified for the action, it is assumed that the actions are statewide and applicable in the South Dakota and Nebraska portions of the Nebraska-South Dakota-Wyoming Uranium Milling Region. There are no coal mines identified in the affected counties in this uranium milling region. The listed actions in Table 5.3-4 are reflective of both past and continuing actions; further, the majority of the actions are expected to continue into the future.

Table 5.3-4. Other Actions Concurrent With Uranium Recovery in the Nebraska-South Dakota-Wyoming Uranium Milling Region*	
Categories of Actions	**Impacts on Resource and Topics†**
Traditional Land Uses	
Livestock grazing	LU, WR, E, HC, S
Agricultural activities	LU, WR, E, HC, S
Protection of significant alluvial farmland	LU, WR, S
Irrigation	GS, WR, S
Development of new or expanded communities	LU, T, GS, WR, E, HC, S, WM
Roads and highways	LU, T, WR, E, HC, S
Indian Reservations • Pine Ridge (Oglala Sioux)	LU, WR, E, HC, VS
Wildlife/Fisheries/Forest Management	
Timber harvests (see National Forests)	LU, T, GS, WR, E, N, S
Wild horse management	LU, E
Protection of T/E species; critical habitat identification	LU, E
Riparian habitat preservation/enhancement	LU, WR, E
Prairie dog management (Weston, Sioux, Dawes)	LU, E
Wildland fires (Black Hills National Forest; all four counties)	LU, T, WR, E, AQ, HC, VS, S
Recreation (See Information on National Forests and State Parks for Specific Location of Activities)	
Hunting, fishing, hiking	E
Camping	LU, E
Overland vehicle use (OHVs)	LU, GS, WR, E
Trail riding	LU, GS
Recreation management plans	LU, WR, E, HC, VS
Scenic byways (Custer, Lawrence, and Pennington)	LU, T, WR, E, HC, VS, S
Black Hills major tourist center (all four counties in South Dakota)	LU, T, WR, E, HC, VS, S
Government Lands and Land Management	
National Forest/Grasslands (Wyoming) • Thunder Basin National Grasslands (Weston, Campbell, Converse)	LU, WR, E, HC, VS
National Parks/Monuments (Wyoming) • Devils Tower, New Mexico (Weston)	LU, WR, E, HC, VS
State Parks (South Dakota) • Custer State Park (Custer) • Angostura State Recreation Area (Fall River)	LU, WR, E LU, WR, E

Table 5.3-4. Other Actions Concurrent With Uranium Recovery in the Nebraska-South Dakota-Wyoming Uranium Milling Region* (continued)

Categories of Actions	Impacts on Resource and Topics†
National Forest/Grasslands (South Dakota)	
• Black Hills National Forest (Fall River, Custer, Pennington, Lawrence)	LU, WR, E, HC, VS
• Buffalo Gap National Grassland (Fall River, Custer, Pennington)	LU, WR, E, HC, VS
National Parks/Monuments (South Dakota)	
• Mt. Rushmore National Memorial (western Pennington)	LU, WR, E, HC, VS
• Jewel Cave National Monument (Custer)	LU, WR, E, HC, VS
• Wind Cave National Park (Custer)	LU, WR, E, HC, VS
State Parks/Recreation Areas (Nebraska)	
• Chadron SP (Dawes); within the Nebraska National Forest	LU, WR, E, HC, VS
• Ft. Robinson SP (Sioux, Dawes)	LU, WR, E, HC, VS
• Box Butte Reservoir State Recreation Area (Dawes)	LU, WR, E, HC, VS
National Forests/Grasslands	
• Oglala National Grasslands (Sioux, Dawes)	LU, WR, E, HC, VS
o Toadstool Geologic Park (Sioux); operated by US Forest Service	LU, WR, E, HC, VS
• Nebraska National Forest (Sioux, Dawes)	LU, WR, E, HC, VS
o Within the Forest is Soldier Creek Wilderness (Sioux)	LU, WR, E, HC, VS
o Within the Forest is Pine Ridge National Recreation Area (Dawes)	LU, WR, E, HC, VS
National Parks/Monuments	
• Agate Fossil Beds National Monument (Sioux)	LU, WR, E, HC, VS
Mineral Extraction/Energy Development	
Transmission lines/substations	LU, E
Coal-related actions	
• Power plants	WR, E, AQ, N, HC, VS, S, WM
• Railroad development for hauling coal; past and present action, throughout coal regions	LU, T, WR, E, N, S
• Coal mines	GS, WR, E, AQ
• Mine reclamation	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Coal leasing	LU, GS, WR, E, AQ, N, HC, VS, S

Table 5.3-4. Other Actions Concurrent With Uranium Recovery in the Nebraska-South Dakota-Wyoming Uranium Milling Region* (continued)

Categories of Actions	Impacts on Resource and Topics†
Natural gas and oil	
• Oil and gas leasing (Custer National Forest)	LU, GS
• Conventional oil development (Fall River)	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Natural gas field development	LU, GS, WR, E, AQ, N, HC, S
• Overland natural gas pipelines and compressor stations	LU, T, WR, E, N, HC, S
Uranium activities	
• Permitting of new or inactive ISL facilities (Fall River, Custer, Dawes)	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Continued operation of ISL facilities	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Conventional mining and milling	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
Other	
• Energy corridors‡	LU, T, WR, E, N, HC, S
• Limestone conveyor system (Custer)§	LU, T, E, AQ, N, HC, VS, S
Cultural Resources Preservation	
Big Thunder historic gold mine (Pennington)	LU, HC
Several pioneer homesteads in Black Hills	LU, HC
Museum of the Fur Trade (Dawes)	LU, HC

*The Nebraska-South Dakota-Wyoming Uranium Milling Region includes all or portions of three Wyoming counties; specifically, this region includes Crook County, the eastern half of Weston County, and the northeastern portion of Niobrara County. In addition, the South Dakota portion of the region includes Fall River, Custer, and Lawrence Counties and the western half of Pennington County. The Nebraska portion of the region includes Sioux, Box Butte, and Dawes Counties in the far northwestern portion of the state.

†The resources and topics codes include

- LU = land use
- T = transportation
- GS = geology and soils
- WR = water resources (wetlands, surface water, and groundwater)
- E = ecology (terrestrial, aquatic, and threatened/endangered species)
- AQ = air quality (non-radiological)
- N = noise
- HC = historical and cultural resources
- VS = visual and scenic resources
- S = socioeconomics
- PO = public and occupational health and safety
- WM = waste management

‡Federal Departments of Agriculture, Commerce, Defense, Energy, and the Interior are proposing to designate corridors on Federal land for locating future oil, natural gas, and hydrogen pipelines and electricity transmission and distribution infrastructure in the West. These corridors would be the agency-preferred locations where pipelines and transmission lines may be sited and built in the future. Such corridors could be proposed for South Dakota.

§This is a proposed 11-km [7-mi] enclosed, aboveground conveyor belt to transfer limestone in Custer County, South Dakota. The project will cross national forest lands, BLM lands, and private lands. The BLM is preparing an EIS on this project.

5.3.4 Northwestern New Mexico Uranium Milling Region

Table 5.3-5 is structured similarly to Table 5.3-1, with a listing of six categories of actions in the State of New Mexico that could impact the resources and topics addressed in Chapters 3 and 4 (see Sections 3.5 and 4.5). The six categories (traditional land uses; wildlife/fisheries/forest management; recreation; government lands and land management; mineral extraction/energy development; and cultural resources preservation) include specific actions which illustrate the respective categories. The listed actions in Table 5.3-5 are reflective of both past and continuing actions; further, the majority of the actions are expected to continue into the future.

5.4 Approaches to Conducting a Site-Specific Cumulative Effects Analysis

Each of the four uranium milling regions analyzed in this GEIS includes existing and previous uranium recovery facilities (Table 5.2-1), as well as anticipated new, modified, or planned restarts of uranium ISL facilities (NRC, 2008). In addition, each region includes a number of individual and programmatic present and RFFAs as reflected by recent EISs (Tables 5.2-2 through 5.2-6).

Table 5.3-5. Other Actions Concurrent With Uranium Recovery in the Northwestern New Mexico Uranium Milling Region*

Categories of Actions	Impacts on Resource and Topics†
Traditional Land Uses	
Livestock grazing	LU, WR, E, HC, S
Agricultural activities	LU, WR, E, HC, S
Protection of significant alluvial farmland	LU, WR, S
Irrigation	GS, WR, S
Development of new or expanded communities	LU, T, GS, WR, E, HC, S, WM
Roads and highways	LU, T, WR, E, HC, S
Indian reservations	
• Navajo (McKinley)	LU, WR, E, HC, VS
• Zuni (McKinley, Cibola)	LU, WR, E, HC, VS
• Ramah Navajo (Cibola)	LU, WR, E, HC, VS
• Acoma (Cibola)	LU, WR, E, HC, VS
• Lacuna (Cibola)	LU, WR, E, HC, VS
• Canonito (Cibola)	LU, WR, E, HC, VS
• Alamo Bend Navajo (Socorro)	LU, WR, E, HC, VS
Wildlife/Fisheries/Forest Management	
Timber harvests (see National Forests)	LU, T, GS, WR, E, N, S
Wild horse management	LU, E
Protection of T/E species; critical habitat identification	LU, E
Riparian habitat preservation/enhancement	LU, WR, E
Endangered species reintroduction (Aplomado falcon) (Socorro)	LU, E

Table 5.3-5. Other Actions Concurrent With Uranium Recovery in the Northwestern New Mexico Uranium Milling Region* (continued)	
Categories of Actions	**Impacts on Resource and Topics†**
Recreation (See Information on National Forests and State Parks for Specific Location of Activities)	
Hunting, fishing, hiking	E
Camping	LU, E
Overland vehicle use (OHVs) (Catron, Socorro)	LU, GS, WR, E
Trail riding	LU, GS
Recreation management plans	LU, WR, E, HC, VS
Government Lands and Land Management	
State Parks	
• Bluewater SP (Cibola)	LU, WR, E
• Red Rock SP (McKinley)	LU, WR, E
National Forest/Grasslands	
• Cibola National Forest (all four counties)	LU, WR, E, HC, VS
• Apache-Sitgreaves National Forest (Catron)	LU, WR, E, HC, VS
• Gila National Forest (Catron)	LU, WR, E, HC, VS
National Monuments/Recreation areas/Wildlife refuges/Conservation areas	
• Gila Cliff Dwelling National Monument (Catron)	LU, E, HC, VS
• El Morro National Monument (Cibola)	LU, E, HC, VS
• Chain of Craters Wilderness Study Area (Cibola)	LU, E, HC, VS
• El Malpais National Conservation Area (surrounds El Malpais National Monument, but does not include it; Cibola)	LU, E, HC, VS
• El Malpais National Monument; lava beds (Cibola)	LU, E, HC, VS
• Salinas Pueblo Mission National Monument (Socorro)	LU, E, HC, VS
• Datil Well NRA (Catron; within the Cibola National Forest)	LU, E, HC, VS
• Bosque del Apache NWR (Socorro)	LU, E, HC, VS
Ft. Wingate Military Reservation (McKinley)	LU, E, HC
Mineral Extraction/Energy Development	
Transmission lines/substations	LU, E
Coal-related actions	
• Power plants (McKinley)	WR, E, AQ, N, HC, VS, S, WM
• Coal mines (McKinley, Cibola)	GS, WR, E, AQ
• Coal leasing	LU, GS, WR, E, AQ, N, HC, VS, S

Table 5.3-5. Other Actions Concurrent With Uranium Recovery in the Northwestern New Mexico Uranium Milling Region* (continued)	
Categories of Actions	**Impacts on Resource and Topics†**
Natural gas and oil	
• Conventional oil development	LU, GS, WR, E, AQ, N, HC, VS, S, WM
• Natural gas field development (McKinley)	LU, GS, WR, E, AQ, HC, S
• Overland natural gas pipelines and compressor stations	LU, T, WR, E, N, HC, S
Uranium activities	
• Permitting of new or inactive ISL facilities	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Continued operation of ISL facilities	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Conventional mining and milling	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
• Reclaimed open pit mines	LU, T, GS, WR, E, AQ, N, HC, VS, S, PO, WM
Mining of other minerals	
• Perlite (Socorro)	LU, T, GS, WR, E, AQ, N, HC, VS, S, WM
• Humate (McKinley)	LU, T, GS, WR, E, AQ, N, HC, VS, S, WM
• Travertine (Cibola)	LU, T, GS, WR, E, AQ, N, HC, VS, S, WM
Cultural Resources Preservation	
Numerous Native American sacred sites	LU, HC

*The Northwestern New Mexico Uranium Milling Region includes McKinley County and the northern portions of Cibola, Catron, and Socorro Counties.
†The resources and topics codes include
LU = land use
T = transportation
GS = geology and soils
WR = water resources (wetlands, surface water, and groundwater)
E = ecology (terrestrial, aquatic, and threatened/endangered species)
AQ = air quality (non-radiological)
N = noise
HC = historical and cultural resources
VS = visual and scenic resources
S = socioeconomics
PO = public and occupational health and safety
WM = waste management

As described in Chapter 4, construction, operations, aquifer restoration, and decommissioning/reclamation activities associated with uranium ISL facilities can affect different resource areas within each of the uranium milling regions. In conducting a site-specific cumulative effects analysis, an approach such as the CEQ (1997) 11-step process described in Appendix D can be tailored, depending on the current conditions of the affected environment and the level of impacts (SMALL, MODERATE, or LARGE) to a specific resource area.

If a proposed ISL facility (or an expansion/restart) is in compliance with applicable federal and state laws and policies (e.g., the Endangered Species Act) and if the expected impacts to a specific resource area are small, then a Level 1 site-specific cumulative effects analysis would be appropriate. Based on the CEQ (1997) 11-step process described in Appendix D, a Level 1 analysis is based on consideration of the four scoping steps (Steps 1 through 4) along with two of the three environmental description steps (Steps 6 and 7). Further, brief consideration should be given to the types, sizes, and locations of other present and RFFAs in the uranium milling region (including other uranium ISL facilities) and their contribution to effects on each resource area.

If concerns are identified during the site-specific analysis with respect to the sustainability or quality of a given resource area in the uranium milling region, then a Level 2 cumulative effects analysis would be appropriate. Based on the CEQ (1997) 11-step process (see Appendix D), a Level 2 analysis is based on the same considerations as a Level 1 analysis, with a more detailed evaluation of the types, sizes, and locations of present and RFFAs and their relative contributions to effects on each resource area (Step 8). The effects of each of the other actions (for example, activities included in the EISs identified in Tables 5.2-3 through 5.2-6) would be tabulated and discussed with respect to the timing of different stages (construction, operation, aquifer restoration, and decommissioning/reclamation) of the ISL facility life cycle.

If the site-specific analysis identifies that a specific resource area reflects stresses that exceed regulatory or policy limits, has diminished usage due to quality degradation, or there are concerns regarding noncompliance with respect to statutory or policy requirements as reflected by moderate or large impacts, then a Level 3 cumulative effects analysis would be appropriate. In undertaking a site-specific Level 3 analysis, each of the CEQ (1997) 11 steps would be applied, including scoping (Steps 1 through 4), environmental description (Steps 5-7) and environmental consequences (Steps 8 through 11). Detailed descriptions and analysis would be used to fully characterize the cumulative effects of the ISL facility and other past, present, and RFFAs on the status of a resource area, such as land use or groundwater, within the affected environment.

A systematic resource-by-resource review of the conditions of the affected environment within each geographic region, the levels of impacts of ISL facilities for all four stages of the ISL lifecycle (construction, operations, aquifer restoration, and decommissioning) and the identification of other past, present, and RFFAs in each designated region, was used to determine the potential level of cumulative effects analysis. The results of this analysis revealed that a Level 1 or Level 2 site-specific cumulative effects analysis would be expected to be sufficient for nine resources in each of the four regions. The nine resources included land use, transportation, geology and soils, air quality, noise, visual and scenic resources, socioeconomics, public and occupational health and safety, and waste management. Another result of this review was that for the four other resources, a Level 1, 2, or 3 analysis might be required. The Level 3 analysis would be highly dependent on local site-specific conditions. The four resources that could potentially be analyzed at this level included surface water resources (primarily wetlands), groundwater resources, terrestrial and aquatic ecology (primarily threatened or endangered species), and historical and cultural resources.

5.5 References

CEQ. "Considering Cumulative Effects Under the National Environmental Policy Act." Washington, DC: Executive Office of the President. 1997.

Committee on Hard Rock Mining on Federal Lands. "Hardrock Mining on Federal Lands." Washington, DC: National Research Council, National Academics Press. 1999.

NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 1/24/2008." 2008. <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public-012408.pdf> (08 February 2008).

6 ENVIRONMENTAL JUSTICE

Environmental justice means that people of all races, cultures, and incomes are treated fairly with regard to the development and implementation (or lack thereof) of environmental laws, regulations, and policies (Executive Order 12898). On February 11, 1994, The President signed Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which directs each federal agency to "... make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations" (Office of the President, 1994). Executive Order 12898 makes it clear that environmental justice matters also apply to programs involving Native Americans (CEQ, 1997).

On December 10, 1997, the Council on Environmental Quality (CEQ) issued, "Environmental Justice Guidance Under the National Environmental Policy Act." The Council developed this guidance to "... further assist Federal agencies with their National Environmental Policy Act (NEPA) procedures." As an independent agency, the Council's guidance is not binding on the U.S. Nuclear Regulatory Commission (NRC). However, the NRC considered the Council's guidance on environmental justice in developing its own environmental justice analysis procedures.

In August 2004, NRC published a final policy statement in the Federal Register to provide a "... comprehensive statement of the Commission's policy on the treatment of environmental justice matters in NRC regulatory and licensing actions" (NRC, 2004). The NRC Environmental Justice Policy is to use its normal and traditional NEPA review process to meet the goals articulated in Executive Order 12898. "NRC believes that an analysis of disproportionately high and adverse impacts needs to be done as part of the agency's NEPA obligations to accurately identify and disclose all significant environmental impacts associated with a proposed action."

NRC received comments on its draft Environmental Justice Policy on whether environmental justice should be considered in a programmatic or generic environmental impact statement (GEIS). In clarifying its position, NRC noted that for a non-site-specific assessment of potential environmental impacts such as that presented in a GEIS, it is "... difficult to foresee or predict many circumstances, if any, in which a meaningful environmental justice analysis could be completed." However, the final policy statement does not preclude the possibility of an environmental justice analysis in a GEIS if "... a meaningful review can be completed."

NRC has concluded that it can use the GEIS to help conduct a meaningful environmental justice analysis by using population information available through the U.S. Census Bureau, the regional and sub-regional information discussed in Chapter 3, and the potential environmental impacts evaluated in Chapters 4 and 5. The GEIS lists regional resource areas where there is no information indicating that the impacts described in Chapters 4 and 5 would be any different for the identified minority or low-income population than the general population. The GEIS also lists regional resource areas where further site-specific information should be gathered to evaluate whether there is a disproportionately high and adverse environmental or health impact on the minority or low-income populations in the area.

It should be noted, under NEPA, the identification of a disproportionately high and adverse human health or environmental effect on a minority or low-income population does not preclude a proposed agency action from going forward, nor does it necessarily result in a conclusion that a proposed action is environmentally unsatisfactory. Rather, the identification of such an effect should heighten agency attention to alternatives (including alternative sites), mitigation strategies, monitoring needs, and preferences expressed by the affected community or population (CEQ 1997).

The following sections in this chapter discuss NRC's procedure to conduct an environmental justice analysis and then apply the procedure to the regional areas under consideration in this GEIS.

6.1 Environmental Justice Analysis

6.1.1 Background and Guidance

NRC environmental justice guidance (NRC, 2004) discusses the procedure to evaluate potential disproportionately high and adverse impacts associated with physical, socioeconomic, health, and cultural resources to low-income and minority populations. The environmental justice process is shown in Figure 6.1-1.

NRC guidance (NRC, 2004; 2003, Appendix C) states that NRC's policy is to address environmental justice in every environmental impact statement (EIS) and, as appropriate, supplements to an EIS, which are issued by the Office of Nuclear Materials Safety and Safeguards. Under most circumstances, no environmental justice review should be conducted where an environmental assessment is prepared because if a particular action would have *no significant environmental impact*, then there is no need to consider whether the action would have disproportionately high and adverse impacts on certain populations. However, on a case-by-case basis where there is an obvious potential that consideration of site-specific demographic information may identify significant impacts that would not otherwise be considered, a manager can determine that an environmental justice review should be conducted for an environmental assessment.

> **Components of an Environmental Justice Analysis (CEQ, 1997; NRC, 2004)**
>
> *Minority population* is identified as consisting of individual(s) who are American Indian or Alaskan Native, Asian or Pacific Islander, Black (not of Hispanic origin), or Hispanic.
>
> *Low-income population* is identified in comparison to statistical poverty thresholds identified in U.S. Census Bureau information.
>
> *Disproportionately high and adverse effects* include both potential effects on human health and the environment. Disproportionately high and adverse effects are evaluated by determining whether there are one or more attributes that could lead to impacts that would be expected to significantly and adversely affect a minority or low-income population more than the general population as a whole.

The first step in the process is to gather demographic and socioeconomic data for the immediate site and surrounding communities to identify minority or low-income populations. The guidance document describes the radius of influence it considers when it evaluates potential environmental justice concerns for licensing a uranium recovery facility, as an ISL mill. That radius is normally 1 km [0.6 mi] from the center of the proposed site in urban areas and 6.4 km [4 mi] if the facility is located in a rural area.

Most potential ISL facilities are expected to be located in rural areas, indicating that the 6.4-km [4-mi] radius would generally be appropriate. The NRC final policy statement (NRC, 2004) notes, however, that the distances are intended as guidelines, not requirements. The geographic scale considered in a site-specific environmental justice analysis should be

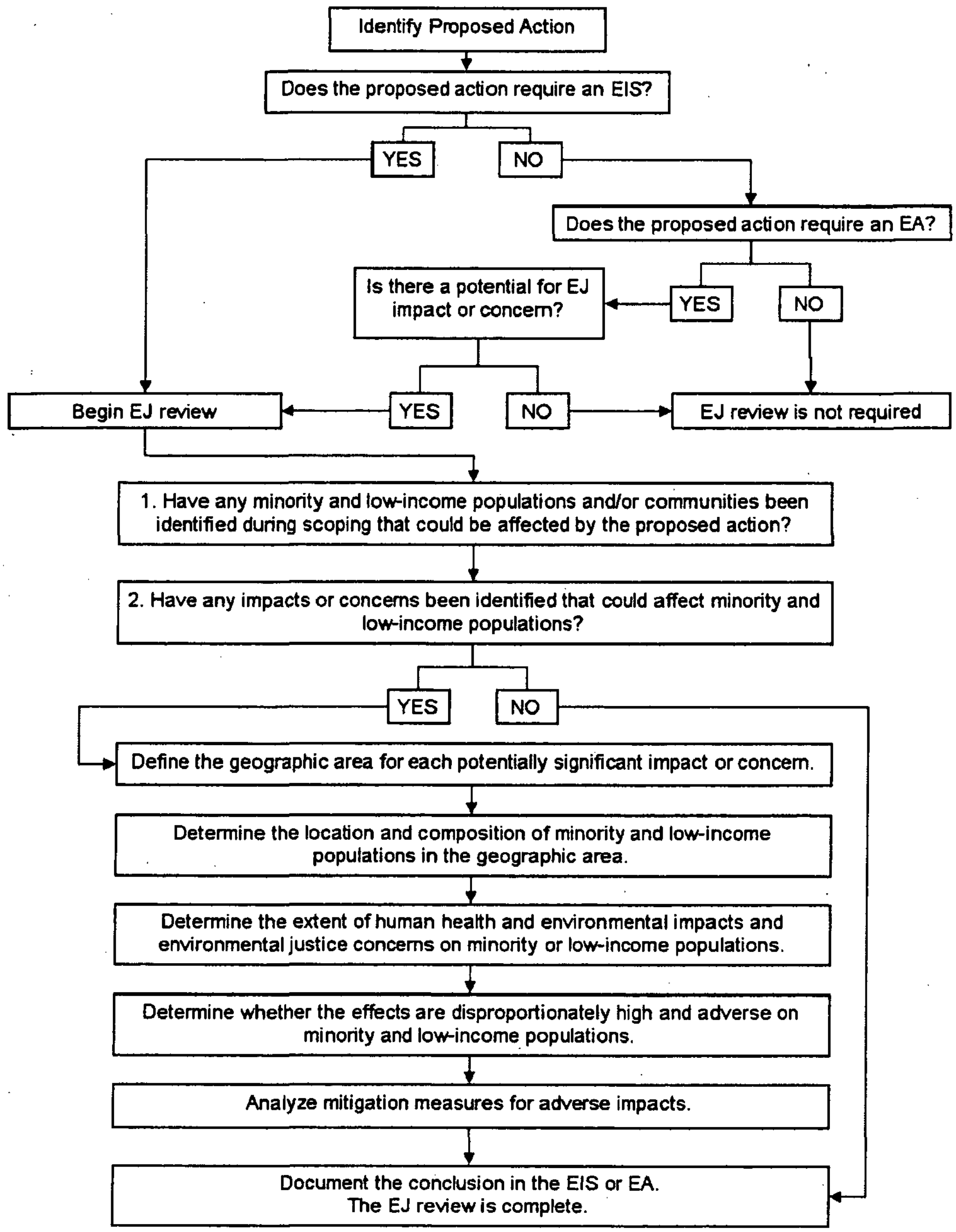

Figure 6.1-1. Environmental Justice Process Flow Chart

appropriate for the potential impact area. Because ISL well fields can cover large geographic areas, NRC has decided to evaluate demographic and socioeconomic data within at least an 80-km [50-mi] radius of the existing or potential facilities. This analysis includes a sample of the surrounding population, because the goal of environmental justice analysis is to evaluate the "communities," neighborhoods, or areas that may be disproportionately impacted (NRC, 2003, Appendix C).

NRC guidance recommends using the U.S. Census Bureau "census block group" as the geographic area for evaluating demographic and income data. NRC used this data source and examined delineations of tribal lands and resources for this GEIS. NRC can also use other site-specific information to identify minority or low-income populations not identified through this demographic data to determine whether further environmental justice analysis is needed in an environmental review for an individual license application.

The next step is to compare the percentage of minority populations in the area for assessment to the state and county percentages of minority populations and compare the area's percentage of economically stressed households to the state and county percentages of economically stressed households. As general guidance, NRC (2003, Appendix C) notes that differences greater than 20 percentage points may be considered significant, and if either the minority or low-income population percentage in the radius of influence exceeds 50 percent, environmental justice should be considered in greater detail. Depending on a specific facility's location, it is possible that the radius of influence could cross county and state lines—a fact that should be considered when making comparisons. If no minorities or low-income populations are identified in the potentially affected area or environmental impact area, then the conclusion should be documented and the environmental justice review is complete.

After minority or low-income populations are identified, the next step is to determine whether there is a "disproportionately high and adverse" impact (human health or environmental effect) to these populations.

NRC guidance recommends determining the impacts of the proposed action in the usual manner, including cumulative and multiple impacts, where appropriate. Environmental impacts and cumulative impacts for facilities using ISL technology are discussed in Chapters 4 and 5 of the GEIS. These impacts have been evaluated to determine whether they would disproportionately affect minority or low-income populations by considering whether there are unique pathways of exposure to these populations compared to the general population. Where a proposed action would not cause adverse environmental impacts, and therefore not cause any high and adverse health or environmental impacts, specific demographic analysis may not be warranted (CEQ, 1997).

The next step is to determine whether the impacts disproportionately impact the minority or low-income populations. In general, populations located next to a site would likely have a disproportionate impact compared to other populations located farther from the site. For example, potential exposure to effluents may be greater to those living closest to the facility, noise and traffic may disrupt nearby residents to a greater extent than those living far from the site, and the potential risk due to accidents may be greater for nearby residents. Additionally, cultural differential patterns of consumption of natural resources may change the impact to the identified population (NRC, 2003, Appendix C). In this example, a subsistence consumption analysis can be used to evaluate whether there are cultural factors that change the estimated "dose" for the sections discussing impacts on public and occupational health and safety. If there are no disproportionate impacts, no further analysis would be needed and the reviewer would document this finding in the environmental justice section (NRC, 2003, Appendix C).

If there are disproportionate impacts to minority or low-income populations, the next step in the analysis would be to evaluate the significance of the impacts to determine whether they are "high and adverse." Impacts that are significant, unacceptable, or above generally accepted levels (such as regulatory limits or state and local statutes and ordinances) may be considered high and adverse. Each impact, and where appropriate, the cumulative and multiple effect of the impacts, should be reviewed for significance. If it can be stated that no combination of the impacts is significant, then there are not disproportionately adverse or high on the minority or low-income populations, and this finding should be documented in the environmental justice section of the environmental review (NRC, 2003, Appendix C).

If there are significant impacts to minority or low-income populations, it is then necessary to look at mitigative measures and benefits. Any mitigation measures that could be taken to reduce the impact should be considered. To the extent practicable, mitigation measures should also reflect the needs and preferences of the affected minority or low-income populations. The environmental review should also discuss benefits of the project to the surrounding communities, including economic benefits (NRC, 2003, Appendix C).

The resulting environmental justice review should indicate whether there is a disproportionately high and adverse human health or environmental impact that is likely to result from the proposed action and if there are any alternatives. It should also indicate any mitigation measures that could be used to reduce this impact and any benefits of the project to the surrounding community. In this way, the final decision makers can weigh all aspects when making the agency decision (NRC, 2003, Appendix C).

6.1.2 Identifying Minority and Low-Income Populations in the Four Geographic Uranium Milling Regions Considered in This GEIS

Demographic and socioeconomic information from the 2000 Census is presented in detail in Sections 3.2.10 (Wyoming West), 3.3.10 (Wyoming East), 3.4.10 (Nebraska-South Dakota-Wyoming), and 3.5.10 (Northwestern New Mexico) for the four geographic regions considered in this GEIS. Minority and low-income populations within the regions were identified using the criteria in NRC guidance (NRC, 2004, 2003) by comparing community demographics to the state level (Table 6.1-1). The distances provided in Table 6.1-1 are given from the border of an identified population (e.g., a reservation boundary) to the nearest existing or potential ISL facility as well as to the farthest ISL facility, based on current information (NRC, 2008).

In the Wyoming West Uranium Milling Region, the only sensitive population identified using the criterion from NRC (2004, 2003) is the Wind River Indian Reservation (Figure 6.1-2). The boundary of the Wind River Indian Reservation is 16 km [10 mi] from the closest potential ISL facility and about 107 km [65 mi] from the farthest potential facility. The reservation has a Native American population of about 35 percent (Eastern Shoshone and Northern Arapaho). This compares to the Wyoming state level of 2.3 percent. The towns of Arapahoe, Ethete, and Fort Washakie are located within the reservation and have both minority (80 percent or more Native American) and low-income populations. The closest potential ISL facility would be about 24 km [15 mi] to the southeast of Araphaoe at Sand Draw.

Table 6.1-1. Minority and Low-Income Populations* in the Four Geographic Uranium Milling Regions Considered in This Generic Environmental Impact Statement				
Uranium Milling Region	**Affected Area Within Region of Influence**	**Distance (Range) of Project Locations to Affected Area**	**Minority Population**	**Low-Income Population?**
West Wyoming	Wind River Indian Reservation (Towns of Arapahoe, Ethete, and Fort Washakie)	16-105 km (10–65 mi)	Native American (Eastern Shoshone and Northern Arapaho Tribes)	Yes
East Wyoming	Albany County	8-161 km (5–100 mi)	None	Yes
Nebraska-South Dakota-Wyoming	Pine Ridge Indian Reservation (Towns of Oglala and Pine Ridge)	32-161 km (20–100 mi)	Native American (Oglala Sioux Tribe)	Yes
Northwestern New Mexico	Cibola County	0-43 km (0–27 mi)	Native American and Hispanic Origin	Yes
	McKinley County	0-5 km (0–3 mi)	Native American	Yes
	City of Gallup	29-101 km (18–63 mi)	Native American and Hispanic Origin	Yes
	Town of Grants	16-85 km (10–53 mi)	Some Other Race and Hispanic Origin	Yes
	Acoma Pueblo (Cibola County)	21-92 km (13–57 mi)	Native American (Acoma)	Yes
	Laguna Pueblo (Bernanillo, Cibola, Sandoval, Valencia Counties)	27-97 km (17–60 mi)	Native American (Laguna)	Yes
	Navajo Nation (Cibola and McKinley Counties)	2-74 km (1–46 mi)	Native American (Navajo)	Yes
	Ramah Navajo Indian Reservation (Cibola and McKinley Counties)	37-64 km (23–40 mi)	Native American (Ramah Navajo)	Yes
	Tohajiilee Indian Reservation (Cibola and Sandoval Counties)	45-129 km (28–80 mi)	Native American (Tohajiilee)	Yes
	Zuni Indian Reservation (Cibola and McKinley Counties)	37-80 km (23–50 mi)	Native American (Zuni)	Yes

*Based on U.S. Census Bureau. "American FactFinder." 2000. <http://factfinder.census.gov/home/saff/main.html?_lang=en> (18 October 2007 and 25 February 2008).

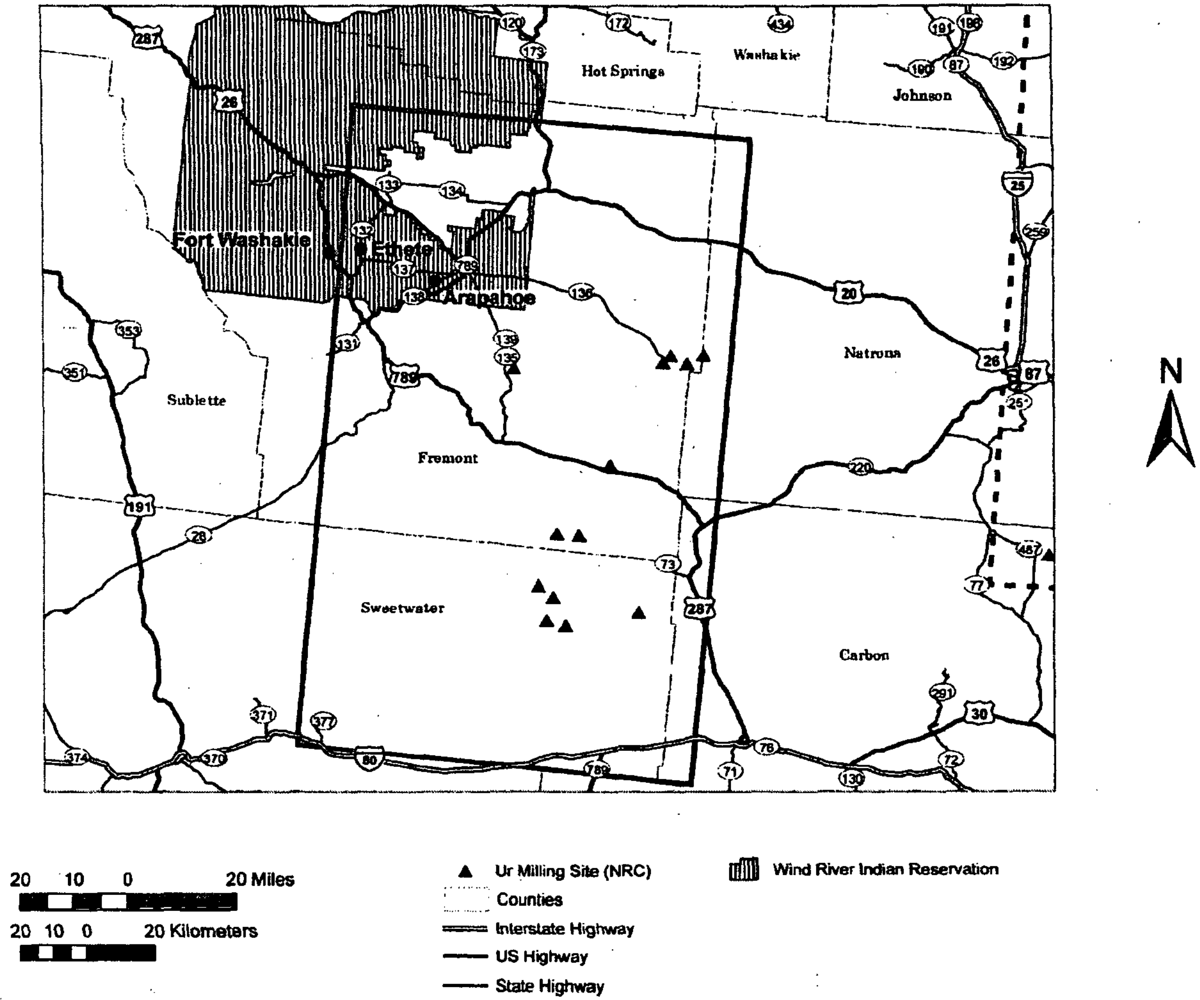

Figure 6.1-2. Affected Minority and Low-Income Population for the Wyoming West Uranium Milling Region

In the Wyoming East Uranium Milling Region, no minority populations were identified using 2000 Census data and the criteria from NRC (2004, 2003), but Albany County was identified as a low-income population (Figure 6.1-3). Albany County is about 8 km [5 mi] from the closest Wyoming East Uranium Milling Region. Northern Albany County is predominantly rural (see Section 3.3.1), with no population centers or towns identified by the U.S. Census Bureau within the portion of the county that lies within the Wyoming East Uranium Milling Region.

In the Nebraska-South Dakota-Wyoming Uranium Milling Region, the closest sensitive population identified using criteria from NRC (2004, 2003) is the Pine Ridge Indian Reservation, adjacent to the southeastern boundary of the region (Figure 6.1-4). The Pine Ridge Indian Reservation is 48 km [30 mi] from the closest existing and potential ISL facilities at Crow Butte in Dawes County, Nebraska, and about 160 km [100 mi] from the farthest potential facility in Crook County, Wyoming. Communities within the Pine Ridge Indian Reservation include the towns of Oglala and Pine Ridge. Based on U.S. Census Bureau information, these towns have both minority (greater than 90 percent Native American) and low-income populations. They are a little over 75 km [47 mi] from the nearest existing ISL facility at Crow Butte.

In the Northwestern New Mexico Uranium Milling Region (Figure 6.1-5), the potential sensitive minority and low-income populations include the following:

Acoma Indian Reservation

The Acoma Indian Reservation is 21 km [13 mi] from the nearest potential ISL facility and approximately 92 km [57 mi] from the farthest potential known facility. A portion of the Acoma Indian Reservation lies within eastern Cibola County.

Tohajiilee Indian Reservation

The Tohajiilee Indian Reservation is about 45 km [28 mi] from the closest potential ISL facility and approximately 129 km [80 mi] from the farthest potential ISL facility.

Laguna Indian Reservation

The Laguna Indian Reservation is 27 km [17 mi] from the closet potential ISL facility and 97 km [60 mi] from the farthest ISL facility. The majority of the Tohajiilee and Laguna Indian Reservations lie within eastern Cibola County with small portions within Sandoval, Bernalillo, and Valencia Counties.

Navajo Nation

The Navajo Nation represents the largest tribal area and is located approximately 1.6 km [1 mi] from the closest potential ISL facility and 74 km [46 mi] from the farthest known potential ISL facility. A portion of the Navajo Nation lies within McKinley County in the northwestern portion of the Northwestern New Mexico Uranium Milling Region.

Ramah Navajo Nation

The Ramah Navajo Nation is 37 km [23 mi] from the nearest potential ISL facility and 64 km [40 mi] from the farthest potential ISL facility. The majority of the Ramah Navajo Nation lies within western Cibola County.

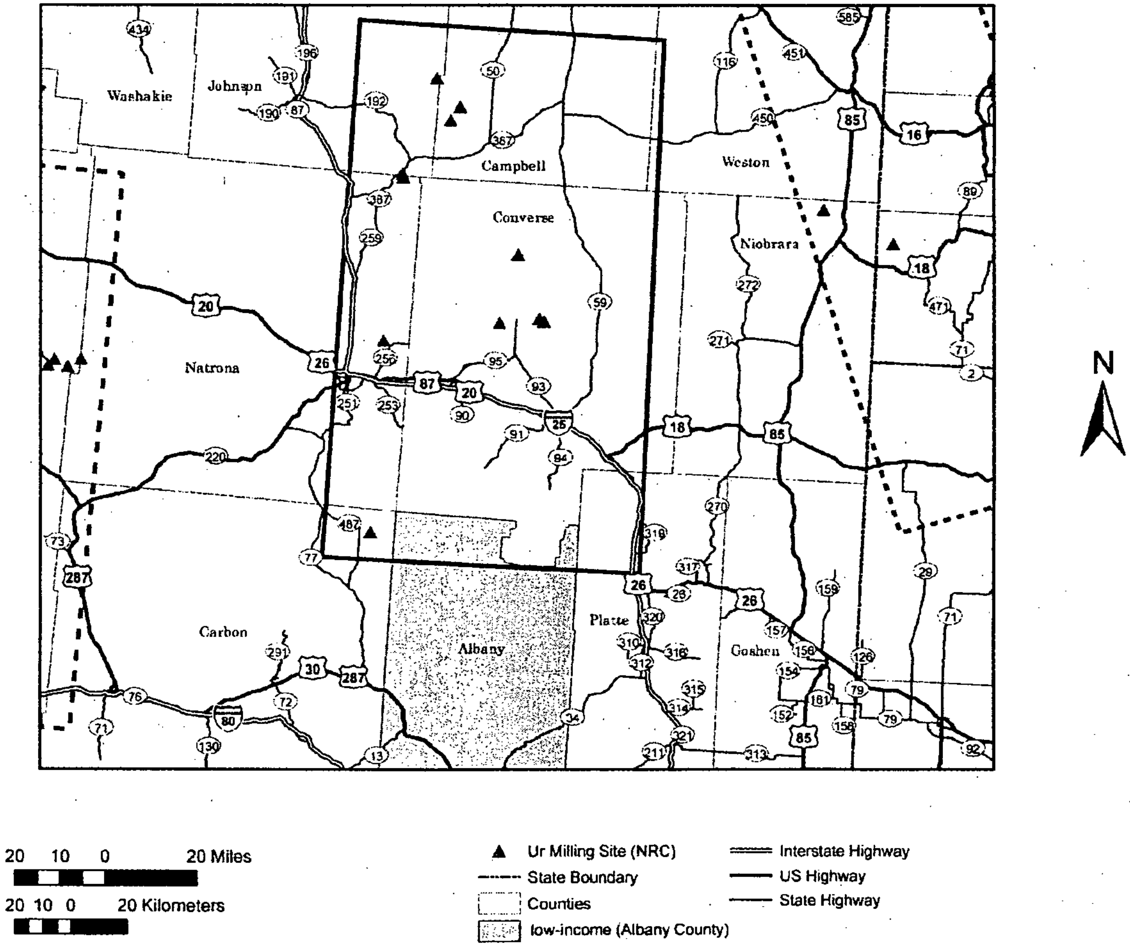

Figure 6.1-3. Affected Minority and Low-Income Population for the Wyoming East Uranium Milling Region (No Minority Populations Were Identified)

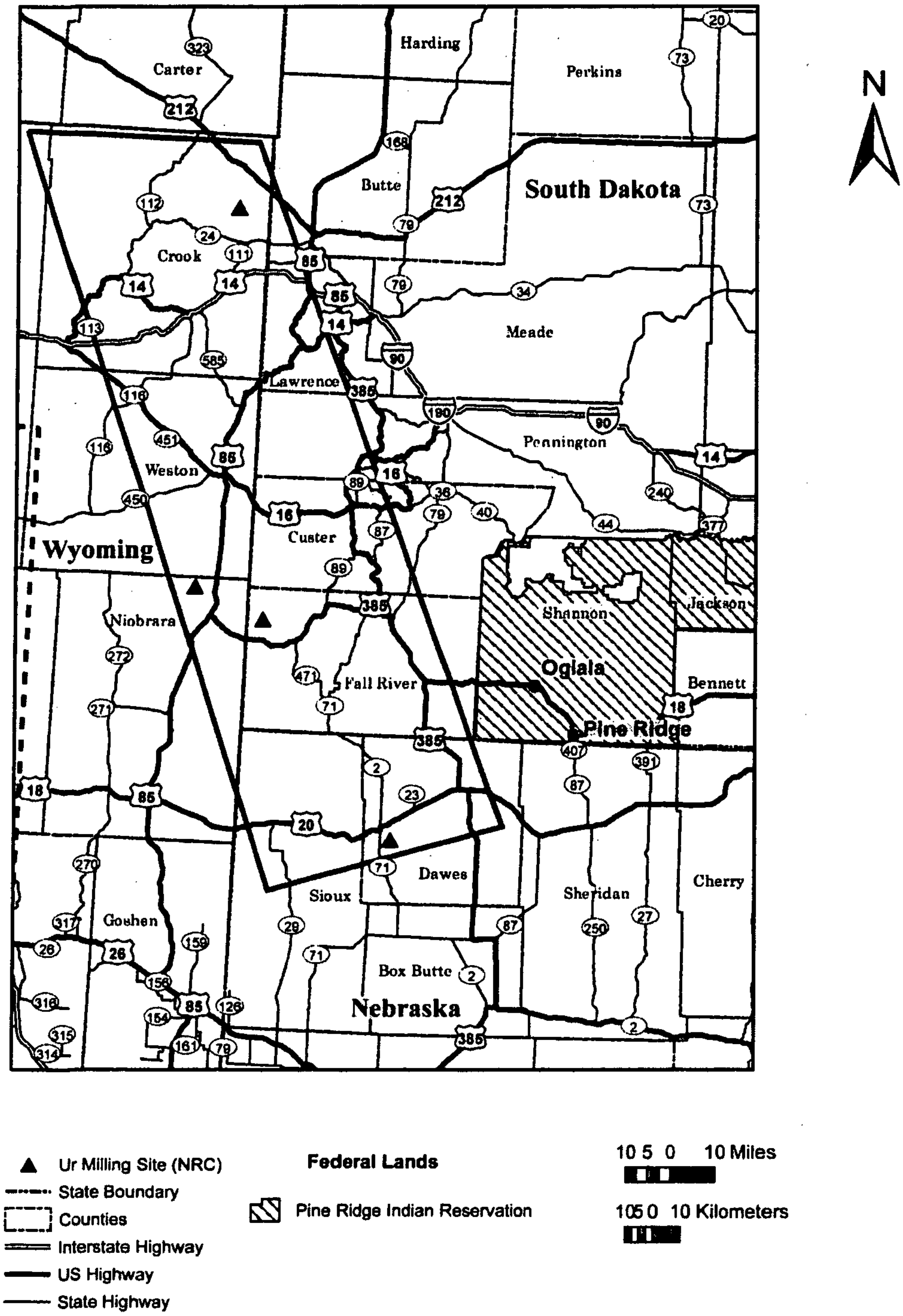

Figure 6.1-4. Affected Minority and Low-Income Population for the Nebraska-South Dakota-Wyoming Uranium Milling Region

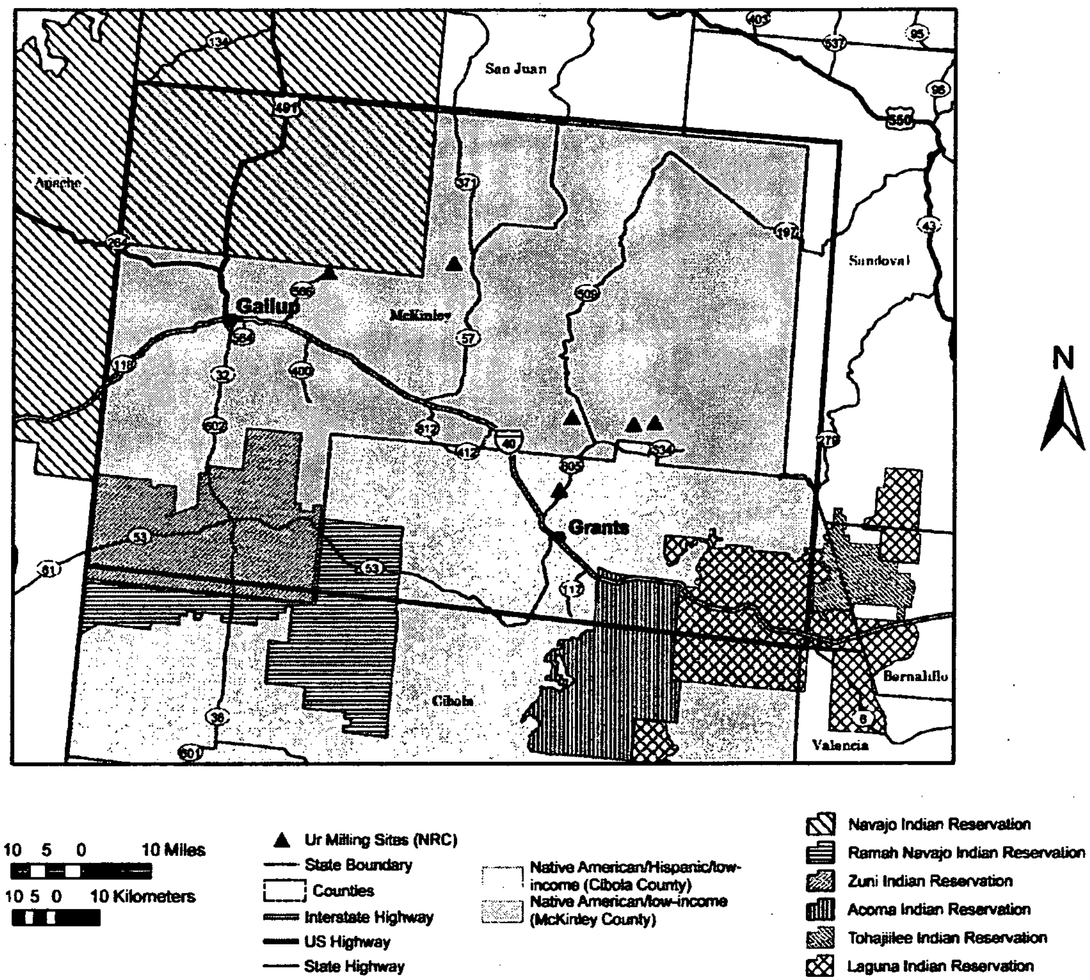

Figure 6.1-5. Affected Minority and Low-Income Populations for the Northwestern New Mexico Uranium Milling Region

Zuni Indian Reservation

The Zuni Indian Reservation is 37 km [23 mi] from the nearest potential ISL facility and 80 km [50 mi] from the farthest potential ISL facility. The majority of the Zuni Indian Reservation lies within southwest McKinley County.

Each of these six tribal areas has a Native American population of greater than 95 percent (compared to the state level of 9.5 percent) and is classified as a low-income population based on 2000 Census information. Where reported, unemployment levels on the reservations are greater than 60 percent (Laguna, Navajo, and Zuni).

Town of Grants

The Town of Grants, located in Cibola County, is about 16 km [10 mi] from the closest potential ISL facility and 85 km [53 mi] from the farthest potential ISL facility. Grants has Hispanic population of greater than 50 percent.

Sandoval County

A small portion of Sandoval County is included within the eastern border of the Northwestern New Mexico Uranium Milling Region. The southwestern border of Sandoval County is about 37 km [23 mi] from the closest potential ISL facility and 108 km [67 mi] from the furthest ISL facility. The total population of the county is 29.4 percent Hispanic and 16.3 percent Native American. However, the southwestern portion of the county that is nearest to the Grant's Uranium Milling District is expected to have a lower percentage of Native American population than the county as a whole.

McKinley County

McKinley County includes most of the potential ISL facilities identified to date (NRC, 2008) and has a Native American population of almost 75 percent, as compared to the state level of 9.5 percent. McKinley County contains portions of three of the reservations identified in Table 6.1-1. These comprise approximately 35 percent of the area in the county. The percentage of individuals below poverty level in McKinley County (36 percent) and Gallup (21 percent) also identify low-income populations. The Core-Based Statistical Area of Gallup is located 29 km [18 mi] from the nearest potential ISL facility and 101 km [63 mi] from the farthest potential ISL facility. It is located in McKinley County, but outside of the tribal lands.

Cibola County

With the exception of the Navajo Nation, Cibola County contains portions of all of the tribal reservations identified in Table 6.1-1, and they comprise almost 50 percent of the county by area. Cibola County has a Native American population of greater than 40 percent, and the percentage of individuals living below the poverty level in Cibola County (25 percent) and Grants (21.9 percent) indicates low-income populations.

The socioeconomic information from the 2000 Census indicates that all of the existing or potential ISL facilities are located in areas of low income. The census data for the Wyoming East Uranium Milling Region did not identify a minority population. The other milling regions used for this analysis identified Native American or Hispanic populations may be impacted if an individual ISL facility is located in their proximate area.

6.2 Wyoming West Uranium Milling Region

The affected minority and low-income populations for the Wyoming West Uranium Milling Region are in the Wind River Indian Reservation and the towns of Ethete, Arapahoe, and Fort Washakie (see Figure 6.1-2). The closest potential ISL facility to the Wind River Indian Reservation is at least 16 km [10 mi] away. Based on current information, the tribal populations on the Wind River Indian Reservation could be located within a 80 km [50 mi] radius of potential ISL facilities and could raise specific environmental justice concerns. The low-income population in the area also triggers an environmental justice analysis for existing and potential facilities located in this area.

General cultural information indicates tribal populations in the Great Plains still use hunting and wild plant gathering, to a limited extent, to supplement family food resources that today are derived primarily from tribal and federal assistance programs or wage labor on and off the reservation. In addition, herbs gathered for subsistence, medicinal, and ritual/ ceremonial uses remain important to maintaining traditional cultural practices. Traditional use areas claimed by the tribes are places in which traditional subsistence practices and the procurement of animals and plants for ritual, ceremonial, medicinal, and other traditional needs should be accessed on a site-specific basis. Disruption in the availability of or access to areas in which traditional subsistence and ritual/ceremonial practices can be performed should be considered as having the potential to differentially affect the ability of the tribes in this region to practice their traditional lifeways. No culturally significant places listed in the National Register of Historic Places or the state register are located in the Wyoming West Uranium Milling Region (see Section 4.2.8).

NRC concludes that environmental reviews for ISL facilities located in the Wyoming West Uranium Milling Region would need an environmental justice analysis based on this demographic data. Using current available information, NRC has concluded there are no known cultural factors that would change the Chapters 4 and 5 analyses and conclusions of the potential environmental or health impacts from ISL facility activities for tribal or low-income populations compared to the general population for the following resource areas: land use, transportation, geology and soils, meteorology/climate/air quality, noise, visual/scenic resources, and socioeconomic in the Wyoming West Uranium Milling Region.

NRC also concludes that site-specific information is needed to complete the environmental justice analysis in the following resource areas: water resources, historic and cultural resources, ecological resources, and public and occupational health. Site-specific cultural information should be used to evaluate whether the analyses and conclusions in Chapters 4 and 5 should be supplemented before determining whether the minority or low-income populations in the area would receive a disproportionately high and adverse environmental or health impact from the ISL facility activities.

For further site-specific analyses, staff will consider, among other things:

- Subsistence—In areas where there is a significant consumption of native plants and animals, a subsistence consumption analysis of fish, wildlife, and other natural resources should be done to evaluate the estimated "dose" discussed in the occupational and public health sections.

- Cultural—site-specific historic and cultural information should be gathered because of the proximity of tribal populations.

NRC will continue to examine potential environmental justice considerations that may be identified as part of the public comment period on this GEIS or during consultations with Native American and other affected communities within the Wyoming West Uranium Milling Region. The NRC staff would conduct an environmental justice analysis based on the methodologies in the appropriate NRC guidance for site-specific environmental reviews.

6.3 Wyoming East Uranium Milling Region

No minority populations were identified in the Wyoming East Uranium Milling Region using 2000 Census data and the criteria from NRC (2004, 2003). Albany County was identified as a low-income population (Figure 6.1-3). At its closest point, Albany County would be about 8 km [5 mi] from the closest potential ISL facility at Shirley Basin. However, northern Albany County is predominantly rural (see Section 3.3.1) with no population centers or towns identified by the U.S. Census Bureau within the portion of the county that lies within the Wyoming East Uranium Milling Region. For this reason, no environmental justice considerations would be expected for the portion of Albany County that is located within the Wyoming East Uranium Milling Region.

NRC concludes that for ISL facilities located in the Wyoming East Uranium Milling Region, no minority and low-income population will experience a disproportionately high and adverse impact. However, NRC would review environmental justice on a site-specific basis to confirm the GEIS conclusion remains valid. Based on NRC's information, the area in northern Albany County that is nearest potential ISL facilities is sparsely populated. There are no known cultural factors that would change the Chapters 4 and 5 analyses and conclusions of the potential environmental or health impacts from ISL facility activities on this low-income population compared to the general population in this region.

6.4 Nebraska-South Dakota-Wyoming Uranium Milling Region

As identified in Table 6.1-1, the closest affected minority and low-income population for the Nebraska-South Dakota-Wyoming Uranium Milling Region is the Pine Ridge Indian Reservation and the towns of Oglala and Pine Ridge in South Dakota (Figure 6.1-4). The Pine Ridge Indian Reservation is 48 km [30 mi] from the closest existing, and potential, ISL facilities at Crow Butte in Dawes County, Nebraska. Based on current information, the tribal populations on the Pine Ridge Indian Reservation could be located within a 80 km [50 mi] radius of potential ISL facilities and could raise specific environmental justice concerns. The low-income population in the area also triggers an environmental justice analysis for existing and potential facilities located in this area.

General cultural information indicates tribal populations in the Great Plains still use hunting and wild plant gathering, to a limited extent, to supplement family food resources that today are derived primarily from tribal and federal assistance programs or wage labor on and off the reservation. In addition, herbs gathered for subsistence, medicinal, and ritual/ ceremonial uses remain important to maintaining traditional cultural practices. Traditional use areas claimed by the tribes are places in which traditional subsistence practices and the procurement of animals and plants for ritual, ceremonial, medicinal, and other traditional needs should be assessed on a site-specific basis. Disruption in the availability of, or access to, areas in which traditional subsistence and ritual/ceremonial practices can be performed should be considered as having the potential to differentially affect the ability of the tribes in this region to practice their traditional lifeways.

Historically, the land of Black Hills is seen by tribes in Montana, Wyoming, and South Dakota to have provided both sustenance (for fishing, hunting, and plant food gathering) and spiritual value (i.e., as a place in which important personal and tribal rituals and ceremonies were customarily performed and are still performed today). Devils Tower, or Bear Lodge as it is known to many of the tribes in the region, is located in northeastern Wyoming at the western fringe of the Black Hills in the Nebraska-South Dakota-Wyoming Uranium Milling Region. It is the site of annual ritual and ceremonial events by tribal members in the month of June. Native American tribes in the region believe that preserving and maintaining access to sacred lands is essential to both cultural and spiritual aspects of traditional Native American societies of the northern plains (Iverson, 1985). The cultural significance of these areas should also be considered during the environmental justice analysis for licensing applications in this region.

In addition, availability of affordable housing with water, electricity, plumbing, and sewer service is a concern at the Pine Ridge Indian Reservation in Shannon County, South Dakota (Housing Assistance Council, 2002; Steele, 2007). Inadequate availability of housing may be a concern with regard to overcrowding and should be evaluated in the environmental justice analysis for the socioeconomic resource area.

NRC concludes that environmental reviews for ISL facilities located in the Nebraska-South Dakota-Wyoming Uranium Milling Region would need an environmental justice analysis based on this demographic data. Using current available information, NRC has concluded there are no known cultural factors that would change the Chapters 4 and 5 analyses or conclusions of the potential environmental or health impacts from ISL facility activities for tribal or low-income populations compared to the general population for the following resource areas in the Nebraska-South Dakota-Wyoming Uranium Milling Region: land use, transportation, geology and soils, meteorology/climate/air quality, noise, and visual/scenic resources.

NRC also concludes that site-specific information is needed to complete the environmental justice analysis in the following resource areas: water resources, historic and cultural resources, ecological resources, public and occupational health, socioeconomics, and visual/scenic resources. Site-specific cultural information should be used to evaluate whether the analysis and conclusions in Chapters 4 and 5 should be supplemented before determining whether the minority or low-income populations in the area would receive a disproportionately high and adverse environmental or health impact from the ISL facility activities.

For further site-specific analyses, staff would consider, among other things:

- Subsistence—In areas where there is a significant consumption of native plants and animals, a subsistence consumption analysis of fish, wildlife, and other natural resources should be conducted to evaluate the estimated "dose" discussed in the occupational and public health sections.

- Cultural—site-specific historic and cultural information should be gathered because of the proximity of tribal populations.

NRC would continue to examine potential environmental justice considerations that may be identified as part of the public comment period on this GEIS or during consultations with Native American and other affected communities within the Nebraska-South Dakota-Wyoming Uranium Milling Region. The NRC staff would conduct an environmental justice analysis based on the methodologies in the appropriate NRC guidance for site-specific environmental reviews.

6.5 Northwestern New Mexico Uranium Milling Region

Based on 2000 Census information and the NRC environmental justice criteria (NRC, 2004, 2003), affected minority and/or low-income populations for the Northwestern New Mexico Uranium Milling Region include Acoma Pueblo, Laguna Pueblo, the Navajo Nation, the Ramah Navajo Indian Reservation, the Tohajiilee Indian Reservation, and the Zuni Indian Reservation (Figure 6.1-4). In addition, minority and low-income populations are identified for Cibola County, McKinley County, the Gallup Core-Based Statistical Area, and the town of Grants. The affected communities are located throughout the region and are close to potential ISL facilities, based on current information. For example, at least one potential facility would be located within about 1.6 km [1 mi] of the border of the Navajo Nation (Figure 6.1-4) and another would be located near the community of Crownpoint. The location of minority and low-income populations triggers an environmental justice analysis for existing and potential facilities located in this area.

In particular, sensitive communities in proximity to a potential ISL facility would also receive potentially disproportionately high and adverse impacts with regard to water resources in the Northwestern New Mexico Uranium Milling Region. As described in Section 3.5.4, these impacts could include: (1) sedimentation in surface waters, (2) degradation of water quality in the ore-bearing aquifer, (3) degradation of groundwater quality near well fields if lixiviant unexpectedly travels from the production zone and beyond the boundaries of the well field, and (4) vertical excursions where barren or pregnant lixiviant migrates into other aquifers above or below the production zone. As described in Section 4.5.4 and Chapters 7 and 8, licensees are required to obtain underground injection control permits and implement monitoring programs and remediation actions to mitigate these potential impacts. In addition, aquifer restoration upon completion of uranium recovery is designed to reduce potential impacts to groundwater quality and use. Site-specific analysis of environmental justice concerns with respect to sensitive communities would be necessary for individual license applications. These site-specific environmental reviews would include consultations with local communities or jurisdictions to evaluate key concerns with respect to water resources.

Land use impacts could result in environmental justice considerations if a potential ISL facility is located near tribal lands or abuts private lands, allottees, or residences, particularly in the checkerboard region where land ownership is complicated. As described in Section 4.5.1, impacts from all phases could: (1) change and disturb land uses, (2) restrict access and/or establish right-of-way for access, (3) affect mineral rights and land use by allottees and others, (4) restrict livestock grazing areas and revoke grazing permits, (5) restrict recreational activities, and (6) alter ecological, cultural, and historical resources. Site-specific analysis of environmental justice concerns for sensitive communities would be necessary for individual license applications. These site-specific environmental reviews would include consultations with local communities or jurisdictions to evaluate key land ownership and jurisdictional issues.

Because of the large area covered by tribal lands in the Northwestern New Mexico Uranium Milling Region, there may be disproportionately high and adverse affects related to historical, cultural, and visual resources. As described in Section 3.5.8, there are a large number of cultural and historical sites in the Northwestern New Mexico Uranium Milling Region that could be affected by land-disturbing activities, such as grading roads, installing wells, and constructing surface facilities and well field infrastructure. Impacts to a community's historical and cultural resources may also occur if activities at an ISL facility prevent or limit access to a culturally significant site or affect the visual landscape. The Mt. Taylor Traditional Cultural Property listing in February 2008 is one example of a culturally significant area that would need to be evaluated for disproportionate potential impacts. As described in Section 4.5.8, site-specific analysis of environmental justice concerns with respect to cultural resources and sensitive communities would be necessary for individual license applications. These site-specific environmental reviews would include consultations with local communities or jurisdictions to evaluate key concerns with respect to water resources.

Western Puebloan Tribes (Acoma and Zuni)

The Acoma and Zuni foster and encourage the continuance of traditional subsistence practices including agriculture and, to a limited extent, herding (Garcia-Mason, 1979; Ladd, 1979). The Acoma and Zuni traditionally reside in clustered settlements or villages. Both tribes view game hunting and the gathering of wild plant foods and herbs for subsistence, medicinal, and ritual/ceremonial uses as central to their traditional cultural practices (Dozier, 1970; Dutton, 1976; Green, 1979; Ladd, 1979).

Traditional agricultural practices in the arid Southwest rely on the availability of arable land with access to reliable sources of water from rainfall and runoff at Zuni and from irrigation at Acoma (Dozier, 1970; Garcia-Mason, 1979). Summer precipitation in the arid upland Southwest is characterized by high spatial and temporal variability. As a result, successful traditional agricultural practice distributes fields in a variety of areas where rainfall, runoff, and other techniques help to maximize the potential for sufficient rainfall to occur at least one of the fields. Traditional hunting and gathering of wild plant food resources also contribute to annual subsistence to a limited extent. Farming, hunting, and gathering are used to supplement store-bought food items purchased with funds obtained through tribal and federal assistance programs, by working for federal and tribal governments on the reservation, or from wage labor away from the reservation.

Because of Acoma and Zuni reliance on traditional forms of agriculture and hunting and gathering of wild foods to supplement their food resources, disruption in the availability and access to areas in which these traditional subsistence practices can be performed, or disruptions in the ability to gather animal and plant foods, should be considered as having the potential to differentially affect the ability of the Acoma and Zuni tribal members to practice traditional lifeways. In addition, specific types of plants and animals are obtained for use in ritual and ceremonial and, in the case of plants, medicinal contexts. Restriction of access to the places in which these resources might be obtained or in which they have traditionally been obtained should also be considered as a differentially adverse effect to the practice of traditional Acoma and Zuni lifeways.

Navajo Tribe

Traditional Navajo subsistence relies on a mix of small agricultural fields and herding of sheep and goats (Kluckhohn and Leighton, 1974; Bailey and Bailey,1986). The traditional Navajo settlement pattern is characterized by extended family household clusters, traditionally termed and outfitted (Kluckhohn and Leighton, 1974), that reside in proximity to one another. Several such related households are often spatially dispersed across the landscape. In traditional

Navajo practice, agricultural fields are tended by individual households, whereas sheep and goats from related households are combined into larger flocks that graze over wide areas of open range belonging to the combined related households (Downs, 1964; Witherspoon, 1983; Bailey and Bailey, 1986). Goats and sheep, in addition to supplying meat and milk for consumption, also provide wool and mohair for sale and for use in making traditional textiles that are then sold to supplement family income (Adams, 1971; Aberle, 1983). Traditional households often maintain one or more horses and occasionally cattle as well. The horses and cattle are often grazed on the open range wherever sufficient forage is available. Subsistence farming, sheep and goat grazing, and to a far more limited extent, hunting and wild plant gathering, are used to supplement family food resources obtained through tribal and federal assistance programs or wage labor on and off the reservation (Aberle, 1983; Bailey and Bailey, 1986).

Like the Zuni and Acoma tribes, disruption in the availability of or access to areas in which traditional subsistence practices can be performed should be considered as having the potential to differentially affect the ability of the Navajo to practice traditional lifeways. Animals are hunted and plants are gathered for non-subsistence use as well. Both animals and plants are used for traditional ritual, ceremonial, medicinal, and other needs. Restriction of access to the places in which these resources might be obtained or in which they have traditionally been obtained should also be considered as a differentially adverse effect to the practice of traditional Navajo lifeways.

NRC concludes that environmental reviews for ISL facilities located in the Northwestern New Mexico Uranium Milling Region would need an environmental justice analysis based on this demographic data. Using current available information, NRC has concluded there are no known cultural factors that would change the Chapters 4 and 5 analyses or conclusions of the potential environmental or health impacts from ISL facility activities for tribal or low-income populations compared to the general population for the following resource areas in the Northwestern New Mexico Uranium Milling Region: transportation, meteorology/climate/air quality, noise, or socioeconomic.

NRC also concludes that site-specific information is needed to complete the environmental justice analysis in the following resource areas: water resources, historic and cultural resources, ecological resources, public and occupational health, visual/scenic resources, and land use. Site-specific cultural information should be used to evaluate whether the analyses and conclusions in Chapters 4 and 5 should be revised before determining whether the minority or low-income populations in the area would receive a disproportionately high and adverse environmental or health impact from the ISL facility activities.

For further site-specific analyses, staff woul consider, among other things:

- Subsistence—In areas where there is a significant consumption of native plants and animals, a subsistence consumption analysis of fish, wildlife, and other natural resources should be done to evaluate the estimated "dose" discussed in the occupational and public health sections.

- Cultural—site-specific historic and cultural information should be gathered because of the proximity of tribal populations.

6.6 Summary

Based on 2000 Census information and criteria from NRC guidance (NRC, 2004, 2003), a number of sensitive populations were identified (Table 6.1-1). NRC concludes potential environmental justice concerns were raised in three of the identified uranium milling regions. All of the identified milling regions are located in low-income areas. Environmental reviews for ISL facilities located in the Wyoming East Uranium Milling Region do not need an environmental justice analysis, because demographic data failed to identify a minority or low-income population that has the potential to receive disproportionately high and adverse environmental or health impacts compared to the general population in the area. Minority populations and tribal lands were identified in: (1) the Wyoming West, (2) the Northwestern New Mexico, and (3) the Nebraska-South Dakota-Wyoming Uranium Milling Regions. This situation triggers NRC's obligation to conduct an environmental justice analysis in these three regions.

While the GEIS does not identify impacts that are disproportionately high and adverse for a minority or low-income area, it does identify resource areas that could raise environmental justice concerns and note where site-specific information is needed to complete the environmental justice analysis. For example, resource areas are identified where there are no known cultural factors that would change the Chapters 4 and 5 analyses or conclusions of the potential environmental or health impacts from ISL facility activities for tribal or low-income populations compared to the general population for specific resource areas in each region.

Other regional resource areas were identified that need site-specific information to evaluate whether the analyses and conclusions in Chapters 4 and 5 should be revised when determining whether the minority or low-income populations in the area would receive a disproportionately high and adverse environmental or health impact from the ISL facility activities. In those cases, the revised impact analysis would be used in the environmental justice analysis to determine whether there is a disproportionately high and adverse environmental or health impact on these minority or low-income populations.

NRC continues to examine potential environmental justice issues that may arise during the public comment period on this draft GEIS or during consultations with Native American and other affected communities within all four regions.

6.7 References

Adams, W.Y. "Navajo Ecology and Economy: A Problem in Cultural Values". In *Apachean Culture History and Ethnology*, edited by K. Basso and M. Opler, pp. 77–81. Anthropological Papers of the University of Arizona Number 21, Tucson Arizona: University of Arizona Press. 1971.

Aberle, D.F. "Navajo Economic Development." In, *Handbook of North American Indians, Volume 10, Southwest*, edited by Alfonso Ortiz. Washington DC: Smithsonian Institution. 1983. pp. 641–658.

Bailey, G. and R.G. Bailey. *A History of the Navajos: The Reservation Years*. Santa Fe, New Mexico: School of American Research Press. 1986.

CEQ. "Environmental Justice Guidance Under the National Environmental Policy Act." Washington, DC: CEQ. December 1997.

Downs, J.F. *The Navajo*. New York: Holt, Rinehart, and Winston. 1971.

Downs, James F. "Animal Husbandry in Navajo Society and Culture." *University of California Publications in Anthropology, Volume 1.* Berkeley, California: University of California Press. 1964.

Dozier, E.P. *The Pueblo Indians of North America.* Prospect Heights, Illinois: Waveland Press. 1970.

Dutton, B.P. *The Pueblos.* Englewood Cliffs, New Jersey: Prentice-Hall. 1976.

EPA. "Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses." Washington, DC: EPA. April 1998.

Garcia-Mason, V. "Acoma Pueblo". *Handbook of North American Indians, Volume 9, Southwest*, edited by Alfonso Ortiz. Washington DC: Smithsonian Institution. 1979. pp. 450–466.

Green, J. (editor). *Zuni: Selected Writings of Frank Hamilton Cushing.* Lincoln, Nebraska: University of Nebraska Press. 1979.

Housing Assistance Council. "Taking Stock: Rural People, Poverty, and Housing at the Turn of the 21st Century." Washington, DC: Housing Assistance Council. December, 2002.

Kluckhohn, C. and D. Leighton. *The Navajo.* Revised edition. Cambridge, Massachusetts: Harvard University Press. 1974.

Ladd, E.J. "Zuni Economy." In *Handbook of North American Indians, Volume 9, Southwest*, edited by Alfonso Ortiz. Washington DC: Smithsonian Institution. 1980. pp. 492–498.

NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 1/24/2008." 2008. <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public-012408.pdf> (08 February 2008).

NRC. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register* 69. pp. 52040–52048. August 24, 2004.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Final Report. Washington, DC: NRC. August 2003.

NRC. NUREG–1508, "Final Environmental Impact Statement to Construct and Operate the Crown Point Uranium Solution Mining Project, Crown Point, New Mexico." Washington, DC: NRC. February 1997.

Office of the President. "Executive Order 12898 on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations With Accompanying Memorandum." Washington, DC: Office of the President. February 11, 1994.

Steele, J.Y.B. "Testimony of the Honorable John Yellow Bird Steele, President of the Oglala Sioux Tribe, Oversight Hearing on Indian Housing Before the Senate Committee on Indian Affairs, March 22, 2007." Washington, DC: U.S. Senate. March 2007.

U.S. Census Bureau. "American FactFinder." 2000. <http://factfinder.census.gov/home/saff/main.html?_lang=en> (18 October 2007 and 25 February 2008).

Witherspoon, G. "Navajo Social Organization". In, *Handbook of North American Indians, Volume 10, Southwest*, edited by Alfonso Ortiz. Washington DC: Smithsonian Institution. pp. 524–535. 1983.

7 POTENTIAL BEST MANAGEMENT PRACTICES, MITIGATION MEASURES, AND MANAGEMENT ACTIONS TO MITIGATE ADVERSE ENVIRONMENTAL IMPACTS

7.1 Introduction

This chapter describes potential best management practices, mitigation measures, and management actions that a licensee or facility operator might use to reduce potential adverse impacts associated with construction, operation, aquifer restoration, and decommissioning of an *in-situ* leach (ISL) milling facility. The Council on Environmental Quality (CEQ) defines mitigation as (40 CFR 1508.20):

- Avoiding the impact altogether by not taking a certain action or parts of an action.
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments.

Potential mitigation measures can include general best management practices and more site-specific management actions.

How Are Adverse Impacts Mitigated?

Best Management Practices are techniques, methods, processes, activities, or incentives that are more effective at delivering a particular outcome. Best management practices can also be defined as efficient and effective ways of meeting a given objective based on repeatable procedures that have proven themselves over time. Well-designed best management practices combine existing managerial and scientific knowledge with knowledge about the resource being protected. The Wyoming Department of Environmental Quality (WDEQ) defines best practicable technology as "A technology based process determined by WDEQ as justifiable in terms of existing performance and achievability (in relation to health and safety) which minimizes, to the extent safe and practicable, disturbances and adverse impacts of the operation on human or animal life, fish, wildlife, plant life and related environmental values." (WDEQ, 2007).

Management Actions are active measures a licensee or facility operator implements to reduce potential adverse impacts to a specific resource area. These site-specific actions are sometimes related to environmental (or adaptive) management systems (CEQ, 2007).

7.2 Best Management Practices

Best management practices are processes, techniques, procedures, or considerations that can be used to cost-effectively avoid or reduce the potential environmental impacts. While best management practices are not regulatory requirements, they can overlap and support such requirements. Best management practices would not replace any U.S. Nuclear Regulatory Commission (NRC) requirements or other local, state, or federal regulations.

7.3 Management Actions

Management actions are those that the licensee specifically implements to reduce potential adverse impacts. These actions include compliance with applicable government agency stipulations or specific guidance, coordination with government agencies or interested parties, and monitoring of relevant ongoing and future activities. If appropriate, corrective actions could be implemented to limit the degree or magnitude of a specific action leading to an adverse impact (reducing or eliminating the impact over time by preservation and maintenance operations) and repairing, rehabilitating, or restoring the affected environment.

Licensees may also minimize potential adverse impacts through specific management actions. These may be part of a broad, more formalized environmental (or adaptive) management system similar to those described in CEQ (2007), or they may be more focused on a particular impact. In establishing management actions, the licensee should create measurable environmental objectives with measurable goals and targets (for example, pollution prevention goals for reducing waste). The licensee then would implement these programs, procedures, and controls for monitoring and measuring progress; document progress; and, if appropriate, institute corrective actions. These management actions may be established through standard operating procedures that are reviewed and approved by the appropriate local, state, or federal agency (including NRC). NRC may also establish requirements for management actions by identifying license conditions. These conditions are written specifically into the NRC source and byproduct material license and then become commitments that are enforced through periodic NRC inspections.

The management actions should specifically describe how mitigation commitments would be implemented and reflect available information about these actions. In an environmental management system approach, planned mitigation actions can be revised as more specific and detailed information becomes available. Typically, monitoring activities could be conducted during all phases of the project to ensure the mitigation of potential adverse impacts.

7.4 Potential Best Management Practices, Management Actions, and Mitigation Measures

Potential best management practices and mitigation measures that are commonly used to minimize potential adverse impacts are listed in Table 7.4-1. The list is based on historical best management practices and mitigation measures used for existing and planned ISL uranium recovery facilities (NRC, 1997, 1998, 2006a,b; Energy Metals Corporation, U.S., 2007). The list in Table 7.4-1 is not comprehensive and does not imply that NRC endorses these measures. Because the practices, actions, and measures identified in Table 7.4-1 have been developed for a broad geographic area, each practice or mitigation measure described in the table may not apply to a specific project. The list provides a foundation for developing customized management and mitigation plans for a proposed facility or project.

Table 7.4-1. Summary of Potential Best Management Practices and Management Actions	
Environmental Resource	**Potential Best Management Practices and Management Actions**
Land use	• Limit land disturbance to only what is necessary for operation. • Conduct historic and cultural resource surveys prior to land disturbance. • Conduct ecological resource surveys prior to land disturbance. • Reclaim lands disturbed during the construction process. • Decontaminate and decommission facilities. • Reclaim lands disturbed by surface facilities no longer needed. • Plug and abandon wells.
Transportation	• Use dedicated tanker trucks for transporting uranium-loaded and barren resins from satellite facilities. • Use of accepted industry codes and standards for handling and transporting hazardous chemicals. • Maintain shipping records (bill of lading) to identify nature and quantity of shipped materials. • Conduct surveys of truck exterior and cab prior to each shipment of yellowcake or resin. • Establish an emergency response plan for yellowcake spill and other potential transportation accidents. • Implement safe driving and emergency response training for personnel and truck drivers. • Use check-in/check-out or global positioning satellite technology to track shipments. • Install communication systems to connect trucks to shipper/receiver/emergency responders.
Geology and soils	• Use structures to temporarily divert and/or dissipate surface runoff from undisturbed areas around the disturbed areas. • Retain sediment within the disturbed areas by using silt fencing, retention ponds, and hay bales. • Salvage and stockpile topsoil from the central plant facility area and from well field access roads so that wind and/or water erosion can be avoided (e.g., graded stockpiles, temporary vegetative cover, fencing and signs, sedimentation catchments). • Fill pipeline and cable trenches with excavated rock and soil soon after completion and regrade to surrounding topography. • Reestablish temporary or permanent native vegetation as soon as possible after disturbance. • Construct roads to minimize erosion (e.g., surfacing with a gravel road base, construct stream crossings at right angles with adequate embankment protection and culvert installation, and provide adequate road drainage with runoff control structures and revegetation). • Implement a spill prevention and cleanup plan to minimize soil contamination. • Collect and monitor soils and sediments for potential contamination including areas used for land application of treated waste water, transport routes for yellowcake and ion exchange resins, and well field areas where spills or leaks are possible.

Table 7.4-1. Summary of Potential Best Management Practices and Management Actions (continued)	
Environmental Resource	**Potential Best Management Practices and Management Actions**
Surface water	• Follow construction practices to reduce potential impacts as defined by the U.S. Army Corps of Engineers permitting process. • Minimize disturbance of surface areas and vegetation, which would minimize changes in surface-water flow and soil porosity that would change infiltration and runoff rates. • Minimize physical changes to drainage channels by building bridges or culverts where roadways would intersect areas of intermittent water flow. • Use erosion and runoff control features such as proper placement of pipe, grading to direct runoff away from water bodies, and use of riprap at these intersections to make bridges or culverts more effective. • Use sediment-trapping devices such as hay or straw bales, fabric fences, and devices to control water flow and discharge to trap sediments moved by runoff. • Maintain natural contours as much as possible, stabilize slopes, and avoid unnecessary off-road vehicle travel to minimize erosion. • Follow reclamation guidelines in and near floodplains. • Train employees in the handling, storage, distribution, and use of hazardous materials. • Conduct fueling operations and store hazardous materials and other chemicals in bermed areas with proper set back distances from water bodies. • Provide rapid response cleanup and remediation capability, techniques, procedures, and training for potential spills. • Prepare and implement a Storm Water Pollution Prevention Plan consistent with state and federal standards for construction activities. • Implement a spill prevention and cleanup plan to minimize soil contamination. • Conduct land application of treated waste water activities in a manner consistent with local climate, soil, and vegetation conditions to ensure excess irrigation does not run off into surface water.
Groundwater	• Recycle water collected in subsurface areas for use in dust suppression and other activities. • Implement measures to minimize water use during operations. • Minimize surface disturbance, which will minimize changes in surface-water flow and subsequent infiltration. • Implement a spill prevention and cleanup plan to minimize soil contamination. • Provide rapid response cleanup and remediation capability, techniques, procedures, and training for potential spills. • Monitor to detect and define unanticipated surface spills, releases, or similar events that may infiltrate into the groundwater system. • Manage water balance to ensure hydraulic flow into production zone. • Monitor well pressures to detect leaks. • Install monitoring wells in well field and near surface impoundments to monitor for potential lixiviant that travels beyond the production zone or for process solution leaks from impoundments. • Manage pumping and injection to control and recover excursions. • Monitor closest private domestic, livestock, and agricultural wells as appropriate during operations.

Table 7.4-1. Summary of Potential Best Management Practices and Management Actions (continued)

Environmental Resource	Potential Best Management Practices and Management Actions
Ecology	• Use measures to control erosion, dust, and particulates that may affect ecological resources from construction, operation, aquifer restoration, and decommissioning. • Use dust suppression measures to minimize wind and other erosion and aid recovery on disturbed areas. • Conduct pre-construction surveys to evaluate important ecological resources and habitats and to determine the reclamation potential of sites. • Implement measures to relocate or avoid sensitive species. • Minimize groundbreaking or land-clearing activities during the critical nesting period for migratory birds. • Before ground-disturbing activities, collect data to plan to restore disturbed areas and minimize impacts to sensitive habitats. • Phase construction to the extent practicable. • Limit grading activities to the phase immediately under construction, and limit ground disturbance to areas necessary for project-related construction activities. • Revegetate with appropriate native species to minimize potential for invasive species. • Use weed control as necessary.
Air quality	• Reduce fugitive dust emissions using standard dust control measures (e.g., water application, speed limits). • Reduce maximum fugitive dust by coordinating dust-producing activities. • Use fossil-fuel vehicles that meet applicable emission standards.
Noise	• Avoid construction activities during night. • Use sound controls on operating equipment and facilities. • Use personal hearing protection for workers in high noise areas.
Historic and cultural resources	• Consult with appropriate state and tribal historic preservation officers. • Ensure that onsite employees complete cultural resource sensitivity and protection training to reduce the potential for intentional or accidental harm to sites or artifacts. • Conduct pre-construction surveys to ensure that work would not affect important archaeological resources. • Develop additional mitigation measures such as documenting and collecting resources according to a cultural resource management plan if construction threatens important archaeological resources and modification or relocation of facilities and roads is not feasible.
Visual and Scenic	• Use exterior lighting only where needed to accomplish facility tasks. • Limit the height of exterior lighting units. • Use shielded or directional lighting to limit lighting only to areas where it is needed.
Socioeconomics	• Purchase materials from local vendors as appropriate. • Hire local employees and contractors.
Occupational and public health and safety	• Use ventilation to keep radon levels as low as is reasonably achievable. • Use vacuum dryers, bag filters, and vapor filtration to reduce particulate emissions during yellowcake drying. • Use high-efficiency particulate air filters or similar controls for particulates. • Use personal monitoring devices and respirators as appropriate. • Design task procedures to reduce potential accidents.

Table 7.4-1. Summary of Potential Best Management Practices and Management Actions (continued)	
Environmental Resource	**Potential Best Management Practices and Management Actions**
	• Implement health and safety procedures and administrative controls to minimize worker risks during construction and operations.
Waste and hazardous materials	• Recycle wastewater to reduce the amount of water needed for facilities and the amount of wastewater that could require disposal. • Use decontamination techniques that would reduce waste generation. • Institute preventive maintenance and inventory management programs to minimize waste from breakdowns and overstocking. • Recycle nonradioactive materials where appropriate. • Encourage the reuse of materials and use of recycled materials. • Avoid using hazardous materials when possible. • Develop a spill prevention plan for petroleum products and other hazardous materials. • Ensure that equipment is available to respond to spills, and identify the location of such equipment. • Inspect and replace worn or damaged components. • Salvage extra materials and use them for other construction activities or for regrading activities.
Utilities, energy, and materials	• Implement procedures and equipment that would minimize the use of utility services, energy, and materials. • Incorporate high-performance and sustainable building criteria into the design and construction of nonnuclear facilities.

7.5 References

CEQ. "Aligning National Environmental Policy Act Processes With Environmental Management Systems. A Guide for NEPA and EMS Practitioners." Washington, DC: CEQ. April 2007.

Energy Metals Corporation, U.S. "Application for USNRC Source Material License Moore Ranch Uranium Project, Campbell County, Wyoming: Environmental Report." Casper, Wyoming: Energy Metals Corporation, U.S. [ADAMS Accession Number: ML072851249] September 2007.
NRC. "Environmental Assessment for the Addition of the Reynolds Ranch Mining Area to Power Resources, Inc.'s Smith Ranch/Highlands Uranium Project Converse County, Wyoming." Source Material License No. SUA–1548. Docket No. 40-8964. Washington, DC: NRC. November 2006a.

NRC. "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." Source Materials License SUA–56. Docket No. 40-1162. Washington, DC: NRC. August 2006b.

NRC. "Environmental Assessment for Renewal of Source Material License No. SUA–1534. Crow Butte Resources Incorporated Crow Butte Uranium Project Dawes County, Nebraska." Docket No. 40-8943. Washington, DC: NRC. February 1998.

NRC. NUREG–1508, "Final Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico." Washington, DC: NRC. February 1997.

WDEQ. "Guideline No. 4: *In-Situ* Mining." Cheyenne, Wyoming: WDEQ, Land Quality Division. 2007. <http://deq.state.wy.us/lqd/guidelns/Guide4=3-00.pdf> (18 December 2007).

8 ENVIRONMENTAL MONITORING ACTIVITIES

8.1 Introduction

Monitoring programs, in general, are developed for *in-situ* leach (ISL) facilities to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and environment beyond the facility boundary. Worker safety monitoring programs are developed as part of a radiological protection program summarized in Section 2.7. This chapter discusses environmental monitoring programs that address the environment beyond the operational areas.

Monitoring programs provide data on operational and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected. In this regard, monitoring helps to limit potential environmental impacts at ISL facilities. Required monitoring programs can be modified to address unique site-specific characteristics by the addition of license conditions resulting from the conclusions of the U.S. Nuclear Regulatory Commission's (NRC) safety and environmental reviews.

The discussion of monitoring programs in this section is organized by the following general categories:

- Radiological monitoring (Section 8.2)
- Physiochemical monitoring (Section 8.3)
- Ecological monitoring (Section 8.4)

Descriptions of typical monitoring programs are provided in this chapter. Other NRC guidance documents (NRC, 2007a, 2003, 1980) provide more detailed descriptions.

8.2 Radiological Monitoring

NRC regulations at 10 CFR Parts 20 and 40 address radiological effluents and exposures to the public. NRC requires that operators have an effluent and environmental monitoring program that complies with these rules. An effluent and environmental monitoring program includes a number of monitoring sites where surface waters, groundwater, sediments, soils, and the air are sampled for radionuclides. Operators must document the sampling and monitoring results and maintain records for a specified period of time. In addition, under 10 CFR 40.65, operators must submit the results of the effluent and environmental monitoring program to NRC twice a year.

General radiological monitoring practice is described in NRC (1980). Although this regulatory guidance was developed for conventional uranium mills, both NRC and the Wyoming Department of Environmental Quality (WDEQ) (NRC, 2003, WDEQ, 2007) have recommended it for ISL facilities. Other acceptable approaches to radiological monitoring are described in a series of NRC guidance documents listed in NRC (2003, Section 5.7).

8.2.1 Airborne Radiation Monitoring Program

For offsite air monitoring, operators must establish monitoring stations and environmental sampling areas. Sampling locations are selected based on the proposed facility, nearest residences, and population centers. As described in NRC (1980), offsite air quality is typically monitored for particulates and radon at a variety of locations near the facility, including the following:

- At least three locations at or near the site boundary;
- At the nearest residence or "occupiable" structure within 10 km [6 mi] of the site with the highest predicted airborne radionuclide concentrations;
- At least one residence or occupiable structure where predicted doses exceed 5 percent of the standards in 40 CFR Part 190;
- A remote location representing background conditions.

The guidance recommends sampling locations be the same as those used to establish pre-operational baseline conditions; filters be changed at least weekly, depending on dust conditions; and radon-222 be monitored continuously for at least 1 week per month (NRC, 1980, Section 2.1).

8.2.2 Soils and Sediments Monitoring

Soils and sediments are typically monitored annually, both onsite and offsite (NRC, 1980). For consistency, soil sampling locations are generally the same as those for the airborne radiation monitoring program (see Section 8.2.1) and sediment samples should be collected from surface water locations (see Section 8.3.3). Sampling is conducted both at the surface and across a soil-depth profile to a depth of about 1 m [3 ft] or until rock is encountered. These sampling programs may include surveys for gamma radiation, as well as sampling for natural uranium, thorium-230, and lead-210.

As an example of soil and sediment monitoring, the operator of the Crow Butte ISL uranium facility in Dawes County, Nebraska, implemented a soil monitoring program that involves sampling surface soil at the plant site before and after topsoil removal, at evaporation pond sites before excavation, and at air sampling stations (NRC, 1998).

8.2.3 Vegetation, Food, and Fish Monitoring

If a potentially significant exposure pathway is identified, vegetation (forage), food, and fish samples may be collected and analyzed for radionuclides in accordance with NRC sampling location and sampling frequency guidance (NRC, 1980, Section 2). Vegetation should be sampled three times during the growing season, and livestock grazing within 3 km [5 mi] of the site are sampled at the time of slaughter.

8.2.4 Surface Water Monitoring

Water and bed-sediment samples from perennial streams, standing water bodies (ponds, lakes, etc.) and water samples from springs within and near the ISL facility are tested periodically to determine whether contaminants are leaving the facility through surface runoff. The chemical analyses are established on a site- and process-specific basis, and include, but are not limited to, the measurements of sulfate or bicarbonate (or total alkalinity), pH, uranium, iron, aluminum, and heavy metals.

Sampling frequency and distribution are site specific and established by license condition. For example, at the Crow Butte ISL uranium facility in Dawes County, Nebraska, the effluent monitoring program requires one upstream and one downstream sample for each stream passing through the well field area, as well as quarterly sampling from each water impoundment area in the well field area (NRC, 1998).

8.2.5 Groundwater Monitoring

Environmental monitoring of groundwater for radiological constituents at an ISL facility is similar to chemical constituent groundwater monitoring discussed in Section 8.3.1.

8.3 Physiochemical Monitoring

Environmental monitoring for chemical constituents at ISL facilities, as needed to comply with environmental requirements or license conditions, is expected to overlap with radiological monitoring activities already discussed in Section 8.2 (e.g., sampling of surface water, sediments, soils). Unique and important aspects of physiochemical monitoring at ISL facilities primarily include the groundwater and well field monitoring activities discussed in this section.

8.3.1 Groundwater Monitoring

The ISL production process directly affects groundwater near the operating well field. For this reason, groundwater conditions are extensively monitored both before and during operations.

8.3.1.1 Pre-Operational Groundwater Sampling

Typically, a licensee must establish baseline groundwater quality before beginning uranium production in a well field. This is done to characterize water quality in monitoring wells that are used to detect lixiviant excursions from the production zone, to recover excursions, and to establish standards for aquifer restoration after uranium recovery ends. General criteria for establishing baseline water quality are described in NRC (2003, Section 2.7)

Baseline water quality can be established through examining records and reports for existing local water wells and by sampling wells developed for the ISL program before production begins. Although it will vary with deposit and aquifer geometry, a typical sampling to establish baseline conditions is about one production or injection well for every 1.6 ha [4 acres], all wells in the monitoring ring, and wells in aquifers above and below the confining layers for the production zone. Wells are sampled periodically for 25 or more major, minor, and trace elements and other parameters such as pH, specific conductivity, and total dissolved solids (see Table 8.2-1). Sampling should ensure that a stable baseline water quality is established. To determine baseline water quality conditions, at least four sets of samples, spaced sufficiently to indicate seasonal

Table 8.2-1. Typical Baseline Water Quality Parameters and Indicators for Groundwater*		
Physical Indicators		
Specific Conductivity	Total Dissolved Solids†	pH‡
Major Elements and Ions		
Alkalinity	Chloride	Sodium
Bicarbonate	Magnesium	Sulfate
Calcium	Nitrate	
Carbonate	Potassium	
Trace and Minor Elements		
Arsenic	Iron	Selenium
Barium	Lead	Silver
Boron	Manganese	Uranium
Cadmium	Mercury	Vanadium
Chromium	Molybdenum	Zinc
Copper	Nickel	
Fluoride	Radium-226§	
Radiological Parameters		
Gross Alpha‖	Gross Beta	

*Based on U.S. Nuclear Regulatory Commission (NRC). NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications—Final Report." Table 2.7.3-1. Washington, DC: NRC. June 2003.
†Laboratory only.
‡Field and laboratory determination.
§If site initial sampling indicates the presence of thorium-232, then radium-228 should be considered in the baseline sampling, or an alternative may be proposed.
‖Excluding radon, radium, and uranium.

variability, should be collected and analyzed for each listed constituent (NRC, 1997, 1998, 2003).

8.3.1.2 Groundwater Quality Monitoring

For early detection of potential horizontal and vertical excursions of lixiviants from the production zone, monitoring wells are situated around the well fields, in the aquifers overlying and underlying the ore-bearing production aquifers within the well field. Monitoring well placement is based on what is known about the nature and extent of the confining layer and presence of drill holes, hydraulic gradient, and aquifer transmissivity and well abandonment procedures used in the region. For example, monitoring wells should be placed downgradient from the production zone to detect excursion plumes. Monitoring wells completed in the uranium bearing horizon must be in hydraulic communication with the production zone to be effective (i.e., groundwater can easily flow between the production zone and the monitoring wells). Additional, more closely spaced wells may be necessary if there are preferred flow paths in the aquifer (preferred flow paths are identified in the subsurface drilling program discussed in Section 2.11.4). If an excursion is detected, additional monitoring wells may also be installed to delineate the extent of the excursion (NRC, 1998).

The ability of a monitoring well to detect groundwater excursions is influenced by several factors, such as the thickness of the aquifer monitored, the distance between the monitoring wells and the well field, the distance between adjacent monitoring wells, the frequency of groundwater sampling, and the magnitude of changes in chemical indicator parameters (see bulleted list below) that are monitored to determine whether an excursion has occurred.

The spacing, distribution, and the number of monitoring wells at a given ISL facility are site specific and established by license condition. For example, at the Smith Ranch ISL uranium facility, Wyoming, the monitoring wells for detecting horizontal excursions are located approximately 150 m [500 ft] beyond the well field perimeter, with a maximum spacing of 150 m [500 ft] between wells (NRC, 2006). At the proposed ISL facility at Crownpoint, New Mexico, the applicant proposed that wells completed in the production zone (Westwater Canyon formation) encircle each well field 140 m [460 ft] from the outermost production or injection wells with 140 m [460 ft] between each monitoring well (NRC, 1997).

Spacing for monitoring wells to detect vertical excursions in overlying and underlying aquifers at uranium ISL facilities is variable and ranges from 1 well per 1.2 ha [3 acres] to 1 well per 2 ha [5 acres] (NRC, 2006; 1998; 1997; Mackin et al., 2001). In some cases, hydrologic conditions are such that underlying aquifers may not need to be monitored. For example, at the Crow Butte ISL facility in Dawes County, Nebraska, the underlying confining layer is very thick (more than 300 m [1,000 ft]), and the underlying aquifer is not used as source of water (NRC, 1998).

Generally, a small group of parameters provides early warning of an excursion. These indicators are based on lixiviant chemistry and groundwater geochemistry (NRC, 2003, Section 5.7.8). The best excursion indicators are measurable and more highly concentrated in the lixiviant during ISL operations than in the natural groundwater. Typical excursion indicators include the following:

- *Chloride (Cl).* Chloride does not interact strongly with the minerals in the aquifer (a conservative tracer), is easily measured, and Cl concentration significantly increases during the ISL process because of ion exchange reactions in the milling circuit.

- *Specific conductivity.* Lixiviants have higher total dissolved solids than the local groundwater and therefore, have a higher specific conductivity. Elevated specific conductivity measurements, therefore, may indicate an excursion has taken place. If conductivity is used to estimate total dissolved solids, measurements will be normalized to a reference temperature (usually 25 °C [77 °F]) because of the temperature dependence of conductivity (Staub, et al., 1986; Deutsch, et al., 1985).

- *Total alkalinity* (carbonate plus bicarbonate plus hydroxide). This is appropriate for ISL operations where sodium bicarbonate or carbon dioxide is used in the lixiviant.

Cations such as calcium and sodium are usually found at significantly higher levels in lixiviants, but these elements tend to interact more strongly with the minerals in the aquifer. This interaction tends to delay the arrival of calcium and sodium at a monitoring well. For this reason, calcium and sodium should generally not be used as excursion indicators. Similarly, some major ions such as sulfate are present in significantly higher concentrations in the lixiviants, but complex reduction-oxidation chemistry may complicate the interpretation of the results (NRC, 2003, Section 5.7.8).

An excursion is detected when the concentrations of one or more of the excursion indicators exceed the upper control limit (UCL) concentrations. These UCLs are typically developed for the chosen excursion indicators by analyzing the baseline groundwater quality for a given well field. The UCLs should be set high enough that false positives (false alarms from natural fluctuations in water quality) are not a frequent problem, but not so high that groundwater quality significantly degrades by the time an excursion is identified. Each UCL also must be greater than the baseline concentration for its respective excursion indicator. ASTM D6312 (ASTM International, 1998) and NRC (2003, Section 5.7.8) discuss appropriate statistical methods that can be used to establish UCLs.

The monitoring wells are sampled periodically to verify that ISL solutions are contained within the operating well field; monitoring frequency depends on hydraulic conductivity. NRC (2003, Section 5.7.8) provides basic guidelines for monitoring frequency and response to an excursion detection. As an example, at the Crow Butte ISL uranium recovery facility in Dawes County, Nebraska, baseline water quality was established within the ore zone and in the first aquifer overlying the ore zone prior to uranium recovery. These water quality data are used to determine groundwater monitoring UCLs for five excursion parameters (chloride, sulfate, sodium, conductivity, and alkalinity) (NRC, 1998). The UCLs were calculated as 20 percent above the maximum baseline standards from three samples taken from a well. During well field production, samples are taken every two weeks from monitoring wells. A lixiviant excursion is assumed only when two UCLs in any monitoring well are exceeded or if a single UCL at a monitoring well is exceeded by 20 percent. If there is a lixiviant excursion, the operator must notify NRC within 24 hours to institute corrective actions, increase the sampling frequency to weekly, and prepare an excursion report for NRC. If the actions taken in response to the excursion are not effective by the time the 60-day excursion report is submitted, the licensee must stop injecting lixiviant until aquifer cleanup is complete (NRC, 1998, 2003). The surety may also be revised to cover the anticipated increase in aquifer restoration costs (NRC, 2003).

8.3.2 Well Field and Pipeline Flow and Pressure Monitoring

The operator typically will monitor injection and production well flow rates to manage the water balance for the entire well field (NRC, 2006). For example, at the proposed Reynolds Ranch expansion for the Smith Ranch/Highlands Uranium Project in Converse County, Wyoming, the operator proposed to monitor the flow rate of each production and injection well by monitoring individual flow meters in each well field header house (NRC, 2006, Section 6). Production well flow rates would be monitored daily and injection well flow rates at least every 3 days.

Additionally, the pressure of each production well and the production trunk line in each well field header house is monitored daily and compared to a maximum surface pressure that is calculated to maintain well integrity. Unexpected losses of pressure may indicate equipment failure, a leak, or a problem with well integrity.

8.4 Ecological Monitoring

Depending on the ecological resources in the area of a facility, the operator may be required to monitor other environmental resources such as plant or animal species.

Ecological monitoring may include surveys of habitat, species counts, or other measures of the health of endangered, threatened, and sensitive species. In addition, surveys may be used to determine whether planned activities are resulting in establishing invasive species populations. Specific survey requirements typically are established through consultations with Federal agencies such as the U.S. Fish and Wildlife Service or State agencies such as the Wyoming Department of Environmental Quality or the New Mexico Environmental Department. Surveys typically cover all phases and areas of planned activity for the life of the project (Energy Metals Corporation, U.S., 2007, Section 6.3). To understand potential impacts on seasonal breeding, timing may be important for some species. For example, in accordance with Wyoming Department of Environmental Quality requirements, Power Resources Inc. conducts a raptor survey in late April or early May of each year to identify any new nests and to address whether known nests are being used (NRC, 2007b). These surveys are conducted to protect against unforeseen conditions where raptors would be nesting in close proximity to operations.

8.5 References

ASTM International. "Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring." Designation D6312–98. West Conshohocken, Pennsylvania: ASTM International. 1998.

Council on Environmental Quality. "Aligning National Environmental Policy Act Processes With Environmental Management Systems. A Guide for NEPA and EMS Practitioners." Washington, DC: Council on Environmental Quality. April 2007.

Deutsch, W.J., W.J. Martin, L.E. Eary, and R.J. Serne. NUREG/CR–3709, "Method of Minimizing Ground-Water Contamination From *In-Situ* Leach Uranium Mining." Washington, DC: NRC. 1985.

Energy Metals Corporation, U.S. "Application for USNRC Source Material License Moore Ranch Uranium Project, Campbell County, Wyoming: Environmental Report." Casper, Wyoming: Energy Metals Corporation, U.S. [ADAMS Accession Number: ML072851249] September 2007.

Mackin, P.C., D. Daruwalla, J. Winterle, M. Smith, and D.A. Pickett. NUREG/CR–6733, "A Baseline Risk-Informed Performance-Based Approach for *In-Situ* Leach Uranium Extraction Licensees." Washington, DC: NRC. September 2001.

NRC. "Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations)—Effluent Streams and the Environment, Revision 2." Washington, DC: NRC. July 2007a.

NRC. "Environmental Assessment for the Construction and Operation of *In-Situ* Leach Satellite SR-2, Amendment No. 12 to Source Materials License No. SUA-1548, Power Resources, Inc.'s Smith Ranch/Highlands Uranium Project Converse County, Wyoming." Source Material License No. SUA–1548. Docket No. 40-8964. Washington, DC: NRC. December 2007b.

NRC. "Environmental Assessment for the Addition of the Reynolds Ranch Mining Area to Power Resources, Inc.'s Smith Ranch/Highlands Uranium Project Converse County, Wyoming." Source Material License No. SUA–1548. Docket No. 40-8964. Washington, DC: NRC. November 2006.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications—Final Report." Washington, DC: NRC. June 2003.

NRC. "Environmental Assessment for Renewal of Source Material License No. SUA–1534. Crow Butte Resources Incorporated Crow Butte Uranium Project Dawes County, Nebraska." Docket No. 40-8943. Washington, DC: NRC. February 1998.

NRC. NUREG–1508, "Final Environmental Impact Assessment To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico." Docket No. 40-8968. Washington, DC: NRC. February 1997.

NRC. "Regulatory Guide 4.14, Radiological Effluent and Environmental Monitoring at Uranium Mills, Revision 1." Washington, DC: NRC. 1980.

Staub, W.P., R.E. Williams, F. Anastasi, N.E. Hinkle, J. Osiensky, and D. Rogness. NUREG/CR–3967, "An Analysis of Excursions at Selected *In-Situ* Uranium Mines in Wyoming and Texas." Washington, DC: NRC. 1986.

WDEQ. "*In-Situ* Mining Permit Application Requirements Handbook. Application Content Requirements—Adjudication and Baseline Information." Cheyenne, Wyoming: WDEQ, Land Quality Division. March 2007.

9 CONSULTATIONS

This Generic Environmental Impact Statement (GEIS) takes a programmatic look at the environmental impacts of *in-situ* leach (ISL) uranium mining on the four regions previously described in Section 1.4. For the purpose of the GEIS, the programmatic aspects of the consultation process are described in this chapter. Each site-specific review would include its own consultation process with the relevant agencies including, but not limited to, state and tribal historic preservation offices [National Historic Preservation Act, Section 106 (NHPA)], U.S. Fish and Wildlife Service (USFWS) (Endangered Species Act, Section 7), and tribal consultations with appropriate Native American communities. The U.S. Nuclear Regulatory Commission (NRC) Consultation process involves early interaction in an effort to gather information to prepare an environmental review. In particular, 10 CFR 51.28(a)(3–5) specifically requires NRC to extend invitations to affected (state, local, tribal and federal government) agencies to meet as part of the scoping process for an environmental impact statement.

National Historic Preservation Act

NRC uses its National Environmental Policy Act (NEPA) process to coordinate Section 106 of the NHPA, which requires that Federal agencies "take into account the effects of their undertakings on historic properties and afford the Council (Advisory Council on Historic Preservation) a reasonable opportunity to comment on such undertakings." Typically, NRC licensing actions can be defined as undertakings based on 36 CFR 800.16(y) because the proposed actions consider applications and licensing amendments that require a "Federal permit, license or approval." NRC performs an evaluation of the proposed action to determine whether the activity has a potential to cause effects on historic properties. NRC initiates consultation with relevant agencies including the State Historic Preservation Office and/or the Tribal Historic Preservation Office, reports the conclusions of its evaluation, and seeks concurrence with its findings.

For the purpose of the GEIS, the proposed action considers the impact of construction, operation, aquifer restoration, and decommissioning of ISL facilities in four geographical regions in the western United States. Because the actual undertaking would occur when site-specific applications are submitted, the GEIS would not include Section 106 consultations. The site specific environmental reviews would identify the area of potential effect and lists any historic properties. Each site-specific environmental review would address the potential impact of the proposed action on the appropriate historic properties.

Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 was enacted to protect critically imperiled species from extinction as a "consequence of economic growth and development untendered by adequate concern and conservation." Section 7 of the ESA directs all Federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the USFWS, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 applies to management of federal lands as well as other federal actions that may affect listed species, such as federal approval of private activities through the issuance of federal permits, licenses, or other actions.

NRC uses its NEPA process to coordinate Section 7 consultations under the ESA. The staff perform an evaluation to identify the action area, determine whether listed species or critical habitat exist in the action area, and evaluates the potential impact on any listed species or critical habitat. For the purpose of this GEIS, the NRC staff identified endangered species in the four regions previously identified. Consultation would be initiated with the USFWS to determine whether critical habitats exist for species of concern on a site-specific basis. At the end of the consultation process, NRC would notify the USFWS of its conclusions and document them in the site-specific environmental analysis.

State Consultation

As a part of the environmental review process, NRC consults with the affected states and solicits comments on the environmental impact of the proposed action. This consultation is designed to address issues raised by state and local agencies and to reduce any duplication of effort in complying with federal, state, and local environmental requirements. During the scoping and information gathering process for a site-specific environmental review, NRC staff typically contact appropriate state and local agencies for initial, informal discussion about the proposed action and potential impacts. Because the GEIS contains a regional, programmatic evaluation, state consultations are not reported as these would be would be conducted during the site-specific review. Should the site-specific review result in the preparation of an environmental assessment (EA), NRC would submit a copy of the draft EA to the State for review and comment.

Tribal Consultation

NRC consults with the affected tribes as part of carrying out the intent behind Executive Order 13175 "Consultation and Coordination With Indian Tribal Governments" and requirements under 10 CFR 51.28(a)(5). Formal and informal consultations through the environmental review process can fulfill these responsibilities. Because the GEIS contains a regional, programmatic evaluation, tribal consultations are not reported as these would be conducted during the site-specific review. Should the site-specific review result in the preparation of an EA, NRC would submit a copy of the draft EA to affected tribes for review and comment.

For applications for new ISL facilities that have potential cultural and resource impacts on the Navajo Nation, NRC has committed to consultations with the Navajo Nation, through the Navajo Nation Department of Justice (U.S. DOI, 2008). These consultations for site-specific environmental reviews would take into account topics identified by NRC and the tribal agencies (e.g., Navajo Nation EPA).

Reference

U.S. Department of the Interior (Bureau of Indian Affairs), et al., 2008. "Health and Environmental Impacts of Uranium Contamination in the Navajo Nation: Five-Year Plan." June 9, 2008.

10 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

The environmental resources in the four geographic regions where current *in-situ* leach (ISL) facilities are located and where future ISL facilities may be located are discussed in Chapter 3. Based on the description of the ISL process and the historical information on ISL facilities in Chapter 2, the potential environmental impacts are described and analyzed in Chapter 4. In this chapter, for each of the four uranium milling regions considered within this Draft GEIS, the potential environmental impacts are summarized for construction, operation, aquifer restoration, and decommissioning at an ISL facility for each environmental resource.

In the Impact Findings column of the table that follows, the impacts are categorized by the significance levels described in Chapter 1:

- **SMALL**—The environmental effects would not be detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

- **MODERATE**—The environmental effects would be sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

- **LARGE**—The environmental effects would be clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

As described in Section 1.8, for each new ISL license application, NRC will conduct an independent site-specific environmental review to meet its responsibilities under the National Environmental Policy Act, drawing on the information and conclusions in the GEIS as appropriate.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region

Topic/ Resource	GEIS Section	Impact Findings
Land Use	4.2.1	CONSTRUCTION—Land use impacts could occur from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions (including limitations of other mineral extraction activities, grazing activities, or recreational activities). Land disturbances during construction would be temporary and limited to small areas within permitted areas. Well sites, staging areas, and trenches would be reseeded and restored. Unpaved access roads would remain in use until decommissioning. Competing access to mineral rights could be either delayed for the duration of the *in-situ* leaching (ISL) project or be intermixed with ISL operations (e.g., oil and gas exploration). Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the small size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected, but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical and cultural resources, the potential impacts would be SMALL. Due to the potential for unidentified resources to be altered or destroyed during excavation, drilling, and grading, the potential impacts to ecological, historical or cultural resources would be SMALL to LARGE, depending on local conditions. OPERATION—The types of land use impacts for operational activities would be expected to be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not occur from conducting operational activities. Because access restriction and land disturbance related impacts would be similar to, or less than, expected for construction, the overall potential impacts to land use from operational activities would be expected to be SMALL. AQUIFER RESTORATION—Due to the use of the same infrastructure, land use impacts would be similar to operations during aquifer restoration, although some operational activities would diminish—SMALL. DECOMMISSIONING—Land use impacts would be similar to those described for construction with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Reclamation of land to preexisting conditions and uses would help mitigate potential impacts—SMALL to MODERATE during decommissioning and SMALL once decommissioning is completed.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Transportation	4.2.2	CONSTRUCTION—Low magnitude traffic generated by ISL construction relative to local traffic counts would not significantly increase traffic or accidents on many of the roads in the region. Existing low traffic roads could be MODERATEly impacted by the additional worker commuting traffic during periods of peak employment. The potential impact would be more pronounced in areas with lower traffic counts. MODERATE dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads)—SMALL to MODERATE. OPERATION—Low magnitude traffic relative to local traffic counts on most roads would not significantly increase traffic, or accidents. Existing low traffic roads could be moderately impacted by commuting traffic during periods of peak employment including dust, noise, and possible incidental wildlife or livestock kill impacts on, or near site access roads. High consequences would be possible for a severe accident involving transportation of hazardous chemicals in a populated area. However, the probability of such accidents occurring would be low, owing to the limited number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion exchange resins, waste materials), compliance with transportation regulations would limit radiological risk for normal operations. Consequently, there is low radiological risk associated with accident conditions. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium—SMALL to MODERATE. AQUIFER RESTORATION—The magnitude of transportation activities would be lower than for construction and operations, with the exception of workforce commuting which could have moderate impacts on, or in the vicinity of, existing low traffic roads—SMALL to MODERATE. DECOMMISSIONING—The types of transportation activities and therefore types of impacts would be similar to those discussed for construction and operations except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks would be bounded by operations yellowcake transportation risk estimates—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Geology and Soils	4.2.3	CONSTRUCTION—Disturbance to soil would occur from construction (clearing, excavation, drilling, trenching, road construction). However, such disturbances would be temporary and SMALL (approx. 10 percent of the total site area), and potential impacts would be mitigated by using best management practices. The well fields, trenches, and access roads would be restored and reseeded after construction. Excavated soils would be stockpiled, seeded, and stored onsite until needed for reclamation fill. No impacts to subsurface geological strata are likely—SMALL. OPERATION—Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation, use of evaporation ponds, or land application of treated waste water. However, detection and response techniques, monitoring of treated waste water, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to soils—SMALL. AQUIFER RESTORATION—Impacts to geology and soils from aquifer restoration activities would be similar to impacts from operations due to use of the same infrastructure and similar activities conducted (e.g., well field operation, transfer lines, waste water treatment and disposal)—SMALL. DECOMMISSIONING—Impacts to geology and soils from decommissioning would be similar to impacts from construction. Activities to cleanup, recontour and reclaim disturbed lands during decommissioning would mitigate long-term impacts to soils—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Surface Waters	4.2.4.1	CONSTRUCTION—Impacts to surface waters and related habitats from construction (road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment) would be mitigated through proper planning, design, construction methods, and best management practices. Some impacts directly related to the construction activities would be temporary and limited to the duration of the construction period. U.S. Army Corps of Engineers permits may be required when filling and crossing of wetlands. Temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase. Incidental spills of drilling fluids into local streams would be SMALL and temporary, due to the implementation of mitigation measures. Impacts from construction of roads, parking areas, and buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces proposed. Infiltration of drilling fluids into the local aquifer would be SMALL, temporary, and localized to a few feet around boreholes—SMALL to MODERATE depending on site-specific characteristics. OPERATION—Impacts from storm water runoff or direct discharge of process waters (brine reject from reverse osmosis, or spent eluants from an ion exchange system) to surface waters would be regulated by the Wyoming Department of Environmental Quality through the Wyoming Pollutant Discharge Elimination System permit. Expansion of facilities or pipelines during operations would generate impacts similar to construction—SMALL to MODERATE, depending on site-specific characteristics. AQUIFER RESTORATION—Impacts from aquifer restoration would be similar to impacts from operations due to use of in-place infrastructure and similar activities conducted (e.g., well field operation, transfer lines, water treatment, storm water runoff)—SMALL to MODERATE, depending on site-specific characteristics. DECOMMISSIONING—Impacts from decommissioning would be similar to impacts from construction. Activities to clean up, re-contour and reclaim disturbed lands during decommissioning would mitigate long-term impacts to surface waters—SMALL to MODERATE, depending on site-specific characteristics.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Water—Groundwater	4.2.4.2	CONSTRUCTION—Water use impacts would be limited by the small volumes of groundwater used for routine activities such as dust suppression, mixing cements, and drilling support over short and intermittent periods. Contamination of groundwater from construction activities would be mitigated by use of best management practices—SMALL to LARGE, depending on site-specific conditions. OPERATION—Potential impacts to shallow aquifers can occur from leaks or spills from surface facilities and equipment. Shallow aquifers are important sources of drinking water in some areas of the Wyoming West Uranium Milling Region. Potential impacts to the ore-bearing and surrounding aquifers include consumptive water use and degradation of water quality (from normal production activities, off-normal excursion events, and deep well injection disposal practices). Consumptive use impacts from withdrawal of groundwater would occur because only 1 to 3 percent of pumped groundwater is not returned to the aquifer (e.g., process bleed). The amount of water lost could be reduced substantially by available treatment methods (e.g., reverse osmosis, brine concentration). Effects of water withdrawal on surface water would be SMALL as the ore zone normally occurs in a confined aquifer. Estimated drawdown effects vary depending on site conditions and water treatment technology applied. Excursions of lixiviant and mobilized chemical constituents could occur from failure of well seals or other operational conditions that result in incomplete recovery of lixiviant. Well seal related excursions would be detected by the groundwater monitoring system and periodic well mechanical integrity testing and impacts would be mitigated during operation or aquifer restoration. Other excursions could result in plumes of mobilized uranium and heavy metals extending beyond the mineralization zone. The magnitude of potential impacts from vertical excursions would vary depending on site-specific conditions. To reduce the likelihood and consequences of potential excursions at ISL facilities, NRC requires licensees to take preventative measures prior to starting operations including well tests, monitoring, and development of procedures that include excursion response measures and reporting requirements. Alterations of ore body aquifer chemistry would be SMALL because the aquifer would: (1) be confined, (2) not be a potential drinking water source, and (3) be expected to be restored within statistical range of preoperational baseline water quality during the restoration period. Potential environmental impacts to confined deep aquifers below the production aquifers from deep well injection of processing wastes would be addressed by the underground injection permitting process regulated by the state of Wyoming—SMALL to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—Potential impacts concern consumptive use and potential deep disposal of brine slurries after reverse osmosis, if applicable. The volume of water removed from the aquifer and related impacts would be dependent on site-specific conditions and the type of water treatment technology the facility uses. In some cases, groundwater consumptive use for the aquifer restoration has been reported to be less than groundwater use during the ISL operation and drawdowns due to aquifer restorations have been less than drawdown caused by ISL operations. Potential environmental impacts associated with water consumption during aquifer restorations are determined by: (1) the restoration techniques chosen, (2) the volume of water to be used, (3) the severity and extent of the contamination, and (4) the current and future use of the production and surrounding aquifers near the ISL facility or at the regional scale—SMALL to LARGE, depending on site-specific conditions. DECOMMISSIONING—Potential impacts from decommissioning would be similar to construction (water use, spills) with an additional potential to mobilize contaminants during demolition and cleanup activities. Contamination of groundwater from decommissioning activities would be mitigated by implementation of an NRC-approved decommissioning plan and use of best management practices—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Ecology—Terrestrial	4.2.5.1	CONSTRUCTION—Potential terrestrial ecology impacts would include the removal of vegetation from well fields, the milling site, the modification of existing vegetative communities, the loss of sensitive plants and habitats from clearing and grading, and the potential spread of invasive species and noxious weed populations. These impacts would be temporary because restoration and reseeding occur rapidly after the end of construction. Introduction of invasive species and noxious weeds would be possible but could be mitigated by restoration and reseeding after construction. Shrub and tree removal would have a longer restoration period. Wildlife habitat fragmentation, temporary displacement of animal species, and direct or indirect mortalities is possible. Implementation of wildlife surveys and mitigation measures following established guidelines would limit these impacts. The magnitude of impacts depends on whether a new facility is being licensed or an existing facility is being extended—SMALL to MODERATE, depending on site-specific conditions. OPERATION—Habitat could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. The Wyoming Game and Fish Department specifies fencing construction techniques to minimize impediments to big game movement. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Temporary contamination or alteration of soils would be from operational leaks and spills and possible from transportation or land application of treated waste water. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures, such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys, would reduce overall impacts—SMALL. AQUIFER RESTORATION—Impacts include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Contamination of soils could result from leaks and spills, or land application of treated waste water. However, detection and response techniques and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites and periodic wildlife surveys would reduce overall impacts—SMALL. DECOMMISSIONING—During decommissioning and reclamation, there would be a temporary disturbance to land (e.g., excavating soils, buried piping, removal of structures). However, revegetation and re-contouring would restore habitat altered during construction and operations. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation are completed and vegetation and habitat is reestablished—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Aquatic	4.2.5.2	CONSTRUCTION—Clearing and grading activities associated with construction could result in a temporary increase in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Clearing of riparian vegetation could affect light and temperature of water. Construction impacts to wetlands would be identified and managed through U.S. Army Corps of Engineers permits, as appropriate. Construction impacts to surface waters and aquatic species would be temporary and mitigated by best management practices—SMALL. OPERATION—Impacts could result from spills or releases into surface water. Impacts would be minimized by spill prevention, identification and response programs, and National Pollutant Discharge Elimination System (NPDES) permit requirements—SMALL. AQUIFER RESTORATION—Activities would use existing (in-place) infrastructure, and impacts could result from spills or releases of untreated groundwater. Impacts would be minimized by spill prevention, identification, and response programs, and NPDES permit requirements—SMALL. DECOMMISSIONING—Decommissioning and reclamation activities could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Threatened or Endangered Species	4.2.5.3	CONSTRUCTION—Numerous threatened and endangered species and State Species of Concern are located in the region. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts depends on the size of a new facility or extension to an existing facility and the amount of land disturbance. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would assiste in identifying potential impacts—SMALL to MODERATE to LARGE—depending on site-specific habitat and presence of threatened or endangered species. OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts would depend on the size of a new facility or extension to an existing facility and the amount of land disturbance. Impacts could potentially result from spills or permitted effluents, but would be minimized by spill prevention measures, identification and response programs, and NPDES permit requirements. Inventory of threatened or endangered species developed during site-specific reviews would identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL to MODERATE—depending on site-specific habitat and presence of threatened or endangered species. AQUIFER RESTORATION—Impacts could result from individual takes due to conflicts with aquifer restoration activities (equipment, traffic). Existing (in-place) infrastructure would be used during aquifer restoration, so additional land-disturbing activities and habitat fragmentation would not be anticipated. Impacts may result from spills or releases of treated or untreated groundwater, but impacts would be minimized by spill prevention measures, identification, and response programs, and NPDES permit requirements. Inventory of threatened or endangered species would be expected to be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL. DECOMMISSIONING—Impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures are demolished and removed and the ground surface is re-contoured. Inventory of threatened or endangered species developed during site-specific environmental review of the decommissioning plan would identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Air Quality	4.2.6	CONSTRUCTION—Fugitive dust and combustion (vehicle and diesel) emissions during land disturbing activities associated with construction would be SMALL, short-term, and reduced through best management practices (e.g., dust suppression). For example, estimated fugitive dust emissions during ISL construction is less than 2 percent of the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and less than 1 percent for PM_{10}. For NAAQS attainment areas such as the Wyoming West Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no Prevention of Significant Deterioration (PSD) Class I areas in the Wyoming West Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. OPERATION—Radiological impacts can result from dust releases from drying of lixiviant pipeline spills, radon releases from well system relief valves, resin transfer, or elution, and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials would be released based on operational controls and rapid response to spills. Required spill prevention, control, and response procedures would be used to minimize impacts from spills. High Efficiency Particulate Air (HEPA) filters and vacuum dryer designs would reduce particulate emissions from operations, and ventilation would reduce radon buildup during operations. Compliance with the NRC-required radiation monitoring program would ensure releases are within regulatory limits. Other potential nonradiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas such as the Wyoming West Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no PSD Class I areas in the Wyoming West Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions, or mitigation measures to reduce impacts—SMALL. AQUIFER RESTORATION—Because the same infrastructure would be used, air quality impacts are expected to be similar to, or less than, operations. For NAAQS attainment areas such as the Wyoming West Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no PSD Class I areas in the Wyoming West Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions, or mitigation measures to reduce impacts—SMALL. DECOMMISSIONING—Fugitive dust and combustion (vehicle and diesel) emissions during land-disturbing activities associated with decommissioning would be similar to, or less than, associated with construction, short-term, and reduced through best management practices (e.g., dust suppression). These potential impacts would decrease as decommissioning and reclamation of disturbed areas are completed. For NAAQS attainment areas such as the Wyoming West Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no PSD Class I areas in the Wyoming West Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions, or mitigation measures to reduce impacts—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Noise	4.2.7	CONSTRUCTION—Noise generated during construction would be noticeable in proximity to operating equipment, but would be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. Traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, compressors) would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Noise may also have an adverse effect on wildlife habitat and their reproductive success in the immediate vicinity of construction activities. Noise levels, however, decrease geometrically with distance, and at distances more than 300 m [1,000 ft], ambient noise levels return to background. Wildlife generally avoid construction noise areas. The two uranium districts within the Wyoming West Uranium Milling Region are more than 16 km [10 mi] from the closest community—SMALL to MODERATE. OPERATION—Noise-generating activities in the central uranium processing facility would be indoors, minimizing offsite sound levels. Well field equipment (e.g., pumps, compressors) would also be contained within structuress (e.g., header houses, satellite facilities), minimizing sound levels to offsite receptors. Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits, and mitigated by use of personal hearing protection. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Most noise would be generated indoors and mitigated by regulatory compliance and use of best management practices. Noise from trucks and other vehicles is typically of short duration. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The two uranium districts within the Wyoming West Uranium Milling Region are more than 16 km [10 mi] from the closest community—SMALL to MODERATE. AQUIFER RESTORATION—Noise generation is expected to be less than during construction and operations. Pumps and other well field equipment contained in buildings minimize sound levels to offsite receptors. Existing operational infrastructure used and traffic levels would be less than during construction and operations. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The two uranium districts within the Wyoming West Uranium Milling Region are more than 16 km [10 mi] from the closest community—SMALL to MODERATE. DECOMMISSIONING—Noise generated during decommissioning would be noticeable only in proximity to operating equipment and be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Noise levels during decommissioning would be expected to be less than during construction and would diminish as less and less equipment is used and truck traffic is reduced. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]} The two uranium districts within the Wyoming West Uranium Milling Region are more than 16 km [10 mi] from the closest community—SMALL.

Topic/ Resource	GEIS Section	Impact Findings
Historical and Cultural	4.2.8	CONSTRUCTION—Potential impacts during ISL facility construction could include loss of, or damage and temporary restrictions on access to, historical, cultural, and archaeological resources. The eligibility evaluation of cultural resources for listing in the National Register of Historic Places (NRHP) under criteria in 36 CFR 60.4(a)–(d) and/or as Traditional Cultural Properties (TCPs) would be conducted as part of the site-specific review and NRC licensing procedures undertaken during the National Environmental Policy Act (NEPA) review process. The evaluation of impacts to any historic properties designated as TCPs and tribal consultations regarding cultural resources and TCPs also occur during the site-specific licensing application and review process. Consultation to determine whether significant cultural resources would be avoided or mitigated occurs during consultations with State Historic Preservation Offices (SHPOs), other governmental agencies, and Native American tribes, including Tribal Historic Preservation Offices (THPOs), as part of the site-specific review. Additionally, as needed, the NRC license applicant would be expected to be required, under conditions in its NRC license, to adhere to procedures regarding the discovery of previously undocumented cultural resources during initial construction. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. OPERATION—Because less land disturbance occurs during the operations phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during operation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—Because less land disturbance occurs during the aquifer restoration phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during aquifer restoration. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE depending on site-specific conditions. DECOMMISSIONING—Because less land disturbance occurs during the decommissioning phase, and because decommissioning and reclamation activities would be focused on previously disturbed areas, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during decommissioning and reclamation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE depending on site-specific conditions.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Visual and Scenic	4.2.9	CONSTRUCTION—Visual impacts result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Most of the Wyoming West Uranium Milling Region is classified as Visual Resource Management (VRM) Class II through IV, and no VRM Class I or Prevention of Significant Deterioration (PSD) Class I areas are located in the region. Most potential visual impacts during construction would be temporary as equipment is moved, and would be mitigated by implementing best management practices (e.g., dust suppression). Because of the generally rolling topography of the region, most visual impacts during construction would not be expected to be visible from more than about 1 km [0.6 mi]. The two uranium districts in the region are located more than 24 km [15 mi] from the closest VRM Class II region, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. OPERATION—Visual impacts during operations would be expected to be less than those associated with construction. Most of the well field surface infrastructure has a low profile, and most piping and cables would be buried. The tallest structures would include the central uranium processing facility {10 m [30 ft]} and power lines {6 m [20 ft]}. Because of the generally rolling topography of the region, most visual impacts during operations would not be visible from more than about 1 km [0.6 mi]. Irregular layout of well field surface structures such as wellhead protection and header houses would reduce visual contrast. Best management practices, design (e.g., painting buildings), and landscaping techniques would be used to mitigate potential visual impact. The two uranium districts in the region are located more than 24 km [15 mi] from the closest VRM Class II region, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as, or less than, during operations—SMALL. DECOMMISSIONING SMALL—Because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be the same as or less than those during construction. Most potential visual impacts during decommissioning would be temporary as equipment is moved and would be mitigated by use of best management practices (e.g., dust suppression). Visual impacts would be low because sites would be in sparsely populated areas, and impacts would diminish as decommissioning activities decrease. An approved site reclamation plan would be required prior to license termination, with the goal of returning the landscape to preconstruction condition (predominantly VRM Class III and IV). Some roadside cuts and hill slope modifications may, however, persist beyond decommissioning and reclamation—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Socioeconomics	4.2.10	CONSTRUCTION—Potential impacts to socioeconomics would result predominantly from employment at an ISL facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. Total peak employment would be about 200 people including company employees and local contractors, depending on timing of construction with other stages of the ISL lifecycle. During construction of surface facilities and well fields, the general practice has been to use local contractors (drillers, construction) if available. A local multiplier of 0.7 would indicate a maximum of about 140 ancillary jobs could be created. For example, local building materials and building supplies would be used to the extent practical. Most employees would live in larger communities with access to more services. Some construction employees, however, would commute from outside the county to the ISL facility, and skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. Some of these employees would temporarily relocate to the project area and contribute to the local economy through purchasing goods and services and taxes. Because of the small relative size and temporary nature of the ISL construction workforce, net impacts would be SMALL to MODERATE, depending on proximity to less populated communities such as Jeffrey City and Bairoil. OPERATION—Employment levels for ISL facility operations would be similar to, or less than, for construction, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Additional revenues would be generated by federal, state, and local taxes on the facility and the uranium produced. Because of similar employment levels, other socioeconomic impacts would be similar to construction SMALL to MODERATE, depending on proximity to sless populated communities such as Jeffrey City and Bairoil. AQUIFER RESTORATION—Because much of the same (in-place) infrastructure would be used, employment levels would be similar to, or less than, for operations, with total peak employment depending on timing and overlap with other activities during the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as Jeffrey City and Bairoil. DECOMMISSIONING—A skill set similar to the construction workforce would be involved in dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/recontouring the ground surface. Employment levels and use of local contractor support during decommissioning would be similar to, or less than, would be required for construction. Employment would be temporary, as decommissioning activities would be limited in duration. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as Jeffrey City and Bairoil.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)		
Topic/ Resource	GEIS Section	Impact Findings
Public and Occupational Health and Safety	4.2.11	CONSTRUCTION—Worker safety would be addressed by standard construction safety practices. Fugitive dust would result from construction activities and vehicle traffic, but would likely be of short duration, and not result in a radiological dose. Diesel emissions would not be expected to be a concern for worker or public health, because the releases are usually of short duration and are readily dispersed into the atmosphere—SMALL. OPERATION—Potential occupational radiological impacts from normal operations would be caused primarily by exposure to radon gas from the well field, ion-exchange resin transfer operations, and venting during processing activities. Workers would also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation would occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures would be limited by NRC regulations at 10 CFR Part 20 that require licensees to implement an NRC-approved radiation monitoring and protection program. (Measured and calculated doses for workers and the public are commonly a fraction of regulated limits.) Non-radiological worker safety matters would be addressed through commonly applied occupational health and safety regulations and practices. Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. Consequences of accidents to workers and the public are generally low, with the exception of a dryer explosion, which could result in worker dose above NRC limits. The likelihood of such an accident would be low, and therefore, the risk would also be low. Potential non-radiological accidents impacts include high-consequence for chemical release events (e.g., ammonia) for both workers and nearby populations. The likelihood of such release events would be low, based on historical operating experience at NRC-licensed facilities, which is partly the result of operators following commonly applied chemical safety and handling protocols—SMALL to MODERATE. AQUIFER RESTORATION—Because the activities during aquifer restoration overlap with similar operational activities (e.g., operation of well fields, waste water treatment and disposal) the types of impacts on public and occupational health and safety would be similar to operational impacts. The absence of some operational activities (e.g., yellowcake production and drying, remote ion exchange) further limits the relative magnitude of potential worker and public health and safety hazards—SMALL. DECOMMISSIONING—Worker and public health and safety would be addressed in a required Decommissioning Plan. This plan details how a 10 CFR Part 20-compliant radiation safety program would be implemented during decommissioning, and ensure the safety of workers and the public, as well as comply with applicable safety regulations—SMALL.

Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Waste Management	4.2.12	CONSTRUCTION—The relatively small scale of construction activities (Section 2.3) and incremental development of well fields at ISL facilities would generate low volumes of construction waste—SMALL. OPERATION—Operational wastes primarily result from liquid waste streams including process bleed, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. State permitting actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public. Waste treatment such as reverse osmosis and radon settling would help in segregating wastes and minimizing disposal volumes. Potential impacts from surface discharge and deep well injection would be limited by the applicable permitting processes. NRC regulations address constructing, operating, and monitoring for leakage from evaporation ponds used to store and reduce volumes of liquid wastes. Potential impacts from land application of treated wastewater would be addressed by NRC review of site-specific conditions prior to approval, routine monitoring, and inclusion of irrigated land areas in decommissioning surveys. Offsite waste disposal impacts would be SMALL for radioactive wastes as a result of required preoperational disposal agreements. Impacts for hazardous and municipal waste would be SMALL due to the volume of wastes generated. For remote areas with limited available disposal capacity, such wastes may need to be shipped greater distances to facilities that have capacity. However, the volume of wastes generated, and magnitude of the shipments, are estimated to be—SMALL. AQUIFER RESTORATION—Waste management activities during aquifer restoration would utilize the same treatment and disposal options implemented for operations. Therefore, impacts associated with aquifer restoration would be similar to operational impacts. While the amount of wastewater generated during aquifer restoration is dependent on site-specific conditions, the potential exists for additional generated wastewater volume and associated treatment wastes during the restoration period. However, this would be offset to some degree by the reduction in production capacity from the removal of a well field. NRC review of future ISL facility applications would verify that sufficient water treatment and disposal capacity (and the associated agreement for disposal of byproduct material) are addressed. As a result, waste management impacts from aquifer restoration would be—SMALL. DECOMMISSIONING—Radioactive wastes from decommissioning ISL facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment) would be disposed of as byproduct material at an NRC-licensed facility. A pre-operational agreement with a licensed disposal facility to accept radioactive wastes ensures sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required Decommissioning Plan , subject toNRC review . This plan would detail how a 10 CFR Part 20-compliant radiation safety program would be implemented during decommissioning, and to ensure safety of workers and the public, as well as to identify measures to comply with applicable safety regulations. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Land Use	4.3.1	CONSTRUCTION—Land use impacts could occur from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions (including limitations of other mineral extraction activities, grazing activities, or recreational activities). A higher percentage of private land ownership occurs in this region than in the Wyoming West Uranium Milling Region, and could increase the potential for land use conflicts with private land owners. Land disturbances during construction would be temporary and limited to SMALL areas within permitted site. Well sites, staging areas, and trenches would be reseeded and restored, but unpaved access roads would remain in use until decommissioning is complete. Competing access to mineral rights could be either delayed for the duration of the ISL project or be intermixed with ISL operations (e.g., oil and gas exploration). Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the SMALL size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical and cultural resources, the potential impacts would be SMALL. Due to the potential for unidentified resources to be altered or destroyed during excavation, drilling, and grading, the potential impacts to ecological, historical or cultural resources would be SMALL to LARGE, depending on local conditions. OPERATION—The types of land use impacts for operational activities would be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not occur from conducting operational activities. Because access restriction and land disturbance related impacts would be similar to, or less than, expected for construction, the overall potential impacts to land use from operational activities would be SMALL. AQUIFER RESTORATION—Due to the use of the same infrastructure, land use impacts would be similar to operations during aquifer restoration, although some operational activities would diminish—SMALL. DECOMMISSIONING—Land use impacts would be similar to those described for construction with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Reclamation of land to preexisting conditions and uses would help mitigate potential impacts—SMALL to MODERATE during decommissioning, and SMALL once decommissioning is completed.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Transportation	4.3.2	CONSTRUCTION—Low magnitude traffic generated by ISL construction relative to local traffic counts would not significantly increase traffic or accidents on many of the roads in the region. Existing low traffic roads could be moderately impacted by the additional worker commuting traffic during periods of peak employment. The impact would be more pronounced in areas with lower traffic counts. MODERATE dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads)—SMALL to MODERATE. OPERATION—Low magnitude traffic relative to local traffic counts on most roads would not significantly increase traffic or accidents. Existing low traffic roads could be moderately impacted by commuting traffic during periods of peak employment including dust, noise, and possible incidental wildlife or livestock kill impacts on, or near, site access roads. High consequences are possible for a severe accident involving transportation of hazardous chemicals in a populated area. However, the probability of such accidents occurring would be low, owing to the limited number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion exchange resins, waste materials) compliance with transportation regulations would limit radiological risk for normal operations. Low radiological risk is estimated for accident conditions. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium—SMALL to MODERATE. AQUIFER RESTORATION—The magnitude of transportation activities would be lower than for construction and operations, with the exception of workforce commuting which could have moderate impacts on, or near, existing low traffic roads—SMALL to MODERATE. DECOMMISSIONING—The types of transportation activities, and therefore, types of impacts would be similar to those discussed for construction and operations except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks would be bounded by operations of yellowcake transportation risk estimates—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Geology and Soils	4.3.3	CONSTRUCTION—Disturbance to soil would occur from construction (clearing, excavation, drilling, trenching, road construction). However, such disturbances would be temporary and SMALL (approx. 10 percent of the total site area), and potential impacts would be mitigated by using best management practices. A large portion of the well fields, trenches, and access roads would be expected to be restored and reseeded after construction. Excavated soils would be stockpiled, seeded, and stored onsite until needed for reclamation fill. No impacts to subsurface geological strata are likely—SMALL. OPERATION—Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation, use of evaporation ponds, or land application of treated waste water. However, detection and response techniques, monitoring of treated waste water, and eventual survey and decommissioning of all potentially impacted soils would limit the magnitude of overall impacts to soils—SMALL. AQUIFER RESTORATION—Impacts to geology and soils from aquifer restoration activities would be similar to impacts from operations due to use of the same infrastructure and similar activities conducted (e.g., well field operation, transfer lines, waste water treatment and disposal)—SMALL. DECOMMISSIONING—Impacts to geology and soils from decommissioning would be similar to impacts from construction. Activities to clean up, re-contour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to soils—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	GEIS Section	Impact Findings
Surface Waters	4.3.4.1	CONSTRUCTION—Impacts to surface waters and related habitats from construction (road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment) would be expected to be mitigated through proper planning, design, construction methods, and best management practices. There is more surface runoff per given area in this region than in the Wyoming West Uranium Milling Region. As a result, there may be a slight increase in runoff-related impacts. Some impacts directly related to the construction activities would be expected to be temporary and limited to the duration of the construction period. U.S. Army Corps of Engineers permits may be required when filling and crossing of wetlands. Temporary changes to surface flows from grading, changes in topography, and natural drainage patterns would be mitigated through best management practices, and restored once the construction phase is complete. Incidental spills of drilling fluids into local streams would be SMALL and temporary due to implementation of mitigation measures. Impacts from construction of roads, parking areas, and buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces proposed. Infiltration of drilling fluids into the local aquifer would be SMALL, temporary, and localized to a few feet around boreholes—SMALL to MODERATE, depending on site-specific characteristics OPERATION—Impacts from storm water runoff or direct discharge of process waters (brine reject from reverse osmosis, or spent eluants from an ion exchange system) to surface waters would be regulated by the Wyoming Department of Environmental Quality through the Wyoming Pollutant Discharge Elimination System permit..The increased areal runoff projections for this region would result in a potential increase of runoff-related impacts Expansion of facilities or pipelines during operations would generate impacts similar to construction—SMALL to MODERATE depending on site-specific characteristics. AQUIFER RESTORATION—Impacts from aquifer restoration would be similar to impacts from operations due to use of in-place infrastructure and similar activities conducted (e.g., well field operation, transfer lines, water treatment, stormwater runoff)—SMALL to MODERATE depending on site-specific characteristics. DECOMMISSIONING—Impacts from decommissioning would be similar to impacts from construction. Activities to clean up, re-contour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to surface waters—SMALL to MODERATE depending on site-specific characteristics.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Water—Groundwater	4.3.4.2	CONSTRUCTION—Water use impacts would be limited by the small volumes of groundwater used for routine activities such as dust suppression, mixing cements, and drilling support over short and intermittent periods. Contamination of groundwater from construction activities would be mitigated by best management practices—SMALL to LARGE, depending on site-specific conditions. OPERATION—Potential impacts to shallow aquifers can occur from leaks or spills from surface facilities and equipment. Shallow aquifers are important sources of drinking water in some areas of the Wyoming East Uranium Milling Region. Potential impacts to the ore-bearing and surrounding aquifers include consumptive water use and degradation of water quality (from normal production activities, off-normal excursion events, and deep well injection disposal practices). Consumptive use impacts from withdrawal of groundwater would be SMALL because only 1 to 3 percent of pumped groundwater would be returned to the aquifer (e.g., process bleed). However, this amount of water lost could be reduced substantially by currently available treatment methods (e.g., reverse osmosis, brine concentration). Effects of water withdrawal on surface water would be SMALL, as the ore zone normally occurs in a confined aquifer. Estimated drawdown effects vary depending on site conditions and water treatment technology applied. Excursions of lixiviant and mobilized chemical constituents could occur from a failure of well seals or other operational conditions that result in incomplete recovery of lixiviant. Well-seal-related excursions could be detected by the groundwater monitoring system, and periodic well integrity testing and impacts would be expected to be mitigated during operation or aquifer restoration. Other excursions could result in plumes of mobilized uranium and heavy metals extending beyond the mineralization zone. The magnitude of potential impacts from vertical excursions would vary depending on site-specific conditions. To reduce the likelihood and consequences of potential excursions at ISL facilities, NRC requires licensees to take preventative measures prior to starting operations including well tests, monitoring, and development of procedures that include excursion response measures and reporting requirements. Alterations of ore body aquifer chemistry would be SMALL because the aquifer would: (1) be confined, (2) not be a potential drinking water source, and (3) be restored within statistical range of preoperational baseline water quality during the restoration period. Potential environmental impacts to confined deep aquifers below the production aquifers from deep well injection of processing wastes would be addressed by the underground injection permitting process regulated by the State of Wyoming—SMALL to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—Potential impacts would result in consumptive use and potential deep disposal of brine slurries after reverse osmosis, if applicable. The volume of water removed from the aquifer and related impacts would be dependent on site-specific conditions and the type of water treatment technology the facility used. In some cases, groundwater consumptive use for the aquifer restoration has been reported to be less than groundwater use during the ISL operation and drawdowns due to aquifer restorations have been reported as smaller than drawdown caused by ISL operations. Potential environmental impacts associated with water consumption during aquifer restorations are determined by: (1) the restoration techniques chosen, (2) the volume of water to be used, (3) the severity and extent of the contamination, and (4) the current and future use of the production and surrounding aquifers in the vicinity of the ISL facility or at the regional scale—SMALL to LARGE, depending on site-specific conditions. DECOMMISSIONING—Potential impacts from decommissioning would be similar to construction (water use, spills) with an additional potential to mobilize contaminants during demolition and cleanup activities. Contamination of groundwater from decommissioning activities would be mitigated by implementation of an NRC-approved decommissioning plan and use of best management practices—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	GEIS Section	Impact Findings
Ecology—Terrestrial	4.3.5.1	CONSTRUCTION—Potential terrestrial ecology impacts would include the removal of vegetation from well fields, the milling site, the modification of existing vegetative communities, the loss of sensitive plants and habitats from clearing and grading, and the potential spread of invasive species and noxious weed populations. These impacts would be temporary because restoration and reseeding occur rapidly after the end of construction. Introduction of invasive species and noxious weeds would be expected to be possible but could be mitigated by restoration and reseeding after construction. Shrub and tree removal would have a longer restoration period. Construction noise could affect reproductive success of sage grouse leks by interfering with mating calls. Temporary displacement of animal species would also be possible. Crucial wintering and year-long ranges are important to survival of big game and sage grouse. Wildlife habitat fragmentation, temporary displacement of animal species, and direct or indirect mortalities is also possible. Implementation of wildlife surveys and mitigation measures following established guidelines would limit these impacts. The magnitude of impacts depends on whether a new facility is being licensed or an existing facility is being extended—SMALL to MODERATE, depending on site-specific habitat. OPERATION—Habitat could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. However, the Wyoming Game and Fish Department specifies fencing construction techniques to minimize impediments to big game movement. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Temporary contamination or alteration of soils would be from operational leaks and spills and possible from transportation or land application of treated waste water. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soil, limits the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduce overall impacts—SMALL. AQUIFER RESTORATION—Impacts include habitat disruption, but existing (in-place) infrastructure would be used duringaquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Contamination of soils could result from from leaks and spills, or land application of treated waste water. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduce overall impacts—SMALL. DECOMMISSIONING—During decommissioning and reclamation, there would be a temporary disturbance to land (e.g., excavating soils, buried piping, removal of structures). However, revegetation and re-contouring would restore habitat altered during construction and operations. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation were completed and vegetation and habitat reestablished—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Ecology—Aquatic	4.3.5.2	CONSTRUCTION—Clearing and grading activities associated with construction could result in a temporary increase in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Clearing of riparian vegetation could affect light and temperature of water. Construction impacts to wetlands would be identified and managed through U.S. Army Corps of Engineers permits, as appropriate. Construction impacts to surface waters and aquatic species would be temporary and mitigated by best management practices—SMALL. OPERATION—Impacts could result from spills or releases into surface water. Impacts would be minimized by spill prevention, identification and response programs, and National Pollutant Discharge Elimination System (NPDES) permit requirements—SMALL. AQUIFER RESTORATION—Activities would use existing (in-place) infrastructure, and impacts could result from spills or releases of untreated groundwater. Impacts would be minimized by spill prevention, identification, and response programs, and NPDES permit requirements—SMALL. DECOMMISSIONING—Decommissioning and reclamation activities could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Threatened or Endangered Species	4.3.5.3	CONSTRUCTION—Numerous threatened and endangered species and State Species of Concern are located in the region. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts depends on the size of a new facility or extension to an existing facility and the amount of land disturbance. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would reduce impacts—SMALL to MODERATE to LARGE—depending on site-specific habitat and presence of threatened or endangered species. OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts would depend on the size of a new facility or extension to an existing facility and the amount of land disturbance. Impacts could potentially result from spills or permitted effluents, but would be minimized by spill prevention measures, identification and response programs, and NPDES permit requirements. Inventory of threatened or endangered species developed during site-specific reviews would identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL to MODERATE—depending on site-specific habitat and presence of threatened or endangered species. AQUIFER RESTORATION—Impacts could result from individual takes due to conflicts with aquifer restoration activities (equipment, traffic). Existing (in-place) infrastructure would be used during aquifer restoration, so additional land-disturbing activities and habitat fragmentation would not be anticipated. Impacts may result from spills or releases of treated or untreated groundwater, but impacts would be minimized by spill prevention measures, identification, and response programs, and NPDES permit requirements. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL. DECOMMISSIONING—Impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures are demolished and removed and the ground surface is re-contoured. Inventory of threatened or endangered species developed during site-specific environmental review of the decommissioning plan would identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assit in identifying potential impacts. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Air Quality	4.3.6	CONSTRUCTION—Fugitive dust and combustion (vehicle and diesel) emissions during land-disturbing activities associated with construction would be small, short-term, and reduced through best management practices (e.g., dust suppression). For example, estimated fugitive dust emissions during ISL construction is less than 2 percent of the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and less than 1 percent for PM_{10}. For NAAQS attainment areas such as the Wyoming East Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no Prevention of Significant Deterioration (PSD) Class I areas in the Wyoming East Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation to reduce impacts—SMALL. OPERATION—Radiological impacts can result from dust releases from drying of lixiviant pipeline spills, radon releases from well system relief valves, resin transfer, or elution, and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials would be expected to be released based on operational controls and rapid response to spills. Required spill prevention, control, and response procedures would be used to minimize impacts from spills. High Efficiency Particulate Air (HEPA) filters and vacuum dryer designs reduce particulate emissions from operations and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program ensures releases would be within regulatory limits. Other potential nonradiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas such as the Wyoming East Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no PSD Class I areas in the Wyoming East Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions, or mitigation measures to reduce impacts—SMALL. AQUIFER RESTORATION—Because the same infrastructure would be used, air quality impacts are expected to be similar to, or less than, operations. For NAAQS attainment areas such as the Wyoming East Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no PSD Class I areas in the Wyoming East Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. DECOMMISSIONING—Fugitive dust, vehicle, and diesel emissions during land-disturbing activities associated with decommissioning would be similar to, or less than that associated with construction, short-term, and reduced through best management practices (e.g., dust suppression). These impacts would decrease as decommissioning and reclamation of disturbed areas are completed. For NAAQS attainment areas such as the Wyoming East Uranium Milling Region, nonradiological air quality impacts would be SMALL, and there are no PSD Class I areas in the Wyoming East Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	GEIS Section	Impact Findings
Noise	4.3.7	CONSTRUCTION—Noise generated during construction would be noticeable in proximity to operating equipment, but would be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. Traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, compressors) would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Noise may also adversely affect wildlife habitat and their reproductive success in immediate vicinity of construction activities. Noise levels decrease geometrically with distance, and at distances more than 300 m [1,000 ft], ambient noise levels would return to background levels. Wildlife generally avoid construction noise areas. The three uranium districts in the Wyoming East Uranium Milling Region are located in undeveloped rural areas, more than 300 m [1,000 ft] from the closest communities—SMALL to MODERATE. OPERATION—Noise-generating activities in the central uranium processing facility would be indoors, minimizing offsite sound levels. Well field equipment (e.g., pumps, compressors) would also be expected to be contained within structuress (e.g., header houses, satellite facilities) minimizing sound levels to offsite receptors. Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be expected to be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Most noise would be generated indoors and mitigated by regulatory compliance and best management practices. Noise from trucks and other vehicles is typically of short duration. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The three uranium districts in the Wyoming East Uranium Milling Region are located in undeveloped rural areas, at least 16 km [10 mi] from the closest communities—SMALL to MODERATE. AQUIFER RESTORATION—Noise generation is expected to be less than during construction and operations. Pumps and other well field equipment contained in buildings, minimizing sound levels to offsite receptors. Existing operational infrastructure would be used and traffic levels would be less than during construction and operations; however, relative increases to existing traffic levels from commuting may be more significant for lightly traveled rural roads through smaller communities. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The three uranium districts in the Wyoming East Uranium Milling Region are located in undeveloped rural areas, at least 16 km [10 mi] from the closest communities—SMALL to MODERATE. DECOMMISSIONING—Noise generated during decommissioning would be noticeable only in proximity to equipment and be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Noise levels during decommissioning would be expected to be less than during construction and would diminish as less and less equipment is used and truck traffic is reduced. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The three uranium districts in the Wyoming East Uranium Milling Region are located in undeveloped rural areas, at least 16 km [10 mi] from the closest communities—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Historical and Cultural	4.3.8	CONSTRUCTION—Potential impacts during ISL facility construction could include loss of, or damage and temporary restrictions on access to, historical, cultural, and archaeological resources. The eligibility evaluation of cultural resources for listing in the National Register of Historic Places (NRHP) under criteria in 36 CFR 60.4(a)–(d) and/or as Traditional Cultural Properties (TCPs) is conducted as part of the site-specific review and NRC licensing procedures undertaken during the National Environmental Policy Act (NEPA) review process. The evaluation of impacts to any historic properties designated as TCPs and tribal consultations regarding cultural resources and TCPs also occurs during the site-specific licensing application and review process. Consultation to determine whether significant cultural resources would be avoided or mitigated occurs during consultations with State Historic Preservation Offices (SHPOs), other governmental agencies (federal, state, and local), and Native American Tribes, including Tribal Historic Preservation Offices (THPOs) as part of the site-specific review. Additionally, as needed, the NRC license applicant would be required, under conditions in its NRC license, to adhere to procedures regarding the discovery of previously undocumented cultural resources during initial construction. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. OPERATION—Because less land disturbance occurs during the operations phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during operation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—Because less land disturbance occurs during the aquifer restoration phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during aquifer restoration. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. DECOMMISSIONING—Because less land disturbance occurs during the decommissioning phase and because decommissioning and reclamation activities would focus on previously disturbed areas, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during decommissioning and reclamation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions.

Topic/ Resource	GEIS Section	Impact Findings
Visual and Scenic	4.3.9	CONSTRUCTION—Visual impacts result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Most of the Wyoming East Uranium Milling Region is classified as Visual Resource Management (VRM) Class II through IV, and no VRM Class I or Prevention of Significant Deterioration (PSD) Class I areas are located in the region. Most potential visual impacts during construction would be expected to be temporary as equipment is moved, and would be mitigated by implementing best management practices (e.g., dust suppression). Because of the generally rolling topography of the region, most visual impacts during construction would not be visible from more than about 1 km [0.6 mi]. The uranium districts in the region are located more than 32 km [20 mi] from the closest VRM Class II region, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. OPERATION—Visual impacts during operations would be expected to be less than those associated with construction. Most of the well field surface infrastructure has a low profile, and most piping and cables would be buried. The tallest structures would include the central uranium processing facility {10 m [30 ft]} and power lines {6 m [20 ft]}. Because of the generally rolling topography of the region, most visual impacts during operations would not be expected to be visible from more than about 1 km [0.6 mi]. Irregular layout of well field surface structures such as wellhead protection and header houses would reduce visual contrast. Best management practices, design (e.g., painting buildings), and landscaping techniques would be used to mitigate potential visual impact. The two uranium districts in the region are located more than 32 km [20 mi] from the closest VRM Class II region, and the visual impacts associated with ISL construction would be expected to be consistent with the predominant VRM Class III and IV—SMALL. AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as or less than those during operations—SMALL. DECOMMISSIONING—Because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be the same as or less than those during construction. Most potential visual impacts during decommissioning would be expected to be temporary as equipment is moved, and mitigated by best management practices (e.g., dust suppression). Visual impacts would be low because these sites would be in sparsely populated areas and impacts would be expected to diminish as decommissioning activities decrease. An approved site reclamation plan is required prior to license termination, with the goal of returning the landscape to preconstruction condition (predominantly VRM Class III and IV). Some roadside cuts and hill slope modifications may, however, persist beyond decommissioning and reclamation—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Socioeconomics	4.3.10	CONSTRUCTION—Potential impacts to socioeconomics would result predominantly from employment at an ISL facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. Total peak employment would be about 200 people, including company employees and local contractors, depending on timing of construction with other stages of the ISL lifecycle. During construction of surface facilities and well fields, the general practice has been to use local contractors (drillers, construction) if available. A local multiplier of 0.7 would indicate a maximum of about 140 ancillary jobs could be created. For example, local building materials and building supplies would be used to the extent practical. Most employees would live in larger communities with access to more services. Some construction employees, however, would commute from outside the county to the ISL facility, and skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. Some of these employees would temporarily relocate to the project area and contribute to the local economy through purchasing goods and services and taxes. Because of the small relative size and temporary nature of the ISL construction workforce, net impacts would be SMALL to MODERATE, depending on proximity to less populated areas such as those in Niobrara or Albany Counties. OPERATION—Employment levels for ISL facility operations would be similar to, or less than for construction, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Additional revenues would be generated by federal, state, and local taxes on the facility and the uranium produced. Because of similar employment levels, other socioeconomic impacts would be expected to be similar to construction—SMALL to MODERATE, depending on proximity to less populated areas such as those in Niobrara or Albany Counties. AQUIFER RESTORATION—Because much of the same (in-place) infrastructure would be used, employment levels would be similar to, or less than, for operations, with total peak employment depending on timing and overlap with other activities during of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated areas such as those in Niobrara or Albany Counties. DECOMMISSIONING—A skill set similar to the construction workforce would be involved in dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/re-contouring the ground surface. Employment levels and use of local contractor support during decommissioning would be similar to or less than what would be required for construction. Employment would be expected to be temporary as decommissioning activities are limited in duration. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated areas such as those in Niobrara or Albany Counties.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Public and Occupational Health and Safety	4.3.11	CONSTRUCTION—Worker safety would be addressed by standard construction safety practices. Fugitive dust would result from construction activities and vehicle traffic but would likely be of short duration, and would not result in a radiological dose. Diesel emissions would not be a concern for worker or public health, because the releases would be of short duration and readily dispersed into the atmosphere—SMALL. OPERATION—Potential occupational radiological impacts from normal operations would be caused primarily by exposure to radon gas from the well field, ion exchange resin transfer operations, and venting during processing activities. Workers would also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation would occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures would be limited by NRC regulations at 10 CFR Part 20 that require licensees to implement an NRC-approved monitoring and radiation protection program. (Measured and calculated doses for workers and the public are commonly a fraction of regulated limits.) Non-radiological worker safety matters would be addressed through commonly applied occupational health and safety regulations and practices. Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. Consequences of accidents to workers and the public are generally low, with the exception of a dryer explosion, which could result in worker dose above NRC limits. The likelihood of such an accident would be low, and therefore, the risk would also be low. Potential non-radiological accidents impacts include high-consequence chemical release events (e.g., ammonia) for both workers and nearby populations. The likelihood of such release events would be low, based on historical operating experience at NRC-licensed facilities, which is partly the result of operators following commonly applied chemical safety and handling protocols—SMALL to MODERATE. AQUIFER RESTORATION—Because the activities during aquifer restoration overlap with similar operational activities (e.g., operation of well fields, waste water treatment and disposal) the types of impacts on public and occupational health and safety would be similar to operational impacts. The absence of some operational activities (e.g., yellowcake production and drying, remote ion exchange) further limits the relative magnitude of potential worker and public health and safety hazards—SMALL. DECOMMISSIONING—Worker and public health and safety would be addressed in a required Decommissioning Plan. This plan details how a 10 CFR Part 20-compliant radiation safety program would be implemented during decommissioning, to ensure safety of workers and the public, and to identify measures to comply with applicable safety regulations—SMALL.

Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Waste Management	4.3.12	CONSTRUCTION—The relatively small scale of construction activities (Section 2.3) and incremental development of well fields at ISL facilities would generate low volumes of construction waste—SMALL. OPERATION—Operational wastes primarily result from liquid waste streams including process bleed, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. State permitting actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public. Waste treatment such as reverse osmosis and radon settling would help in segregating wastes and minimizing disposal volumes. Potential impacts from surface discharge and deep well injection would be limited by the applicable permitting processes. NRC regulations address constructing, operating, and monitoring for leakage evaporation ponds used to store and reduce volumes of liquid wastes. Potential impacts from land application of treated wastewater would be addressed by NRC review of site-specific conditions prior to approval, routine monitoring, and inclusion of irrigated land areas in decommissioning surveys. Offsite waste disposal impacts would be SMALL for radioactive wastes as a result of required preoperational disposal agreements. Impacts for hazardous and municipal waste would be SMALL due to the volume of wastes generated. For remote areas with limited available disposal capacity, such wastes may need to be shipped greater distances to facilities that have capacity. However, the volume of wastes generated, and magnitude of such shipments, are estimated to be low—SMALL. AQUIFER RESTORATION—Waste management activities during aquifer restoration would utilize the same treatment and disposal options implemented for operations. Therefore, impacts associated with aquifer restoration would be similar to operational impacts. While the amount of waste water generated during aquifer restoration is dependent on site-specific conditions, the potential exists for additional generation of wastewater volume and associated treatment wastes during the restoration period. However, this would be offset to some degree by the reduction in production capacity from the removal of a well field. NRC review of future ISL facility applications would verify that sufficient water treatment and disposal capacity (and the associated agreement for disposal of byproduct material) are addressed. As a result, waste management impacts from aquifer restoration would be—SMALL. DECOMMISSIONING—Radioactive wastes from decommissioning ISL facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment) would be disposed of as byproduct material at an NRC-licensed facility. A preoperational agreement with a licensed disposal facility to accept radioactive wastes ensures sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required Decommissioning Plan, subject to NRC review . This plan details how a 10 CFR Part 20-compliant radiation safety program would be implemented during decommissioning, and how the safety of workers and the public would be maintained, as well as how applicable safety regulations would be complied with. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be small—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Land Use	4.4.1	CONSTRUCTION—Land use impacts could occur from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions (including limitations of other mineral extraction activities, grazing activities, or recreational activities). A higher percentage of private land ownership occurs in this region than in the Wyoming West Uranium Milling Region, and could increase the potential for land use conflicts with private land owners. Land disturbances during construction would be temporary and limited to specific areas within permitted area. Well sites, staging areas, and trenches would be reseeded and restored. Unpaved access roads would remain in use until decommissioning. Competing access to mineral rights could be either delayed for the duration of the ISL project or be intermixed with ISL operations (e.g., oil and gas exploration). Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the SMALL size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected, but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical and cultural resources, the potential impacts would be SMALL. Due to the potential for unidentified resources to be altered or destroyed during excavation, drilling, and grading, the potential impacts to ecological, historical or cultural resources would be SMALL to LARGE, depending on local conditions. OPERATION—The types of land use impacts for operational activities would be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not occur from conducting operational activities. Because access restriction and land disturbance related impacts would be be similar to, or less than, expected for construction, the overall potential impacts to land use from operational activities would be SMALL. AQUIFER RESTORATION—Due to the use of the same infrastructure, land use impacts would be similar to operations during aquifer restoration, although some operational activities would diminish—SMALL. DECOMMISSIONING—Land use impacts would be similar to those described for construction with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Reclamation of land to preexisting conditions and uses would help mitigate potential impacts—SMALL to MODERATE during decommissioning and SMALL, once decommissioning is completed.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Transportation	4.4.2	CONSTRUCTION—Low magnitude traffic generated by ISL construction relative to local traffic counts would not significantly increase traffic or accidents on many of the roads in the region. Existing low traffic roads could be moderately impacted by the additional worker commuting traffic during periods of peak employment. This impact would be more pronounced in the Nebraska-South Dakota-Wyoming Uranium Milling Region owing to the relatively lower traffic counts in this region, in comparison to the other milling regions. Moderate dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads)—SMALL to MODERATE. OPERATION—Low magnitude traffic relative to local traffic counts on most roads would not significantly increase traffic or accidents. Existing low traffic roads could be moderately impacted by commuting traffic during periods of peak employment including dust, noise, and possible incidental wildlife or livestock kill impacts on, or near, site access roads. High consequences would be possible for a severe accident involving transportation of hazardous chemicals in a populated area. However, the probability of such accidents occurring would be low owing to the limited number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion exchange resins, waste materials), compliance with transportation regulations would limit radiological risk for normal operations. Low radiological risk is estimated for accident conditions. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium—SMALL to MODERATE. AQUIFER RESTORATION—The magnitude of transportation activities would be lower than for construction and operations, with the exception of workforce commuting, which could have moderate impacts on, or near, existing low traffic roads—SMALL to MODERATE. DECOMMISSIONING—The types of transportation activities and, therefore, types of impacts would be similar to those discussed for construction and operations except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks would be bounded by operations yellowcake transportation risk estimates—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Geology and Soils	4.4.3	CONSTRUCTION—Disturbance to soil would occur from construction (clearing, excavation, drilling, trenching, road construction). However, such disturbances would be temporary and SMALL (approx. 10 percent of the total site area), and potential impacts would be mitigated by using best management practices. A large portion of the well fields, trenches, and access roads would be restored and reseeded after construction. Excavated soils would be stockpiled, seeded, and stored onsite until needed for reclamation fill. No impacts are expected to subsurface geological strata—SMALL. OPERATION—Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation, use of evaporation ponds, or land application of treated wastewater. However, detection and response techniques, monitoring of treated waste water, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to soils—SMALL. AQUIFER RESTORATION—Impacts to geology and soils from aquifer restoration activities would be similar to impacts from operations due to use of the same infrastructure and similar activities conducted (e.g., well field operation, transfer lines, waste water treatment and disposal)—SMALL. DECOMMISSIONING—Impacts to geology and soils from decommissioning would be similar to impacts from construction. Activities to clean up, recontour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to soils—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Surface Waters	4.4.4.1	CONSTRUCTION—Impacts to surface waters and related habitats from construction (road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment) would be mitigated through proper planning, design, construction methods, and best management practices. This region has a higher surface runoff (areal flow) than the Wyoming West Uranium Milling Region, and for that reason, could contribute to a slight increase in runoff-related impacts. Some impacts directly related to the construction activities would be temporary and limited to the duration of the construction period. U.S. Army Corps of Engineers permits may be required when filling and crossing of wetlands. Temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase. Incidental spills of drilling fluids into local streams would be SMALL and temporary, due to the implementation of mitigation measures. Impacts from construction of roads, parking areas, and buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces relatiproposed. Infiltration of drilling fluids into the local aquifer would be SMALL, temporary, and localized to a few feet around boreholes—SMALL to MODERATE depending on site-specific characteristics. OPERATION—Impacts from storm water runoff or direct discharge of produced waters (brine reject from reverse osmosis, or spent eluants from an ion exchange system) to surface waters would be regulatedby individual states through the National Pollutant Discharge Elimination System permits. Increased runoff compared to the Wyoming West Uranium Milling Region could potentially contribute to a slight increase in runoff-related impacts. Expansion of facilities or pipelines during operations would generate impacts similar to construction—SMALL to MODERATE depending on site-specific characteristics. AQUIFER RESTORATION—Impacts from aquifer restoration would be similar to impacts from operations due to use of in-place infrastructure and similar activities conducted (e.g., well field operation, transfer lines, water treatment, stormwater runoff)—SMALL to MODERATE depending on site-specific characteristics. DECOMMISSIONING—Impacts from decommissioning would be similar to impacts from construction. Activities to clean up, re-contour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to surface waters—SMALL to MODERATE depending on site-specific characteristics.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Water—Groundwater	4.4.4.2	CONSTRUCTION—Water use impacts would be limited by the small volumes of groundwater used for routine activities such as dust suppression, mixing cements, and drilling support over short and intermittent periods. Contamination of groundwater from construction activities would be expected to be mitigated by use of best management practices—SMALL to LARGE, depending on site-specific conditions. OPERATION—Potential impacts to shallow aquifers can occur from leaks or spills from surface facilities and equipment. Shallow aquifers are important sources of drinking water in some areas of the Nebraska-South Dakota-Wyoming Uranium Milling Region. Potential impacts to the ore-bearing and surrounding aquifers include consumptive water use and degradation of water quality (from normal production activities, off-normal excursion events, and deep well injection disposal practices). Consumptive use impacts from withdrawal of groundwater would be SMALL because only 1 to 3 percent of pumped groundwater is not returned to the aquifer (e.g., process bleed). However, this amount of lost water can be reduced substantially by currrently available treatment methods (e.g., reverse osmosis, brine concentration). Effects of water withdrawal on surface water would be SMALL, as the ore zone normally occurs in a confined aquifer. Estimated drawdown effects vary depending on site conditions and water treatment technology applied. Excursions of lixiviant and mobilized chemical constituents could occur from a failure of well seals or other operational conditions that cause incomplete recovery of lixiviant. Well-seal-related excursions would be detected by the groundwater monitoring system, and periodic well integrity testing and impacts would be mitigated during operation or aquifer restoration. Other excursions could result in plumes of mobilized uranium and heavy metals extending beyond the mineralization zone. The magnitude of potential impacts from vertical excursions would vary depending on site-specific conditions. To reduce the likelihood and consequences of potential excursions at ISL facilities, NRC requires licensees to take preventative measures prior to starting operations including well tests, monitoring, and development of procedures that include excursion response measures and reporting requirements. Alterations of ore body aquifer chemistry would be SMALLbecause the aquifer would: (1) be confined, (2) not be a potential drinking water source, and (3) be expected to be restored within statistical range of preoperational baseline water quality during the restoration period. Potential environmental impacts to confined deep aquifers below the production aquifers from deep well injection of processing wastes would be addressed by the underground injection permitting process regulated by the state—SMALL to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—Potential impacts would occur concerning consumptive use and potential deep disposal of brine slurries after reverse osmosis, if applicable. The volume of water removed from the aquifer and related impacts would be dependent on site-specific conditions and the type of water treatment technology the facility used. In some cases, groundwater consumptive use for the aquifer restoration has been reported to be less than groundwater use consumption during the ISL operation and drawdowns due to aquifer restorations have been smaller than drawdown caused by ISL operations. Potential environmental impacts associated with water consumption during aquifer restorations would be determined by: (1) the restoration techniques chosen, (2) the volume of water to be used, (3) the severity and extent of the contamination, and (4) the current and future use of the production and surrounding aquifers in the vicinity of the ISL facility or at the regional scale—SMALL to LARGE depending on site-specific conditions. DECOMMISSIONING—Potential impacts from decommissioning would be similar to construction (water use, spills) with an additional potential to mobilize contaminants during demolition and cleanup activities. Contamination of groundwater from decommissioning activities would be mitigated by implementation of an NRC-approved decommissioning plan and use of best management practices—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Terrestrial	4.4.5.1	CONSTRUCTION—Potential terrestrial ecology impacts would include the removal of vegetation from well fields, the milling site, the modification of existing vegetative communities, the loss of sensitive plants and habitats from clearing and grading; and the potential spread of invasive species and noxious weed populations. These impacts would be temporary because restoration and reseeding occur rapidly after the end of construction. Introduction of invasive species and noxious weeds would be possible but could be mitigated by restoration and reseeding after construction Shrub and tree removal would have a longer restoration period. Construction noise could affect reproductive success of sage grouse leks (in the Wyoming part of the region) by interfering with mating calls. Temporary displacement of animal species would be possible. Crucial wintering and year-long ranges are important to survival of big game and sage grouse. . Wildlife habitat fragmentation, temporary displacement of animal species, and direct or indirect mortalities would be possible. Implementation of wildlife surveys and mitigation measures following established guidelines would limit impacts. The magnitude of impacts depends on whether a new facility is being licensed or an existing facility is being extended—SMALL to MODERATE, depending on site-specific habitat. OPERATION—Habitat could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. However, the Wyoming Game and Fish Department specifies fencing construction techniques to minimize impediments to big game movement. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Temporary contamination or alteration of soils would be likely from operational leaks and spills or from land application of treated wastewater. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduces overall impacts—SMALL. AQUIFER RESTORATION—Impacts include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Contamination of soils could result from leaks and spills or land application of treated wastewater. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys, would reduce overall impacts—SMALL. DECOMMISSIONING—During decommissioning and reclamation, there would be a temporary disturbance to land (e.g., excavating soils, buried piping, removal of structures). However, revegetation and re-contouring would restore habitat altered during construction and operations. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation were completed and vegetation and habitat reestablished—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Ecology—Aquatic	4.4.5.2	CONSTRUCTION—Clearing and grading activities associated with construction could result in a temporary increase in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Clearing of riparian vegetation could affect light and temperature of water. Construction impacts to wetlands would be identified and managed through U.S. Army Corps of Engineers permits, as appropriate. Construction impacts to surface waters and aquatic species would be temporary and mitigated by best management practices—SMALL. OPERATION—Impacts could result from spills or releases into surface water. Impacts would be minimized by spill prevention, identification and response programs, and National Pollutant Discharge Elimination System (NPDES) permit requirements—SMALL. AQUIFER RESTORATION—Activities would use existing (in-place) infrastructure, and impacts could result from spills or releases of untreated groundwater. Impacts would be minimized by spill prevention, identification, and response programs, and NPDES permit requirements—SMALL. DECOMMISSIONING—Decommissioning and reclamation activities could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Threatened or Endangered Species	4.4.5.3	CONSTRUCTION—Numerous threatened and endangered species and State Species of Concern are located in the region. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts depends on the size of a new facility or extension to an existing facility and the amount of land disturbance. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would reduce impacts—SMALL to MODERATE to LARGE—depending on site-specific habitat and presence of threatened or endangered species. OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts would depend on the size of a new facility or extension to an existing facility and the amount of land disturbance. Impacts could potentially result from spills or permitted effluents, but would be minimized by implementing spill prevention measures, identification and response programs, and NPDES permit requirements. Inventory of threatened or endangered species developed during site-specific reviews would identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL to MODERATE—depending on site-specific habitat and presence of threatened or endangered species. AQUIFER RESTORATION—Impacts could result from individual takes due to conflicts with aquifer restoration activities (equipment, traffic). Existing (in-place) infrastructure would be used during aquifer restoration, so additional land-disturbing activities and habitat fragmentation would not be anticipated. Impacts may result from spills or releases of treated or untreated groundwater, but impacts would be minimized by implementing spill prevention measures, identification, and response programs, and NPDES permit requirements. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL. DECOMMISSIONING—Impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures are demolished and removed and the ground surface is re-contoured. Inventory of threatened or endangered species developed during site-specific environmental review of decommissioning plan would identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Topic/ Resource	GEIS Section	Impact Findings
Air Quality	4.4.6	CONSTRUCTION—Fugitive dust combustion (vehicle and diesel) emissions during land-disturbing activities associated with construction would be SMALL, short-term, and reduced through best management practices (e.g., dust suppression). For example, estimated fugitive dust emissions during ISL construction is less than 2 percent of the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and less than 1 percent for PM_{10}. For NAAQS attainment areas such as the Nebraska-South Dakota-Wyoming Uranium Milling Region, nonradiological air quality impacts would be SMALL. A Prevention of Significant Deterioration (PSD) Class I area exists (Wind Cave National Park, Black Hills, South Dakota)). More stringent air quality standards would apply to any facility that could potentially impact the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. OPERATION—Radiological impacts can result from dust releases from drying of lixiviant pipeline spills, radon releases from well system relief valves, resin transfer, or elution, and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials would be released based on operational controls and rapid response to spills. Required spill prevention, control, and response procedures would be used to minimize impacts from spills. HEPA filters and vacuum dryer designs reduce particulate emissions from operations and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program would ensure releases are within regulatory limits. Other potential nonradiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas such as the Nebraska-South Dakota-Wyoming Uranium Milling Region, nonradiological air quality impacts would be expected to be small. A PSDClass I area exists at Wind Cave National Park, South Dakota. More stringent air quality standards would apply to any facility that could potentially impact the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. AQUIFER RESTORATION—Because the same infrastructure would be used, air quality impacts are expected to be similar to, or less than, operations. For NAAQS attainment areas such as the Nebraska-South Dakota-Wyoming Uranium Milling Region, nonradiological air quality impacts would be SMALL. A PSD Class I area exists at Wind Cave National Park, South Dakota. More stringent air quality standards would apply to any facility that could potentially impact the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. DECOMMISSIONING—Fugitive dust, vehicle, and diesel emissions during land-disturbing activities associated with decommissioning would be similar to, or less than, construction, short-term, and reduced through use of best management practices (e.g., dust suppression). These impacts would decrease as decommissioning and reclamation of disturbed areas are completed. For NAAQS attainment areas such as the Nebraska-South Dakota-Wyoming Uranium Milling Region, nonradiological air quality impacts would be SMALL. A PSD Class I area exists at Wind Cave National Park, South Dakota. More stringent air quality standards would apply to any facility that could potentially impact the air quality of that area. If impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Noise	4.4.7	CONSTRUCTION—Noise generated during construction would be noticeable in proximity to operating equipment, but would temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. Traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, compressors) would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads inwell fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Noise may also adversely affect wildlife habitat and their reproductive success in immediate vicinity of construction activities. Noise levels decrease geometrically with distance, and at distances more than 300 m [1,000 ft], noise levels return to background. Wildlife would be anticipated to avoid construction areas. The three uranium districts within the Nebraska-South Dakota-Wyoming Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE. OPERATION—Noise-generating activities in the central uranium processing facility would be indoors, minimizing offsite sound levels. Well field equipment (e.g., pumps, compressors) would also be contained within structures (e.g., header houses, satellite facilities) minimizing sound levels to offsite receptors. Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Most noise would be generated indoors and mitigated by regulatory compliance and use of best management practices. Noise from trucks and other vehicles is typically of short duration. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The three uranium districts within the Nebraska-South Dakota-Wyoming Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE. AQUIFER RESTORATION—Noise generation is expected to be less than during construction and operations. Pumps and other well field equipment contained in buildings and minimize sound levels to offsite receptors. Existing operational infrastructure would be used and traffic levels would be less than during construction and operations. There are additional sensitive areas that should be considered within this region, but because of decreasing noise levels with distance, construction activities would have only SMALL and temporary noise impacts for residences, communities, or sensitive areas located more than 300 m [1,000 ft] from specific noise generating activities. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The three uranium districts within the Nebraska-South Dakota-Wyoming Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE. DECOMMISSIONING—Noise generated during decommissioning would be noticeable only in proximity to operating equipment and be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits, and mitigated by use of personal hearing protection. Noise levels during decommissioning would be expected to be less than during construction and would diminish as less and less equipment is used and truck traffic is reduced. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The three uranium districts within the Nebraska-South Dakota-Wyoming Uranium Milling Region are generally more than 300 m [1,000 ft] from the closest community—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Historical and Cultural	4.4.8	CONSTRUCTION—Potential impacts during ISL facility construction could include loss of, or damage and temporary restrictions on access to, historical, cultural, and archaeological resources. The eligibility evaluation of cultural resources for listing in the National Register of Historic Places (NRHP) under criteria in 36 CFR 60.4(a)–(d) and/or as Traditional Cultural Properties TCPs) is conducted as part of the site-specific review and NRC licensing procedures undertaken during the National Environmental Policy Act (NEPA) review process. The evaluation of impacts to any historic properties designated as TCPs and tribal consultations regarding cultural resources and TCPs also occurs during the site-specific licensing application and review process. Consultation to determine whether significant cultural resources would be avoided or mitigated occurs during consultations with State Historic Preservation Offices (SHPOs), other governmental agencies (federal, state, and local), and Native American Tribes, including Tribal Historic Preservation Offices (THPOs) as part of the site-specific review. Additionally, as needed, the NRC license applicant would be required, under conditions in its NRC license, to adhere to procedures regarding the discovery of previously undocumented cultural resources during initial construction. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. OPERATION—Because less land disturbance occurs during the operations phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during operation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE depending on site-specific conditions. AQUIFER RESTORATION—Because less land disturbance occursduring the aquifer restoration phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during aquifer restoration. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. DECOMMISSIONING—Because less land disturbance would be anticipated during the decommissioning phase and because decommissioning and reclamation activities would be focused on previously disturbed areas, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during decommissioning and reclamation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	GEIS Section	Impact Findings
Visual and Scenic	4.4.9	CONSTRUCTION—Visual impacts can result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Most of the Nebraska-South Dakota-Wyoming Uranium Milling Region is classified as Visual Resource Management (VRM) Class II through IV. Most potential visual impacts during construction would be expected to be temporary as equipment is moved, and would be mitigated by use of best management practices (e.g., dust suppression). Because of the generally rolling topography of the region, most visual impacts during construction would not be visible from more than 1 km [0.6 mi]. The three uranium districts in the region are located more than 16 km [10 mi] from the closest VRM Class II region and 40 km [25 mi] from the Prevention of Significant Deterioration PSD Class I area at Wind Cave National Park in South Dakota. The visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. OPERATION—Visual impacts during operations would be expected to be less than those associated with construction. Most of the well field surface infrastructure has a low profile, and most piping and cables would be buried. The tallest structures would include the central uranium processing facility {10 m [30 ft]} and power lines {6 m [20 ft]}. Because of the generally rolling topography of the region, most visual impacts during operations would not be visible from more than about 1 km [0.6 mi]. Irregular layout of well field surface structures such as wellhead protection and header houses would reduce visual contrast. Best management practices, design (e.g., painting buildings), and landscaping techniques would be used to mitigate potential visual impact. The three uranium districts in the region are located more than 16 km [10 mi] from the closest VRM Class II region and 40 km [25 mi] from the PSD Class I area at Wind Cave National Park in South Dakota. The visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as, or less than, during operations—SMALL. DECOMMISSIONING SMALL—Because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be the same as or less than those during construction. Most potential visual impacts during decommissioning would be temporary as equipment is moved and mitigated by use of best management practices (e.g., dust suppression). Visual impacts would be low because these sites would be in sparsely populated areas, and impacts would diminish as decommissioning activities decrease. An approved site reclamation plan is required prior to license termination, with the goal of returning the landscape to preconstruction condition (predominantly VRM Class III and IV). Some roadside cuts and hill slope modifications may, however, persist beyond decommissioning and reclamation—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Socioeconomics	4.4.10	CONSTRUCTION—Potential impacts to socioeconomics would result predominantly from employment at an ISL facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. Total peak employment would be about 200, people including company employees and local contractors, depending on timing of construction with other stages of the ISL lifecycle. During construction of surface facilities and well fields, the general practice has been to use local contractors (drillers, construction) if available. A local multiplier of 0.7 would indicate a maximum of about 140 ancillary jobs could be created. For example, local building materials and building supplies would be used to the extent practical. Most employees would live in larger communities with access to more services. Some construction employees, however, would commute from outside the county to the ISL facility, and skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. Some of these employees would temporarily relocate to the project area and contribute to the local economy through purchasing goods and services and taxes. Because of the relative limited size of the ISL workforce, net impacts would be SMALL to MODERATE, depending on proximity to less populated communities such as Oglala, Pine Ridge, and Sioux City. OPERATION—Employment levels for ISL facility operations would be similar to, or less than, for construction, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Additional revenues would be expected to be generated by federal, state, and local taxes on the facility and the uranium produced. Because of similar employment levels, other socioeconomic impacts would be expected to be similar to construction—SMALL to MODERATE, depending on proximity to smaller communities such as Oglala, Pine Ridge, and Sioux City. AQUIFER RESTORATION—Because much of in-place infrastructure would be used, employment levels would be similar to, or less than, for operations, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as Oglala, Pine Ridge, and Sioux City. DECOMMISSIONING—A skill set similar to the construction workforce would be involved in dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/recontouring the ground surface. Employment levels and use of local contractor support during decommissioning would be similar to or less than what would be required for construction. Employment would be temporary as decommissioning activities are limited in duration. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as Oglala, Pine Ridge, and Sioux City.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Public and Occupational Health and Safety	4.4.11	CONSTRUCTION—Worker safety would be addressed by standard construction safety practices. Fugitive dust would result from construction activities and vehicle traffic, but would likely be of short duration, and not result in a radiological dose. Diesel emissions would not be a concern for worker or public health, because the releases would be of short duration and readily dispersed into the atmosphere—SMALL. OPERATION—Potential occupational radiological impacts from normal operations would be caused primarily by exposure to radon gas from well field, ion-exchange resin transfer operations, and venting during processing activities. Workers would also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation would occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures would be addressed by NRC regulations at 10 CFR Part 20 which require licensees to implement an NRC-approved radiation protection program. (Measured and calculated doses for workers and the public are commonly a fraction of regulated limits.) Non-radiological worker safety matters would be addressed through commonly applied occupational health and safety regulations and practices. Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. Consequences of accidents to workers and the public are generally low, with the exception of a dryer explosion, which could result in worker dose above NRC limits. The likelihood of such an accident would be low, and therefore the risk would also be low. Potential non-radiological accidents impacts include, high-consequence chemical release events (e.g., ammonia) for both workers and nearby populations. The likelihood of such release events would be low, based on historical operating experience at NRC-licensed facilities, which is partly the result of operators following commonly applied chemical safety and handling protocols—SMALL to MODERATE. AQUIFER RESTORATION—Because the activities during aquifer restoration overlap with similar operational activities (e.g., operation of well fields, waste water treatment and disposal) the types of impacts on public and occupational health and safety would be similar to operational impacts. The absence of some operational activities (e.g., yellowcake production and drying, remote ion exchange) further limits the relative magnitude of potential worker and public health and safety hazards—SMALL. DECOMMISSIONING—Worker and public health and safety would be addressed in a required Decommissioning Plan. This plan details how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning, and how to ensure the safety of workers and the public be maintained, as well as how applicable safety regulations would be complied with—SMALL.

Topic/ Resource	GEIS Section	Impact Findings
Waste Management	4.4.12	CONSTRUCTION—The relatively small scale of construction activities (Section 2.3) and incremental development of well fields at ISL facilities would generate low volumes of construction waste—SMALL. OPERATION—Operational wastes primarily result from liquid waste streams including process bleed, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. State permitting actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public. Waste treatment such as reverse osmosis and radon settling would help in segregating wastes and minimizing disposal volumes. Potential impacts from surface discharge and deep well injection would be limited by the applicable permitting processes. NRC regulations address constructing, operating, and monitoring for leakage evaporation ponds used to store and reduce volumes of liquid wastes. Potential impacts from land application of treated wastewater would be addressed by NRC review of site-specific conditions prior to approval, routine monitoring, and inclusion of irrigated land areas in decommissioning surveys. Offsite waste disposal impacts would be SMALL for radioactive wastes as a result of required preoperational disposal agreements. Impacts for hazardous and municipal waste would be SMALL due to the volume of wastes generated. For remote areas with limited available disposal capacity, such wastes may need to be shipped greater distances to facilities that have capacity. However, the volume of wastes generated, and magnitude of the shipments, are estimated to be—SMALL. AQUIFER RESTORATION—Waste management activities during aquifer restoration would utilize the same treatment and disposal options implemented for operations. Therefore, impacts associated with aquifer restoration would be similar to operational impacts. While the amount of wastewater generated during aquifer restoration is dependent on site-specific conditions, the potential exists for additional generation of wastewater volume and associated treatment wastes during the restoration period. However, this would be offset to some degree by the reduction in production capacity from the removal of a well field. NRC review of future ISL facility applications would verify that sufficient water treatment and disposal capacity (and the associated agreement for disposal of byproduct material) are addressed. As a result, waste management impacts from aquifer restoration would be—SMALL. DECOMMISSIONING—Radioactive wastes from decommissioning ISL facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment) would be disposed of as byproduct material at an NRC-licensed facility. A preoperational agreement with a licensed disposal facility to accept radioactive wastes ensures sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required Decommissioning Plan, subject to NRC review. This plan would detail how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning, how to ensure safety of workers and the public would be maintained, and how applicable safety regulations would be complied with. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be—SMALL.

Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued)

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region

Topic/ Resource	GEIS Section	Impact Findings
Land Use	4.5.1	CONSTRUCTION—Land use impacts could occur from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions (including limitations of other mineral extraction activities, grazing activities, or recreational activities). A higher percentage of private land and Native American land ownership occurs in this region than in the Wyoming West Uranium Milling Region, and a more complex patchwork of land ownership could increase the potential for land use conflicts with private and other land owners. Land disturbances during construction would be temporary, but limited to specific locations within permitted site. Well sites, staging areas, and trenches would be reseeded and restored after construction. Unpaved access roads would remain in use until decommissioning is completed. Competing access to mineral rights could be either delayed for the duration of the ISL project or be intermixed with ISL operations (e.g., oil and gas exploration). Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the SMALL size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected but would be minimized due to careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical and cultural resources, the potential impacts would be SMALL. Due to the potential for unidentified resources to be altered or destroyed during excavation, drilling, and grading, the potential impacts to ecological, historical or cultural resources would be SMALL to LARGE, depending on local conditions. OPERATION—The types of land use impacts for operational activities would be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not occur from conducting operational activities. Because access restriction and land disturbance related impacts would be expected to be similar to, or less than, expected for construction, the overall potential impacts to land use from operational activities would be SMALL. AQUIFER RESTORATION—Due to the use of the same infrastructure, land use impacts would be similar to operations during aquifer restoration, although some operational activities would diminish—SMALL. DECOMMISSIONING—Land use impacts would be similar to those described for construction with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Reclamation of land to preexisting conditions and uses would help mitigate potential impacts—SMALL to MODERATE during decommissioning and SMALL, once decommissioning is completed.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Transportation	4.5.2	CONSTRUCTION—Low magnitude traffic generated by ISL construction relative to local traffic counts would not significantly increase traffic or accidents on many of the roads in the region. Existing low traffic roads could be MODERATEly impacted by the additional worker commuting traffic during periods of peak employment. The impact would be more pronounced in areas of low traffic counts. MODERATE dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads)—SMALL to MODERATE. OPERATION—Low magnitude traffic relative to local traffic counts on most roads would not significantly increase traffic or accidents. Existing low traffic roads could be moderately impacted by commuting traffic during periods of peak employment including dust, noise, and possible incidental wildlife or livestock kill impacts on, or near, site access roads. High consequences would be possible for a severe accident involving transportation of hazardous chemicals in a populated area. However, the probability of such accidents occurring would be low, owing to the limited number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion exchange resins, waste materials), compliance with transportation regulations would limit radiological risk for normal operations. Consequently, there is low radiological risk associated with accident conditions. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium—SMALL to MODERATE. AQUIFER RESTORATION—The magnitude of transportation activities would be lower than for construction and operations, with the exception of workforce commuting, which could have moderate impacts on, or near, existing low traffic roads—SMALL to MODERATE. DECOMMISSIONING—The types of transportation activities and, therefore, types of impacts would be similar to those discussed for construction and operations except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks would be bounded by operations yellowcake transportation risk estimates—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Geology and Soils	4.5.3	CONSTRUCTION—Disturbance to soil would occur from construction (clearing, excavation, drilling, trenching, road construction). However, such disturbances would be temporary and SMALL (approx. 10 percent of the total site area), and potential impacts would be mitigated by using best management practices. The well fields, trenches, and access roads would be restored and reseeded after construction has been completed. Excavated soils would be stockpiled, seeded, and stored on site until needed for reclamation fill. No impacts are expected to subsurface geological strata—SMALL. OPERATION—Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation, use of evaporation ponds, or land application of treated wastewater. However, detection and response techniques, monitoring of treated wastewater, and eventual survey and decommissioning of all potentially impacted soils would limit the magnitude of overall impacts to soils—SMALL. AQUIFER RESTORATION—Impacts to geology and soils from aquifer restoration activities would be similar to impacts from operations due to use of the same infrastructure and similar activities conducted (e.g., well field operation, transfer lines, waste water treatment and disposal)—SMALL. DECOMMISSIONING—Impacts to geology and soils from decommissioning would be expected to be similar to impacts from construction. Activities to clean up, re-contour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to soils—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Surface Waters	4.5.4.1	CONSTRUCTION—Impacts to surface waters and related habitats from construction (road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment) would be mitigated through proper planning, design, construction methods, and best management practices. This region experiences less runoff per given area (areal flow per square mile) than the Wyoming West Uranium Milling Region. As a result, the potential for runoff-related impacts would be less. Some impacts directly related to the construction activities would be temporary and limited to the duration of the construction period. U.S. Army Corps of Engineers permits may be required when filling and crossing of wetlands. Temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase. Incidental spills of drilling fluids into local streams would be SMALL and temporary, due to implementation of mitigation measures. Impacts from construction of roads, parking areas, and buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces proposed. Infiltration of drilling fluids into the local aquifer would also be SMALL, temporary, and localized to a few feet around boreholes—SMALL to MODERATE depending on site-specific characteristics. OPERATION—Impacts from storm water runoff or direct discharge of produced waters (brine reject from reverse osmosis, or spent eluants from an ion exchange system) to surface waters would be regulated by a state or EPA-issued National Pollutant Discharge Elimination System (NPDES) permit. . Expansion of facilities or pipelines during operations would generate impacts similar to construction—SMALL to MODERATE depending on site-specific characteristics. AQUIFER RESTORATION—Impacts from aquifer restoration would be similar to impacts from operations due to use of in-place infrastructure and similar activities conducted (e.g., well field operation, transfer lines, water treatment, storm water runoff)—SMALL to MODERATE depending on site-specific characteristics. DECOMMISSIONING—Impacts from decommissioning would be similar to impacts from construction. Activities to cleanup, re-contour, and reclaim disturbed lands during decommissioning would mitigate long-term impacts to surface waters—SMALL to MODERATE depending on site-specific characteristics.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Water—Groundwater	4.5.4.2	CONSTRUCTION—Water use impacts would be limited by the small volumes of groundwater used for routine activities such as dust suppression, mixing cements, and drilling support over short and intermittent periods. Contamination of groundwater from construction activities would be mitigated by use of best management practices—SMALL to LARGE, depending on site-specific conditions. OPERATION—Potential impacts to shallow aquifers can occur from leaks or spills from surface facilities and equipment. Shallow aquifers are important sources of drinking water in some areas of the Northwestern New Mexico Uranium Milling Region. Potential impacts to the ore-bearing and surrounding aquifers include consumptive water use and degradation of water quality (from normal production activities, off-normal excursion events, and deep well injection disposal practices). Consumptive use impacts from withdrawal of groundwater would occur because approximately 1 to 3 percent of pumped groundwater would not be returned to the aquifer, due mostly to process bleed. However, this amount of lost water could be reduced substantially by currently available treatment methods (e.g., reverse osmosis, brine concentration). Effects of water withdrawal on surface water would be SMALL, as the ore zone normally occurs in a confined aquifer. Estimated drawdown effects vary depending on site conditions and water treatment technology applied. Excursions of lixiviant and mobilized chemical constituents could occur from failure of well seals or other operational conditions that result in incomplete recovery of lixiviant. Well-seal-related excursions would be detected by the groundwater monitoring system, and periodic well integrity testing and impacts would be mitigated during operation or aquifer restoration. Other excursions could result in plumes of mobilized uranium and heavy metals extending beyond the mineralization zone. The magnitude of potential impacts from vertical excursions would vary depending on site-specific conditions. To reduce the likelihood and consequences of potential excursions at ISL facilities, NRC requires licensees to take preventative measures prior to starting operations including well tests, monitoring, and development of procedures that include excursion response measures and reporting requirements. Alterations of ore body aquifer chemistry would be SMALL because the aquifer would: (1) be confined, (2) not be a potential drinking water source, and (3) be restored within statistical range of preoperational baseline water quality during the restoration period. Potential environmental impacts to confined deep aquifers below the production aquifers from deep well injection of processing wastes would be addressed by the underground injection permitting process regulated by the state of New Mexico—SMALL to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—There would be potential groundwater impacts resulting from consumptive use and potential deep disposal of brine slurries after reverse osmosis, if applicable. The volume of water removed from the aquifer and related impacts would be dependent on site-specific conditions and the type of water treatment technology the facility used. In some cases, groundwater consumptive use for the aquifer restoration has been reported to be less than groundwater use consumption during the ISL operation and drawdowns due to aquifer restorations have been less than drawdown caused by ISL operations. Potential environmental impacts associated with water consumption during aquifer restorations would be determined by: (1) the restoration techniques chosen, (2) the volume of water to be used, (3) the severity and extent of the contamination, and (4) the current and future use of the production and surrounding aquifers in the vicinity of the ISL facility or at the regional scale—SMALL to LARGE, depending on site-specific conditions. DECOMMISSIONING—Potential impacts from decommissioning would be similar to construction (water use, spills) with an additional potential to mobilize contaminants during demolition and cleanup activities. Contamination of groundwater from decommissioning activities would be mitigated by implementation of an NRC-approved decommissioning plan and use of best management practices—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Terrestrial	4.5.5.1	CONSTRUCTION—Potential terrestrial ecology impacts would include the removal of vegetation from well fields, the milling site, the modification of existing vegetative communities, the loss of sensitive plants and habitats from clearing and grading, and the potential spread of invasive species and noxious weed populations. These impacts would be temporary because restoration and reseeding occur rapidly at the completion of construction. Introduction of invasive species or noxious weeds would be possible but could be mitigated by restoration and reseeding after construction. Shrub and tree removal would require a longer restoration period. Construction noise could affect reproductive success of sage grouse leks by interfering with mating calls. In addition ttemporary displacement of animal species is also possible. Critical wintering habitats vital for survival of local elk populations are located within the region. Raptors breeding onsite may be impacted by construction activities or mining operations and may be temporarily impacted depending on the time of year construction activities occur. Wildlife habitat fragmentation, temporary displacement of animal species, and direct or indirect mortalities are also possible. Implementation of wildlife surveys and mitigation measures following established guidelines would limit impacts. The magnitude of impacts depends on whether a new facility is being licensed or an existing facility is being extended—SMALL to MODERATE, depending on site-specific habitat affected. OPERATION—Habitat could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) could limit impacts. Temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation or land application of treated wastewater. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduce overall impacts—SMALL. AQUIFER RESTORATION—Impacts include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing, netting, and periodic wildlife surveys (e.g., raptor surveys) would limit impacts. Contamination of soils result from leaks and spills, or land application of treated waste water. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and periodic wildlife surveys would reduce overall impacts—SMALL. DECOMMISSIONING—During decommissioning and reclamation, there would be a temporary disturbance to land (e.g., excavating soils, buried piping, removal of structures). However, revegetation and re-contouring would restore habitat altered during construction and operations. Wildlife would be temporarily displaced, but are anticipated to return after decommissioning and reclamation were complete and vegetation and habitat is reestablished—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Aquatic	4.5.5.2	CONSTRUCTION—Clearing and grading activities associated with construction could result in a temporary increase in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Clearing of riparian vegetation could affect light and temperature of water. Construction impacts to wetlands would be identified and managed through U.S. Army Corps of Engineers permits, as appropriate. Construction impacts to surface waters and aquatic species would be temporary and mitigated by use of best management practices—SMALL. OPERATION—Impacts could result from spills or releases into surface water. Impacts would be minimized by spill prevention, identification and response programs, and National Pollutant Discharge Elimination System (NPDES) permit requirements—SMALL. AQUIFER RESTORATION—Activities would use existing (in-place) infrastructure, and impacts could result from spills or releases of untreated groundwater. Impacts would be minimized by spill prevention, identification, and response programs, and NPDES permit requirements—SMALL. DECOMMISSIONING—Decommissioning and reclamation activities could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Ecology—Threatened or Endangered Species	4.5.5.3	CONSTRUCTION—Numerous threatened and endangered species and State Species of Concern are located in the region. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts depends on the size of a new facility or extension to an existing facility and the amount of land disturbance. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations conducted with U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL to MODERATE to LARGE—depending on site-specific habitat and presence of threatened or endangered species. OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur, but most species readapt quickly. The magnitude of impacts would depend on the size of a new facility or extension to an existing facility and the amount of land disturbance. Impacts could potentially result from spills or permitted effluents, but would be limited by spill prevention measures, identification and response programs, and NPDES permit requirements. Inventory of threatened or endangered species developed during site-specific reviews would identify unique or special habitats, and Endangered Species Act consultations conducted with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL to MODERATE—depending on site-specific habitat and presence of threatened or endangered species. AQUIFER RESTORATION—Impacts could result from individual takes due to conflicts with aquifer restoration activities (equipment, traffic). Existing (in-place) infrastructure would be used during aquifer restoration, so additional land-disturbing activities and habitat fragmentation would not occur. Impacts may result from spills or releases of treated or untreated groundwater, but would be limited by spill prevention measures, identification, and response programs, and NPDES permit requirements. Inventory of threatened or endangered species would be developed during site-specific reviews to identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts—SMALL. DECOMMISSIONING—Impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures were demolished and removed and the ground surface re-contoured. Inventory of threatened or endangered species developed during site-specific environmental review of Decommissioning Plan would identify unique or special habitats, and Endangered Species Act consultations with the U.S. Fish and Wildlife Service would assist in identifying potential impacts. With completion of decommissioning, revegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Air Quality	4.5.6	CONSTRUCTION—Fugitive dust and combustion (vehicle and diesel) emissions during land-disturbing activities associated with construction would be SMALL, short-term, and reduced through use of best management practices (e.g., dust suppression). For example, estimated fugitive dust emissions during ISL construction is less than 2 percent of the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and less than 1 percent for PM_{10}. For NAAQS attainment areas such as the Northwestern New Mexico Uranium Milling Region, nonradiological air quality impacts would be SMALL. There are no Prevention of Significant Deterioration (PSD) Class I areas in the Northwestern New Mexico Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. OPERATION—Radiological impacts can result from dust releases from drying of lixiviant pipeline spills, radon releases from well system relief valves, resin transfer, or elution, and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials would be released based on operational controls and rapid response to spills. Required spill prevention, control, and response procedures would be used to minimize impacts from spills. HEPA filters and vacuum dryer designs reduce particulate emissions from operations and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program would ensure releases are within regulatory limits. Other potential nonradiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas such as the Northwestern New Mexico Uranium Milling Region, nonradiological air quality impacts would be SMALL. There are no PSD Class I areas in the Northwestern New Mexico Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. AQUIFER RESTORATION—Because the same (in-place) infrastructure would be used, air quality impacts would be similar to, or less than, operations. For NAAQS attainment areas such as the Northwestern New Mexico Uranium Milling Region, nonradiological air quality impacts would be SMALL. There are no PSD Class I areas in the Northwestern New Mexico Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL. DECOMMISSIONING—Fugitive dust and combustion (vehicle and diesel) emissions during land disturbing activities associated with decommissioning would be similar to, or less than, associated with construction, be short-term, and reduced through use of best management practices (e.g., dust suppression). These impacts would decrease as decommissioning and reclamation of disturbed areas are completed. For NAAQS attainment areas such as the Northwestern New Mexico Uranium Milling Region, nonradiological air quality impacts would be SMALL. There are no PSD Class I areas in the Northwestern New Mexico Uranium Milling Region. Furthermore, if impacts were initially assessed at a higher significance level, permit requirements would impose conditions or mitigation measures to reduce impacts—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Noise	4.5.7	CONSTRUCTION—Noise generated during construction would be noticeable in proximity to operating equipment, but would be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. Traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, compressors) would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Noise may adversely affect wildlife habitat and their reproductive success in immediate vicinity of construction activities. Noise levels decrease geometrically with distance, and at distances more than 300 m [1,000 ft], ambient noise levels return to background. Wildlife generally avoid construction noise areas. The uranium districts within the Northwestern New Mexico Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE. OPERATION—Noise-generating activities in the central uranium processing facility would be indoors, minimizing offsite sound levels. Well field equipment (e.g., pumps, compressors) would also be contained within structures (e.g., header houses, satellite facilities) minimizing sound levels to offsite receptors. Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and mitigated by use of personal hearing protection. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be SMALL for larger roads, but may be MODERATE for lightly traveled rural roads through less populated communities. Most noise would be generated indoors, and mitigated by regulatory compliance and use of best management practices. Noise from trucks and other vehicles is typically of short duration. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The uranium districts within the Northwestern New Mexico Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE. AQUIFER RESTORATION—Noise generation is expected to be less than during construction and operations. Pumps and other well field equipment contained in buildings, minimize sound levels to offsite receptors. Existing operational infrastructure would be used and traffic levels would be less than during construction and operations. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The uranium districts within the Northwestern New Mexico Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE. DECOMMISSIONING—Noise generated during decommissioning would be noticeable in proximity to operating equipment, but would be temporary (typically daytime only). Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits, and mitigated by use of personal hearing protection. Noise levels during decommissioning would be expected to be less than during construction and would diminish as less and less equipment is used and truck traffic is reduced. Noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft]. The uranium districts within the Northwestern New Mexico Uranium Milling Region are more than 300 m [1,000 ft] from the closest community—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Historical and Cultural	4.5.8	CONSTRUCTION—Potential impacts during ISL facility construction could include loss of, or damage and temporary restrictions on access to, historical, cultural, and archaeological resources. Prominent cultural resources in the Northwestern New Mexico Uranium Milling Region include culturally significant landscapes such as Mt. Taylor. The eligibility evaluation of cultural resources for listing in the National Register of Historic Places (NRHP) under criteria in 36 CFR 60.4(a)–(d) and/or as Traditional Cultural Properties (TSPs) is conducted as part of the site-specific review and NRC licensing procedures undertaken during the National Environmental Policy Act (NEPA) review process. The evaluation of impacts to any historic properties designated as TSPs and tribal consultations regarding cultural resources and TSPs also occurs during the site-specific licensing application and review process. To determine whether significant cultural resources would be avoided or mitigated, consultations occur with the State Historic Preservation Office, other governmental agencies (federal, state, and local), and Native American Tribes, including Tribal Historic Preservation Offices (THPOs) during the site-specific review process. Additionally, as needed, the NRC license applicant is required, under conditions in its NRC license, to adhere to procedures regarding the discovery of previously undocumented cultural resources during initial construction. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to appropriate mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. OPERATION—Because less land disturbance occurs during the operations phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during operation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. AQUIFER RESTORATION—Because less land disturbance would occur during the aquifer restoration phase, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during aquifer restoration. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions. DECOMMISSIONING—Because less land disturbance would occurs during the decommissioning phase and because decommissioning and reclamation activities would focus on previously disturbed areas, potential impacts to historical, cultural, and archaeological resources would be less than during construction. Conditions in the NRC license requiring adherence to procedures regarding the discovery of previously undocumented cultural resources would apply during decommissioning and reclamation. These procedures typically require the licensee to stop work and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures—SMALL or MODERATE to LARGE, depending on site-specific conditions.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)

Topic/ Resource	GEIS Section	Impact Findings
Visual and Scenic	4.5.9	CONSTRUCTION—Visual impacts result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Most of the Northwestern New Mexico Uranium Milling Region is classified as Visual Resource Management (VRM) Class II through IV. A number of VRM Class II areas surrounding the national monuments (El Morro and El Malpais), the Chaco Culture National Historic Park, and the sensitive areas managed within the Mt. Taylor district of the Cibola National Forest would have the greatest potential for impacts to visual resources. Most of these areas, however, are located to the north, south, and east of the potential ISL facilities, at distances of 16 km [10 mi] or more. The facilities would be located in VRM Class III and IV areas. Current understanding indicates that several potential ISL facilities may be located near the Navajo Nation or near Mt Taylor in the San Mateo Mountains. The general visual and scenic impacts associated with ISL facility construction would be temporary and SMALL, but from a Native American perspective, any construction activities would likely to result in adverse impacts to the landscape, particularly for facilities located in areas within view of tribal lands and areas of special significance such as Mt. Taylor. Most potential visual impacts during construction would be temporary as equipment is moved and would be mitigated by use of best management practices (e.g., dust suppression). Because of the generally rolling topography of the region, most visual impacts during construction would not be visible from more than 1 km [0.6 mi]. The visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. OPERATION—Visual impacts during operations would be less than those associated with construction. Most of the well field surface infrastructure has a low profile, and most piping and cables would be buried. The tallest structures would include the central uranium processing facility {10 m [30 ft]} and power lines {6 m [20 ft]}. Because of the generally rolling topography of the region, most visual impacts during operations would not be visible from more than about 1 km [0.6 mi]. Irregular layout of well field surface structures such as wellhead protection and header houses would reduce visual contrast. Best management practices, design (e.g., painting buildings) and landscaping techniques would be used to mitigate potential visual impact. The uranium districts in the region are located more than 16 km [10 mi] from the closest VRM Class II region, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL. AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as, or less than, during operations—SMALL. DECOMMISSIONING SMALL—Because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be the same as or less than those during construction. Most potential visual impacts during decommissioning would be temporary as equipment is moved, and mitigated by use of best management practices (e.g., dust suppression). Visual impacts would be low because these sites are in sparsely populated areas and impacts would diminish as decommissioning activities decrease. An approved site reclamation plan would be required prior to license termination, with the goal of returning the landscape to preconstruction condition (predominantly VRM Class III and IV). Some roadside cuts and hill slope modifications, hoever, may persist beyond decommissioning and reclamation—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	GEIS Section	Impact Findings
Socioeconomics	4.5.10	CONSTRUCTION—Potential impacts to socioeconomics would result predominantly from employment at an ISL facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. Total peak employment would be about 200 people, including company employees and local contractors, depending on timing of construction with other stages of the ISL lifecycle. During construction of surface facilities and well fields, the general practice has been to use local contractors (drillers, construction) if available. A local multiplier of 0.7 would indicate a maximum of about 140 ancillary jobs could be created. For example, local building materials and building supplies would be used to the extent practical. Most employees would live in larger communities with access to more services. Some construction employees, however, would commute from outside the county to the ISL facility, and skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. Some of these employees would temporarily relocate to the project site and contribute to the local economy through purchasing goods and services and taxes. Because of the small relative size of the ISL workforce, net impacts would be SMALL to MODERATE, depending on proximity to less populated communities such as those in Cibola County and the Town of Grants. OPERATION—Employment levels for ISL facility operations would be similar to, or less than, for construction, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Additional revenues would be generated by federal, state, and local taxes on the facility and the uranium produced. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as those in Cibola County and the Town of Grants. AQUIFER RESTORATION—Because much of the same (in-place) infrastructure would be used, employment levels would be similar to, or less than, for operations, with total peak employment depending on timing and overlap with other stages of the ISL lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction is associated with the construction stage. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as those in Cibola County and the Town of Grants. DECOMMISSIONING—A skill set similar to the construction workforce would be involved in dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/re-contouring the ground surface. Employment levels and use of local contractor support during decommissioning would be similar to or less than what would be required for construction. Employment would be temporary, as decommissioning activities would be limited in duration. Because of similar employment levels, other socioeconomic impacts would be similar to construction—SMALL to MODERATE, depending on proximity to less populated communities such as those in Cibola County and the Town of Grants.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Public and Occupational Health and Safety	4.5.11	CONSTRUCTION—Worker safety would be addressed by standard construction safety practices. Fugitive dust would result from construction activities and vehicle traffic but would likely be of short duration, and not result in a radiological dose. Diesel emissions would not be expected to be a concern for worker or public health, because the releases would be of short duration readily dispersed into the atmosphere—SMALL. OPERATION—Potential occupational radiological impacts from normal operations would be caused primarily by exposure to radon gas from well field, ion-exchange resin transfer operations, and venting during processing activities. Workers would also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation would occur from the same radon releases and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures would be addressed by NRC regulations at 10 CFR Part 20, which require licensees to implement an NRC-approved radiation protection program. (Measured and calculated doses for workers and the public are commonly a fraction of regulated limits.) Non-radiological worker safety matters would be addressed through commonly applied occupational health and safety regulations and practices. Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. Consequences of accidents to workers and the public are generally low, with the exception of a dryer explosion which could result in worker dose above NRC limits. The likelihood of such an accident would be low, and therefore the risk would also be low. Potential non-radiological accidents impacts include high-consequence chemical release events (e.g., ammonia) for both workers and nearby populations. The likelihood of such release events would be low, based on historical operating experience at NRC-licensed facilities which is partly the result of operators following commonly applied chemical safety and handling protocols—SMALL to MODERATE. AQUIFER RESTORATION—Because the activities during aquifer restoration overlap with similar operational activities (e.g., operation of well fields, waste water treatment and disposal) the types of impacts on public and occupational health and safety would be similar to operational impacts. The absence of some operational activities (e.g., yellowcake production and drying, remote ion exchange) further limits the relative magnitude of potential worker and public health and safety hazards—SMALL. DECOMMISSIONING—Worker and public health and safety would be addressed in a required Decommissioning Plan. This plan details how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning to ensure safety of workers and the public would be maintained and how applicable safety regulations would be complied with—SMALL.

Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued)		
Topic/ Resource	**GEIS Section**	**Impact Findings**
Waste Management	4.5.12	CONSTRUCTION—The relatively small scale of construction activities (Section 2.3) and incremental development of well fields at ISL facilities would generate low volumes of construction waste—SMALL. OPERATION—Operational wastes primarily result from liquid waste streams including process bleed, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant wash down water. State permitting actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public. Waste treatment such as reverse osmosis and radon settling would help in segregating wastes and minimizing disposal volumes. Potential impacts from surface discharge and deep well injection would be limited by the applicable permitting processes. NRC regulations address constructing, operating, and monitoring for leakage evaporation ponds used to store and reduce volumes of liquid wastes. Potential impacts from land application of treated wastewater would be addressed by NRC review of site-specific conditions prior to approval, routine monitoring, and inclusion of irrigated land areas in decommissioning surveys. Offsite waste disposal impacts would be SMALL for radioactive wastes as a result of required preoperational disposal agreements. Impacts for hazardous and municipal waste would be SMALL due to the volume of wastes generated. For remote areas with limited available disposal capacity, such wastes may need to be shipped greater distances to facilities that have capacity. However, the volume of wastes generated and magnitude of the shipments would be limited—SMALL. AQUIFER RESTORATION—Waste management activities during aquifer restoration would utilize the same treatment and disposal options implemented for operations. Therefore, impacts associated with aquifer restoration would be similar to operational impacts. While the amount of wastewater generated during aquifer restoration would be dependent on site-specific conditions, the potential exists for additional generation of wastewater volume and associated treatment wastes during the restoration period. However, this would be offset to some degree by the reduction in production capacity from the removal of a well field. NRC review of future ISL facility applications would verify that sufficient water treatment and disposal capacity (and the associated agreement for disposal of byproduct material) are addressed. As a result, waste management impacts from aquifer restoration would be—SMALL. DECOMMISSIONING—Radioactive wastes from decommissioning ISL facilities (including contaminated excavated soil, evaporation pond bottoms, process equipment) would be disposed of as byproduct material at an NRC licensed facility. A preoperational agreement with a licensed disposal facility to accept radioactive wastes ensures sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required Decommissioning Plan, subject to NRC review. This plan details how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning to ensure safety of workers and the public and how applicable safety regulations would be complied with. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be limited—SMALL.

11 LIST OF PREPARERS

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12 GLOSSARY

Agreement State: A state that signed an agreement with the U.S. Nuclear Regulatory Commission (NRC) under Section 274 of the Atomic Energy Act (42 U.S.C. 2021). The state subsequently issues licenses and establishes remedial action requirements under its state laws and according to an alternative to Sections 62 or 81 of the Atomic Energy Act.

Alluvial—Pertaining to or composed of alluvium, or deposited by a stream or running water.

Alluvial fan—An outspread, gently sloping mass of alluvium deposited by a stream.

Alluvium—A general term for detrital deposits made by streams on river beds, floodplains, and alluvial fans.

Anticlinal—Of or pertaining to a generally convex upward fold, whose core contains the stratigraphically older rocks.

Aquifer—Porous water-bearing formation (bed or stratum) of permeable rock, sand, or gravel capable of producing significant quantities of water.

Aquifer Exemption—The process by which an aquifer, or a portion of an aquifer, that meets the criteria for an underground source of drinking water, for which protection under the Safe Drinking Water Act has been waived by the applicable underground injection control. Art 146.4, an aquifer may be exempted if it is:

- Not currently being used — and will not be used in the future — as a drinking water source, or
- It is not reasonably expected to supply a public water system due to a high total dissolved solids content (40 CFR 146.4).

Without an aquifer exemption, certain types of energy production, mining, or waste disposal into underground sources of drinking water would be prohibited.

Aquiclude or Aquitard—Geologic units that are impermeable (aquiclude) or of low permeability (aquitard) adjacent to an aquifer. These units serve to confine groundwater (or uranium recovery solutions) within the aquifer.

Arkosic—Sediments with a considerable amount of the mineral feldspar.

Artesian—Pertaining to groundwater under sufficient hydrostatic pressure to rise above the aquifer containing it.

Ash fall—A rain of airborne volcanic ash falling from an eruption cloud.

Ball mill—A rotating, horizontal cylinder with a diameter almost equal to its length supported by a frame or shaft in which ores are ground using various grinders (such as steel balls, quartz pebbles, or porcelain balls).

Bar—An elongate offshore ridge, bank, or mound of sand or gravel, built by waves and currents, especially at the mouth of a river or at a slight distance from the beach.

Barren solution—A solution in hydrometallurgical treatment that has had valuable constituents removed.

Basin—A low area in the earth's crust, of tectonic origin, in which sediments have accumulated.

Bentonite—A soft plastic light-colored clay formed by chemical alteration of volcanic ash.

Bleed solution—A solution drawn to adjust production or to restore groundwater by pumping more fluids from the production zone than are injected, causing fresh groundwater to flow into the production area.

Braided stream—A stream that divides into an interlacing network of branching and reuniting shallow channels separated from each other by islands or channel bars.

Brine solution—A concentrated solution containing dissolved minerals (usually greater than 100,000 mg/liter), especially chloride salts.

Byproduct material—The tailings or wastes produced by extracting or concentrating uranium or thorium from any ore processed primarily for its source material content. See also Source Material.

Calcareous—containing calcium carbonate ($CaCO_3$).

Carbonaceous—A rock or sediment containing organic matter.

Cenozoic—the latest of the four eras into which geologic time is divided; it extends from the close of the Mesozoic era, about 65 million years ago, to the present. The Cenozoic era is subdivided into Tertiary and Quaternary periods.

Channel—The deepest part of a stream.

Channel-fill deposit—Sediments deposited in a stream channel, where the transporting capacity of the stream is insufficient to remove the material supplied to it.

Clastic—Pertaining to a rock or sediment composed principally of fragments derived from pre-existing rocks or minerals, and transported some distance from their places of origin.

Clay—An earthy, extremely fine-grained sediment or soft rock composed primarily of clay-size particles (e.g., particles with diameters less than 1/256 mm).

Claystone—A cemented clay.

Coastal plain—A low, broad plain that has its margin on the oceanic shore and its strata either horizontal or very gently sloping toward the water.

Colluvium—A general term applied to loose or incoherent deposits, usually at the foot of a slope or cliff and brought three chiefly by gravity.

Confining units—A general term applied to low permeability geologic units above and below an aquifer that confine groundwater to flow within the aquifer.

Conformable—Geologic layers or strata characterized by an unbroken sequence in which the layers are formed one above the other in parallel order by uninterrupted deposition.

Conglomerate—A coarse-grained clastic sedimentary rock composed of fragments larger than 2 mm in diameter.

Continental—A sedimentary deposit laid down on land or in bodies of water not directly connected with the ocean.

Conventional Uranium Milling—A chemical process used to extract uranium from mined uranium ore. At conventional uranium mills, the ore arrives via truck and is crushed and chemically leached with sulfuric acid or alkaline solutions to remove about 90 to 95 percent of the uranium. NRC regulates the milling process (after ore enters the mill), but other agencies regulate the mining processes used to extract the ore.

Cretaceous—The first period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 144 and 65 million years ago; also, the corresponding system or rocks.

Crystalline—A general term for igneous and metamorphic rocks as opposed to sedimentary.

Cuesta—An asymmetrical ridge, with a long gentle slope on one side conforming with the dip of the underlying strata, and a steep or cliff like face on the other side formed by the outcrop of the resistant beds.

Decantation—The process of separating sediments from liquid by settling solids below and pouring off liquids above.

Decommissioning—The process of closing down a facility followed by reducing residual radioactivity.

Detrital—Minerals occurring in sedimentary rocks, which were derived from pre-existing rocks.

Disseminated—A scattered distribution of generally fine-grained minerals throughout a rock body, in sufficient quantity to make the deposit an ore.

Dome—An uplift or anticlinal structure, circular or elliptical in outline, in which the rocks dip gently away in all directions.

Eocene—An epoch of the Tertiary period (after the Paleocene and before the Oligocene), thought to have covered the span of time between 54.8 and 33.7 million years ago; also, the corresponding worldwide series of rocks.

Effluent—A waste liquid, solid, or gas, in its natural state or partially or completely treated, that discharges into the environment.

Elution—The process of extracting (or eluting) one material from another by washing with a solvent (eluant) to remove adsorbed material (such as uranium) from an adsorbent such as an ion exchange resin.

Ephemeral—A stream which flows briefly in direct response to precipitation in the immediate vicinity.

Erosion—The wearing-away or soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.

Escarpment—A long, more or less continuous cliff or relatively steep slope, separating two level or gently sloping surfaces, and produced by erosion or faulting.

Excursion—The unintended spread, either horizontally or vertically, of recovery solutions beyond the production zone. Monitoring wells are installed to analyze for appropriate water quality parameters and detect excursions.

Evaporation pond—A containment pond, typically lined, to hold liquid wastes and to concentrate wastewater through evaporation.

Feldspar—A group of abundant rock-forming minerals of the general formula, $MAl(Al, Si)_3O_8$, where M can be K, Na, Ca, Ba, Rb, Sr, or Fe. Feldspars are the most widespread of any mineral group and constitute 60% of the earth's crust.

Flare—The undetected spread of recovery solutions between the well field and monitor wells of the production zone. Flare is also a factor that estimates the amount of aquifer water outside of the pore volume that has been affected by lixiviant flow during the recovery phase. The flare is usually expressed as a horizontal and vertical component to account for differences between the horizontal and vertical hydraulic conductivity of an aquifer material.

Floodplain—That portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.

Fluvial—Produced by the action of a stream or river.

Formation—A body of rock or strata that consists dominantly of a certain lithologic type or combination of types.

Gangue—The valueless rock or mineral aggregates in an ore; that part of the ore that is not economically desirable but cannot be avoided in mining.

Granite—An igneous rock formed below the earth's surface in which quartz makes up 10 to 50 percent of the rock components.

Granitic—Pertaining to or composed of granite.

Groundwater—Water beneath the surface in the saturated zone that is under atmospheric or artesian pressure.

Heap Leach—A method of extracting uranium from ore using a leaching solution. Small ore pieces are placed in a heap on an impervious material (plastic, clay, asphalt) with perforated pipes under the heap. Acidic solution is then sprayed over the ore, dissolving the uranium. The solution in the pipes is collected and transferred to an ion-exchange system for concentration of the uranium.

Heavy metals—Metallic elements, including those required for plant and animal nutrition, in trace concentration, that become toxic at higher concentrations. Examples are mercury, chromium, cadmium, and lead.

Hogback ridge—A sharp-crested ridge formed by the outcropping edges of steeply inclined resistant rocks, and produced by differential erosion.

Holocene—An epoch of the Quaternary period, from the end of the Pleistocene, approximately 8 thousand years ago, to the present time; also, the corresponding series of rocks and deposits.

Horizon—An interface that indicates a particular position in a stratigraphic sequence. Technically it is a surface with no thickness, but in practice it is commonly a distinctive very thin bed.

Humic—Pertaining to or derived from the dark, more or less stable part of the organic matter in soil.

Hydrothermal—Pertaining to a mineral deposit precipitated from a hot solutions.

Igneous—A rock or mineral that solidified from a magma.

Impermeable—A rock, sediment, or soil that is incapable of transmitting fluids under pressure.

Injection—The subsurface discharge of fluids through a well.

Injection zone—A geological formation, group of formations, or part of a formation that receives fluids through a well.

***In-situ* leaching (ISL)**—The in-place recovery of a mineral resource without removing overburden or ore. This is typically accomplished by installing a well and recovering the resource directly from the natural deposit by exposing it to the injection and recovery of a fluid that causes the leaching, dissolution, or recovery of the mineral.

Injection well—A well or a drill hole in an *in-situ* leach operation through which barren solutions enter an underground stratum or ore body by gravity or under pressure.

Interbedded—Rock material or sediments lying between or alternating with others of different character.

Interfinger—To grade or pass from one material into another through a series of interpenetrating wedge-shaped layers.

Interstitial—A mineral deposit in which the minerals fill the pores of the host rock.

Interstratified—*See* **Interbedded**.

Intertonguing—The disappearance of sedimentary bodies in laterally adjacent masses owing to splitting into may thin tongues, each of which reaches an independent pinch-out termination.

Ion exchange— A chemical process used to recover uranium from solution by the exchange dissolved uranium ions between a lixiviant (leach solution) and a solid, either a mineral surface or, more commonly, a synthetic polymer resin.

Isotope—Any two or more forms of an element having identical or very closely related chemical properties and the same atomic number but different atomic weights or mass numbers.

Jurassic—The second period of the Mesozoic era (after the Triassic and before the Cretaceous), thought to have covered the span of time between 206 and 144 million years ago; also, the corresponding system or rocks.

Lacustrine—Pertaining to or produced by a lake or lakes.

Lagoonal—Pertaining to a channel or bay partly or completely separated from the sea by a reef or barrier island, especially the water between an offshore coral reef and the mainland.

Leach—Dissolving of soluble constituents (e.g., uranium) from a rock or ore body by the natural action of percolating water or a lixiviant (leaching solution).

Leachate—The liquid that has percolated through the soil or other medium.

Lenticular—Pertaining to a stratigraphic lens; resembling in shape the cross section of a lens.

Lithologic—The physical character of a rock, such as color, mineralogical composition, and grain size.

Lixiviant—Leachate solution pumped underground to a uranium ore body; it may be alkaline or acidic.

Loam—A rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

Marine—A sedimentary deposit laid down or caused by the sea.

Mechanical integrity—The absence of significant leakage within the injection tubing, casing, or packer (known as internal mechanical integrity), or outside of the casing (known as external mechanical integrity). Mechanical integrity tests (MITs) are performed to determine the adequacy of the construction of an injection well. Periodic mechanical integrity tests (MITs) are performed to confirm that a well maintains internal and external mechanical integrity.

Mesa—A flat-topped mountain bounded on a least one side by a steep cliff.

Mesozoic—An era of geologic time, from the end to the Paleozoic to the beginning of the Cenozoic, or from about 248 to about 65 million years ago; also, the rocks formed during that era. It includes the Triassic, Jurassic, and Cretaceous periods.

Metamorphic—A rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes in response to marked changes in temperature, pressure, shearing stress, and chemical environment.

Meteoric—Pertaining to or derived from the earth's atmosphere, e.g. meteoric water.

Micaceous—Consisting of, containing, or pertaining to mica – a group of minerals of the general formula (K, Na, Ca)(Mg, Fe, Li, $Al)_{2\text{-}3}(Al, Si)_4O_{10}(OH, F)_2$. Micas are prominent rock-forming constituents of igneous and metamorphic rocks.

Mill feed—Uranium ore supplied to a crusher or grinding mill in an ore-dressing process.

Mill tailings—*See* **Tailings**.

Miocene—An epoch of the Tertiary period (after the Oligocene and before the Pliocene), thought to have covered the span of time between 23.8 and 5.3 million years ago; also, the corresponding worldwide series of rocks.

Mudstone—A fine-grained sedimentary rock in which the proportion of clay and silt are approximately equal.

Natural levee—A ridge or embankment of sand and silt, built up by a stream on its flood plain along both banks of its channel.

Oligocene—An epoch of the Tertiary period (after the Eocene and before the Miocene), thought to have covered the span of time between 33.7 and 23.8 million years ago; also, the corresponding worldwide series of rocks.

Ore—A naturally occurring mineral that contains an economically valuable constituent, such as uranium, in sufficient concentration and quantity to allow economic production.

Outcrop—That part of a geologic formation or structure that appears at the surface of the earth.

Overbank deposit—Silt and clay deposited from suspension on a flood plain by floodwaters that cannot be contained within the stream channel.

Oxidation—An oxidizing environment is characterized by an excess of free oxygen (either dissolved or as a gas). During oxidation, the atoms in an element lose electrons and the valence state of the element increases. Chemically, oxidation is the opposite process from reduction (*see* **Reduction**). Oxidized uranium with a 6+ valence state (U^{6+} with fewer electrons) is more readily dissolved than reduced uranium (U^{4+} with more electrons).

Packer—A mechanical device set immediately above the injection zone that seals the outside of the tubing to the inside of the long string casing. A packer may be a simple mechanically set rubber device or a complex concentric seal assembly.

Paleocene—An epoch of the Tertiary period (after the Cretaceous period and before the Eocene), thought to have covered the span of time between 65 and 54.8 million years ago; also, the corresponding worldwide series of rocks.

Paleosol—A buried soil; a soil of the past.

Paleozoic—An era of geologic time, from the end of the Precambrian to the beginning of the Mesozoic, or from about 543 to about 248 million years ago. Also, the rocks formed during that era.

Paludal—Pertaining to a marsh.

Pennsylvanian—A period of the Paleozoic era (before the Permian), thought to have covered the span of time between 323 and 290 million years ago; also, the corresponding system or rocks.

Permeability—The ease with which fluid flows through a porous rock or sediment. Rock or sediment that allows water to move through at an appreciable rate are called "permeable."

Permian—The last period of the Paleozoic era, thought to have covered the span of time between 290 and 248 million years ago; also, the corresponding system of rocks.

Physiographic province—A region of which all parts are similar in geologic structure and climate and which has had a unified geologic history.

Plateau—A relatively elevated area of comparatively flat land which is commonly limited on a least one side by an abrupt descent to lower ground.

Pleistocene—An epoch of the Quaternary period, after the Pliocene of the Tertiary and before the Holocene; also, the corresponding worldwide series of rocks. It began about 1.8 million years ago and lasted until the start of the Holocene some 8,000 years ago.

Pliocene—An epoch of the Tertiary period (after the Miocene and before the Pleistocene), thought of have covered the span of time between 5.3 and 1.8 million years ago; also, the corresponding worldwide series of rocks.

Pore space or porosity—The collective open spaces of a rock. It is a measure of the amount of liquid or gas that may be absorbed or produced by a particular formation.

Pore volume—A volume equal to the open space in rock or soil. The ISL industry uses this term to define an indirect measurement of a unit volume of aquifer water affected by ISL recovery. It represents the volume of water that fills the void space inside a certain volume of rock or sediment. Pore volume provides a unit reference that an operator can use to describe (1) the amount of lixiviant circulation needed to leach an ore body or (2) the unit number of treated water circulations needed to flow through a depleted ore body to achieve restoration. A pore volume allows an operator to use relatively small-scale studies and scale the results to field-level pilot tests or to commercial well field scales. Typically, a pore volume is calculated by multiplying the surficial area of a well field (the area covered by injection and recovery wells) by the thickness of the production zone being exploited and the estimated or measured porosity of the aquifer material.

Potentiometric surface—An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a well.

Precambrian—All geologic time, and its corresponding rocks, before the beginning of the Paleozoic.

Pregnant solution—A solution containing a dissolved, extractable mineral that was leached from the ore; uranium leach solution pumped up from the underground ore zone through a production hole. Also called "pregnant lixiviant."

Primacy or primary enforcement authority—The authority delegated by EPA to implement the UIC Program. To receive primacy, a state, territory, or tribe must demonstrate to EPA that its UIC program is at least as stringent as the federal standards; the state, territory, or tribal UIC requirements may be more stringent than the federal requirements. (For Class II, states must demonstrate that their programs are effective in preventing pollution of USDWs.) EPA may grant primacy for all or part of the UIC program, e.g., for certain classes of injection wells.

Production zone—The uranium-bearing portion of a geological formation or part of a formation that is the target of ISL uranium recovery by underground injection and production of lixiviant.

Pyrite—The most widespread and abundant of the sulfide minerals, H_2S.

Quaternary—The second period of the Cenozoic era, following the Tertiary; also, the corresponding system or rocks. It began about 1.8 million years ago and extends to the present. It consists of two epochs: the Pleistocene and the Holocene.

Quartz—Crystalline silica, an important rock-forming mineral, SiO_2.

Quartzose—Containing quartz as a principal constituent.

Production bleed—*See* **Bleed Solution**.

Production (or recovery) well—A well or a drill hole in an *in-situ* leach operation through which pregnant (uranium-bearing) solutions are extracted from an underground stratum or uranium deposit.

Radioisotope—An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified.

Radon—A chemically inert radioactive gaseous element formed when radium decays. Exposure to radon may pose a potential health hazard.

Reclamation—The process of restoring the surface environment to acceptable pre-existing conditions. Reclamation includes activities such as surface contouring, equipment removal, well plugging, and revegetation.

Reduction—A reducing environment is characterized by little or no free oxygen (dissolved or as a gas). During reduction, the atoms in an element gain electrons and the valence state of the element decreases. Chemically, reduction is the opposite process from oxidation (*see* **Oxidation**). Reduced uranium (U^{4+} with more electrons) is less dissolvable than oxidized uranium (U^{6+} with fewer electrons).

Remote Ion Exchange (RIX)—A type of ISL uranium recovery operation where pregnant lixiviant from production wells is collected at a small satellite (RIX) facility. The uranium is stripped from the lixiviant by loading onto ion exchange resins. The loaded resins are then transported by tanker truck to a larger central facility for additional processing and uranium recovery. RIX operations are used to produce uranium from smaller, more disperse uranium deposits.

Restoration—Returning affected groundwater to its pre-recovery quality or class of use by employing the best practical technology.

Reverse osmosis—The act of reversing a diffusion through a semipermeable membrane, typically separating a solvent and a solution, that tends to equalize their concentrations. In ISL facilities, this process is used to treat wastewater to remove dissolved constituents and reduce total dissolved solids.

Rip rap—Cobblestone or coarsely broken rock used for protection against erosion of embankments or gullies.

Roll front—A localized uranium deposit in the form of a roll or interface that separates an oxidized interior from a reduced exterior. The reduced side of this interface is significantly enriched in uranium.

Runoff—The portion of rainfall that is not absorbed by soil, evaporated, or transpired by plants, but finds its way directly into streams or as overland surface flows.

Sand—A loose aggregate of particles having a diameter in the range of 1/16 to 2 mm.

Sandstone—A clastic sedimentary rock composed of grains of sand size set in a matrix of silt or clay and more or less firmly united by a cementing material.

Satellite facility—A remotely located facility for initial processing of uranium bearing solutions [see **Remote Ion Exchange (RIX)**].

Scour protection—Using flushing water to protect the trench surface from erosion.

Sediment—Solid fragmental material transported and deposited by wind or water, or chemically precipitated from solution, that forms in layers in loose unconsolidated form.

Sedimentary—Pertaining to or containing sediment, or formed by its deposition.

Shale—A fine-grained detrital sedimentary rock, formed by the compaction of clay, silt, and mud.

Silicified—A rock in which silica, in the form of quartz, chalcedony, or opal, has replaced existing minerals.

Silt—A loose aggregate of rock or mineral particles commonly in the range of 1/16 to 1/256 mm.

Siltstone—A massive mudstone in which silt predominates over clay.

Source material—Uranium or thorium ores containing 0.05 percent uranium or thorium regulated under the Atomic Energy Act. In general, this includes all materials containing radioactive isotopes in concentrations greater than natural and the byproduct (tailings) from the formation of these concentrated materials.

Spit—A small point of sand or gravel projecting from the shore into a body of water; a fingerlike extension of the beach.

Stratabound—A type of mineral deposit contained within a single layer of sedimentary rock. Usually refers to a deposit in a permeable rock such as a sandstone bounded by impermeable confining layers such as shelves.

Stratigraphic unit—A body of strata recognized as a unit for description, mapping, and correlation.

Stratigraphic section or sequence—A chronologic succession of sedimentary rocks from older below to younger above, essentially without interruption.

Subsidence—Sinking or downward settling of the earth's surface.

Surety—A type of bond to ensure that funds are available for a specific activity (in this case, dismantling, reclamation, restoration, and remediation of uranium production sites). If the company goes bankrupt, the bonding company pays NRC or the appropriate state the amount of the bond. NRC or the appropriate state must ensure that the amount is adequate for the remediation activities.

Synclinal—Pertaining to a fold of which the core contains the stratigraphically younger rocks; it is generally concave upward.

Tailings—The remaining portion of a metal-bearing ore consisting of finely ground rock and process liquid after some or all of the metal, such as uranium, has been extracted.

Terrace—A relatively level bench or steplike surface breaking the continuity of a slope.

Tertiary—The first period of the Cenozoic era (after the Cretaceous of the Mesozoic era and before the Quaternary), thought to have covered the span of time between 65 million and 1.8 million years ago; also, the corresponding system of rocks. It is divided into five epochs: the Paleocene, Eocene, Oligocene, Miocene, and Pliocene.

Texture—The physical nature of a soil, according to the relative proportions of sand, silt, and clay.

Tiering—For the purposes of the National Environmental Policy Act, tiering is defined by the Council on Environmental Quality in 40 CFR 1508.28. It refers to "the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basinwide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared."

Topography—The general configuration of a land surface including elevations.

Tongue—A minor stratigraphic unit of limited extent, especially a member that extends outward beyond the main body of a formation and disappears laterally.

Transgression—The spread of the sea over land areas.

Triassic—The first period of the Mesozoic era (after the Permian of the Paleozoic era, and before the Jurassic), thought to have covered the span of time between 248 and 206 million years ago; also, the corresponding system of rocks.

Trunkline—Main pipeline that brings together flow from individual wells.

Tuff—A general term for consolidated rocks formed by volcanic explosion or aerial expulsion from a volcanic vent.

Tuffaceous—Rocks or sediments containing particles derived from pre-existing tuff rocks.

Underground Injection Control (UIC)—The UIC Program is administered by the EPA or by tribal or state agencies that have been granted primacy by EPA. The UIC program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal. Based on EPA regulations, UIC programs identify five different classes of injection wells.

Class I wells—Technologically sophisticated wells that inject wastes into deep, isolated rock formations below the lowermost USDW. Class I wells may inject hazardous waste, non-hazardous industrial waste, or municipal wastewater.

Class II wells—Wells that inject brines and other fluids associated with oil and gas production, or storage of hydrocarbons. Class II well types include salt water disposal wells, enhanced recovery wells, and hydrocarbon storage wells.

Class III wells—Wells that inject fluids associated with solution mining of minerals. Mining practices that use Class III wells include salt solution mining, in-situ leaching of uranium, and sulfur mining using the Frasch process.

Class IV wells—Wells that inject hazardous or radioactive wastes into or above a USDW. These wells are banned unless authorized under a federal or state groundwater remediation project.

Class V wells—Wells not included in Classes I to IV. Class V wells inject non-hazardous fluids into or above a USDW and are typically shallow, on-site disposal systems; however, this class also includes some deeper injection operations. There are approximately 20 subtypes of Class V wells.

Underground Source of Drinking Water (USDW)—An aquifer or portion of an aquifer that supplies any public water system or that contains a sufficient quantity of ground water to supply a public water system, and currently supplies drinking water for human consumption, or that contains fewer than 10,000 mg/l total dissolved solids and is not an exempted aquifer.

Uplift—A structurally high area in the crust, produced by movements that raise the rocks, as in a broad dome or arch.

Uraniferous—A rock or sediment that contains uranium.

Viewshed—The Bureau of Land Management uses this term in the Visual Resource Management process to describe landscape that can be seen under favorable atmospheric conditions from a viewpoint (key observation point) or along a transportation corridor.

Visual resources—The visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.

Visual resource management (VRM) classes—

Class I—The objective of this class is to maintain a landscape setting that appears unaltered by humans. It is applied to wilderness areas, some natural areas, wild portions of wild and scenic rivers, and other similar situations in which management activities are to be restricted.

Class II—The objective of this class is to design proposed alterations so as to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III—The objective of this class is to design proposed alterations so as to partially retain the existing character of the landscape. Contrasts to the basic elements (form, line, color, and texture) caused by a management activity may be evident and begin to attract attention in the characteristic landscape; however, the changes should remain subordinate to the existing characteristic landscape.

Class IV—The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, changes should repeat the basic elements (form, line, color, and texture) inherent in the characteristic landscape.

Class V or Rehabilitation Area—Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the naturalistic character has been disturbed to a point at which rehabilitation is needed to make it conform to the surrounding landscape. This class would apply to areas where the quality class has been reduced because of unacceptable cultural modification as identified in the scenic evaluation. The contrast is inharmonious with the characteristic landscape. It may also be applied to areas that have the potential for enhancement, where it would add acceptable visual variety to an area or site. It should be considered an interim or short-term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. The desired VRM class should be identified.

Volcanic—Pertaining to the activities, structures, or rock types of a volcano.

Volcanic ash—Fine (under 2 mm in diameter) clastic rock material formed by volcanic explosion or aerial expulsion from a volcanic vent.

Volcaniclastic—Pertaining to a clastic rock containing volcanic material.

Well field—The area of an ISL operation that encompasses the array of injection, recovery (or production), and monitoring wells and interconnected piping employed in the leaching process.

Yellowcake—Sludge of uranium oxide (nominally U_3O_8) concentrate formed during the final step of the milling process.

APPENDIX A

SCOPING SUMMARY REPORT

GENERIC ENVIRONMENTAL IMPACT STATEMENT

FOR

IN-SITU LEACH URANIUM MILLING FACILITIES

SCOPING SUMMARY REPORT

JUNE 2008

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

U.S. Nuclear Regulatory Commission

Rockville, Maryland

1. INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) expects to receive a number of new license applications for uranium milling at sites in the states of Nebraska, South Dakota, Wyoming and New Mexico over the next several years. NRC anticipates that most of these potential license applications will involve uranium milling facilities that would use the in-situ leach (ISL) process. Because there are environmental issues common to ISL milling facilities, NRC has prepared a Generic Environmental Impact Statement (GEIS) to evaluate the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning at future ISL milling facilities in specific regions of interest within these four western states, where NRC is the licensing authority for uranium milling.

In the ISL process, a leaching agent, such as oxygen with sodium bicarbonate, is added to native ground water for injection through wells into the subsurface ore body to dissolve the uranium. The leach solution, containing the dissolved uranium, is pumped back to the surface and sent to a processing plant, where ion exchange is used to separate the uranium from the solution. The underground leaching of the uranium also frees other metals and minerals from the host rock. Operators of ISL facilities are required to restore the ground water affected by the leaching operations. The milling process concentrates the recovered uranium into the product known as "yellowcake" (U_3O_8). This yellowcake is then shipped to uranium conversion facilities for further processing in the overall uranium fuel cycle.

As part of its evaluation of a license application for uranium milling, NRC conducts an environmental review, as required by 10 CFR Part 51, to meet its obligations under the National Environmental Policy Act (NEPA) and publishes either an environmental assessment or environmental impact statement. NRC also regulates the radiological safety of ISL facilities, including the safe disposal of the waste materials associated with the milling process (these waste materials are regulated as "11e.(2) byproduct material" under the Atomic Energy Act). NRC documents the results of its safety review of a license application in a Safety Evaluation Report. The results of NRC's environmental and safety reviews form the bases for NRC's determination whether or not to issue a 10 CFR Part 40 source material license for uranium milling.

The NRC staff will use the GEIS in its review of site-specific ISL license applications. As part of its comprehensive site-specific review, the NRC staff will incorporate by reference appropriate background information from the GEIS and apply GEIS conclusions to the extent applicable. The GEIS will enhance the quality, consistency, and efficiency of NRC site-specific reviews of ISL license applications by allowing the NRC staff to focus on the issues unique to each proposed site.

The public scoping period for the GEIS opened on July 24, 2007, with the publication in the Federal Register of a Notice of Intent to prepare the GEIS and to conduct the scoping process (72 FR 40344). Scoping is an early and open public process designed to help determine the range of actions, alternatives, and potential impacts to be considered in the GEIS and to identify significant issues related to the proposed action. Input from the public is solicited to focus the analysis on the issues of genuine concern.

On August 7, 2007, August 9, 2007, and September 27, 2007, the NRC staff held public scoping meetings in Casper, WY; Albuquerque, NM; and Gallup, NM; respectively, to solicit both oral and written comments from interested parties. At those meetings, the NRC staff provided an overview of NRC's mission and responsibilities and described both the *in*-situ leach process and NRC's regulatory process for the licensing of ISL facilities. Additionally, the NRC staff explained why the GEIS was being prepared, provided the schedule for the GEIS, and described how the public could participate in the development of the GEIS. After the NRC staff presentations, the remainder of the meeting time was set aside for members of the public to provide oral comments. Transcripts were prepared for all three meetings and are available online at the NRC Agencywide Documents Access and Management System (ADAMS), which is accessible at http://www.nrc.gov/reading-rm/adams.html or through the NRC website for the GEIS at http://www.nrc.gov/materials/fuel-cycle-fac/licensing/geis.html.

In addition to comments received at those three public meetings, interested members of the public also provided written scoping comments by regular mail and electronic mail to NRC. The public scoping period closed on November 30, 2007. Comments received by NRC are available for viewing online through ADAMS (http://www.nrc.gov/reading-rm/adams.html).

The public also will be invited to comment on the draft GEIS when it is made available. NRC will announce the availability of the draft GEIS in the Federal Register, on NRC's website (www.nrc.gov), and in the local news media. NRC's announcement also will provide the dates for the public comment period and information about public meetings. The NRC staff will consider the comments received on the draft GEIS and address them in the final GEIS.

This report summarizes the issues identified during the scoping process. Section 2 of this report summarizes the comments expressed, Section 3 identifies the issues to be considered in the GEIS, and Section 4 identifies those issues that are not within the scope of the GEIS.

2. ISSUES RAISED DURING THE SCOPING PROCESS

2.1 OVERVIEW

During the three public scoping meetings, 79 individuals offered comments. Not all commenters addressed the GEIS scope specifically, preferring instead to comment on the more general topic of uranium mining or milling; however, most expressed an opinion, either favorable or unfavorable, on either the GEIS or uranium mining or milling. Among the 79 commenters who spoke, roughly half of them expressed support for either the GEIS or for uranium mining or milling, while the other half neither supported the GEIS nor uranium mining or milling. The remaining individuals who spoke either expressed concerns or suggestions requesting NRC consider a particular topic of interest in the GEIS or provided information on local conditions.

Additionally, nearly 1400 individuals sent in written comments by electronic mail. Approximately 90 percent of these comments (1246) were sent as identical "form letters" opposing the GEIS. About two percent (28) of the e-mails were modified versions of the form letter (mostly opposing), and the remaining comments (123) were unique individual letters addressing a variety of topics. Five percent of the e-mail submittals (70) were from locations outside the US. Table 1 provides a list of individuals and entities that submitted scoping comments and a classification of the comments. Table 2 provides a list of individuals and entities that submitted duplicate scoping comments by email.

Finally, individuals and organizations provided written scoping comments by regular mail.

In addition to private citizens, commenters included:

- Members of the United States Congress
- Governor for the State of New Mexico
- Representatives of Native American governments
  - Navajo Nation Council
  - Navajo Nation Environmental Protection Agency
  - Eastern Navajo Agency
  - Navajo Attorney Generals Office
  - Pueblo of Acoma
- Members of the New Mexico State Senate
- Local Officials from Crook County in Wyoming; McKinley and Cibola counties in New Mexico; and the City of Grants, New Mexico
- Representatives from Federal agencies or organizations
  - Environmental Protection Agency, Office of Radiation and Indoor Air
  - Department of Interior, Bureau of Land Management
  - Department of Interior, Fish and Wildlife Service
- Representatives of State agencies or departments
  - State of Wyoming, Department of Environmental Quality
  - State of Wyoming, Department of Agriculture
  - State of New Mexico, Department of Fish and Game
  - Commonwealth of Virginia, Department of Mines, Minerals, and Energy
  - State of Colorado, Department of Public Health and Environment
- Representatives of the mining industry
  - National Mining Association
  - Alaska Miners Association

    - New Mexico Mining Association
    - Wyoming Mining Association
- Representatives of uranium mining companies
    - Energy Metals Corporation
    - Neutron Energy, Inc.
    - UR Energy USA
    - Uranerz Energy Corporation
    - Uranium Resources/HRI
- Representatives of other organizations, including:
    - Amigos Bravos
    - Blue Water Valley Down Stream Alliance
    - Biodiversity Conservation Alliance
    - Cebolleta Land Grant
    - Concerned Citizens for Nuclear Safety
    - Diocese of Gallup, New Mexico
    - Eastern Navajo Allottees Association
    - Eastern Navajo Dine Against Uranium Mining (ENDAUM)
    - Hunger Grow Away, Inc.
    - Juan Tafoya Land Grant Corporation
    - National Indian Council on Aging
    - New Mexico Environmental Law Center
    - Post 71 Uranium Committee
    - Powder River Basin Resource Council
    - Puerta Villa Land Grant Corporation
    - Powder State Chapter
    - Sierra Club

The following general topics categorize the comments received during the public scoping period:

- Purpose, need, and scope of the GEIS
- Scoping process for the GEIS
- Public involvement
- History and legacy of uranium mining
- Native American concerns
- Surface and ground water
- Land use
- Ecology
- Site-specific analyses
- Operational safety and emergency response
- Decommissioning and waste management
- Socioeconomics
- Environmental justice
- Historic and cultural resources
- Transportation
- Visual impacts and noise
- Surety
- Alternatives considered
- Cumulative impacts

- Monitoring programs
- Regulations and guidance
- National Environmental Policy Act
- Credibility of NRC

In addition to these comment topic areas, miscellaneous opinions and concerns were raised that dealt with issues such as national energy policy, reprocessing spent nuclear fuel, nuclear power, nuclear weapons, and pre-emptive war.

2.2 SUMMARY OF ISSUES RAISED

Section 2.2 provides a summary of the comments received during the public scoping period. As noted previously, comments were received on a variety of topic areas. The following discussion summarizes the public scoping comments by technical area and/or issues.

2.2.1 Purpose, Need, and Scope of GEIS

A number of comments received dealt with the purpose, need, and scope of the GEIS. Both general and specific comments regarding the content of the GEIS and whether to address both ISL and conventional milling technologies in the GEIS were received.

The majority of commenters questioned the usefulness of a GEIS given the unique site-specific conditions in the geographic areas where uranium recovery is by ISL extraction. These individuals commented that topics such as hydrology, water quality, geology, socioeconomics, and cultural diversity were examples of site-specific attributes that could not be adequately assessed in a GEIS.

Commenters were also concerned that NRC had not requested input on the decision to prepare a GEIS. A few commenters expressed the opinion that the GEIS process should initially assess whether uranium recovery operations should be expanded and then if the conclusion was affirmative, decide to prepare a GEIS. These commenters believed the current demand for uranium was based on market speculation rather than actual demand.

A few commenters thought the purpose for the GEIS was not sufficiently clear, noting that it should identify a specific federal action with all specific sites and locations identified. Another commenter noted that because there are no ISL permits in New Mexico, there was no need for a GEIS addressing ISL uranium recovery activities in New Mexico.

Specific comments regarding the content of the GEIS offered a wide variety of suggestions. A majority of commenters favored a rigorous environmental analysis, with a number of these commenters implying that the GEIS would not be rigorous because of its broader scope. These commenters suggested a site-specific environmental assessment to support a licensing review would also be a limited analysis. A few commenters requested that various topics be included in the GEIS such as:

- uncommon features among ISL facilities that should be considered in site-specific reviews;
- resource estimates for all site-specific license reviews;
- evaluation of the proposed action and all connected actions;

- documentation of the geographic extent of new extraction activity including the details of schedule and licensing process;
- consideration of each type of ISL technology;
- lists of companies that intend to pursue uranium recovery; and
- detailed discussions of air quality standards, implementing agencies, ambient conditions, monitoring requirements, enforcement, and potential air quality impacts including cumulative and indirect impacts.

One commenter suggested the scope of the GEIS should be limited to regional cumulative and synergistic impacts. Another requested the GEIS address "agency capture" and the Federal Advisory Committee Act.

An additional group of comments came from residents or officials of states with uranium deposits that were not identified in NRC's scoping notices. These commenters wanted their states to be included in the scope of the GEIS.

2.2.2 Scoping Process for the GEIS

Numerous commenters provided feedback on the scoping process. Many of these comments reflected concerns regarding public involvement (section 2.2.3). Other comments pertained to cooperation with other agencies. Some comments went beyond the scoping process and applied to the entire GEIS or licensing processes.

Comments from the U.S. Environmental Protection Agency (EPA) requested NRC designate EPA as a commenting rather than cooperating agency because they have statutory authority for various laws that apply to the operation of an ISL (for example, the Uranium Mill Tailings Radiation Control Act, the Safe Drinking Water Act, Clean Water Act, and Clean Air Act). The State of Wyoming requested cooperating agency status for the GEIS. Another comment recommended NRC enter into an MOU with the New Mexico Department of Environmental Quality for regulation of ISL facilities. A U.S. Bureau of Land Management (BLM) employee stressed the importance of communicating with local BLM staff during site-specific actions. The Governor of New Mexico expressed concern about the lack of prior consultation with respect to preparing the GEIS.

2.2.3 Public Involvement

Many commenters stressed the need for meaningful public participation in the GEIS and in the site-specific environmental reviews. One commenter recommended NRC expand the public outreach process for the preparation of both environmental assessments and environmental impact statements. Some individuals desired enhanced transparency, democracy, and sensitivity to potentially affected cultural groups.

Comments were also received on the GEIS scoping process (e.g., the number and location of scoping meetings, the short notice prior to the public scoping meetings, the limited time provided for public comment); the lack of public input on the need for a GEIS (e.g., preparation of the GEIS was a forgone conclusion); and the perception that public involvement could be limited by using a GEIS for site-specific licensing decisions when an environmental assessment is published.

Many commenters favored extending the comment period and having scoping meetings in all affected communities, including: Grants, Gallup, Crownpoint, and Church Rock in New Mexico, and in the states of Utah, Arizona, Colorado, and South Dakota. Other commenters wanted to include specific states and communities so that national interest groups could participate. Another commenter suggested that NRC hold public hearings in the affected areas for each site-specific license application.

2.2.4 History and Legacy of Uranium Mining

A number of individuals commented on the history and legacy of past uranium mining in western states. Some commenters recommended that the GEIS include discussion of both historic and current information on uranium recovery operations and also discuss environmental contamination remaining after the end of operations and remediation. Other commenters provided historical accounts of local public health and environmental problems associated with past uranium mining. Other commenters stressed the need to consider the impacts of existing contaminated "legacy" sites in site-specific assessments (e.g., local cumulative impacts of proposed operation with existing contamination). The need to avoid creation of additional "legacy" sites was also mentioned.

Some commenters expressed concern about remediating contamination after uranium milling is completed. These commenters cited past experience with ISL facilities in Texas where the ground water chemistry was unable to be restored to baseline conditions. Other commenters noted that conventional tailings sites in Utah and Colorado had complex and costly remediation issues.

A number of commenters linked local health problems to past uranium mining and expressed concerns regarding the lack of complete remediation and the limited compensation of workers and communities impacted by past mining activities. Commenters described past environmental contamination that resulted from abandoned conventional mines and unremediated tailings piles, breach of operational evaporation ponds, and ground water contamination. One commenter noted high radium concentrations in soils and the need to subsequently relocate families. Another commenter stated there were 150 abandoned mines in McKinley County (New Mexico) and 50 abandoned mines in Cibola County (New Mexico). A few commenters noted that NRC should not license new facilities until issues at formerly operating uranium recovery facilities had been resolved. A commenter asked who would be responsible for cleanup of legacy sites and feared a repeat of history. One commenter requested that NRC provide the public and other federal agencies with historical information on the existing legacy sites to inform the background characteristics of proposed sites.

2.2.5 Native American Concerns

Uranium ore deposits are located in or adjacent to some Native American communities. Commenters stressed that some of these communities have been impacted by past uranium mining activities and were therefore concerned about future uranium recovery activities in the same areas.

A number of commenters were concerned that the GEIS would undermine the sovereignty of indigenous peoples. Various commenters identified the Diné Natural Resources Protection Act of 2005, which prohibits uranium mining and processing on the Navajo Nation. Commenters stated that New Mexico sites overlapping Navajo Indian Country are subject to tribal law and review. One commenter suggested that NRC consult with the Navajo Nation Environmental Protection Agency to ensure that water quality is protected and that drinking water standards are met. A commenter noted that that some lands have special cultural significance (e.g., Mt. Taylor in New Mexico). Another commenter described how Acoma Pueblo, Laguna Pueblo, and All Indian Pueblo Council have adopted resolutions opposing any new resource development (including uranium milling) that could negatively impact Pueblo sacred sites, lands, and water resources. The commenter suggested NRC not license uranium facilities on Pueblo land.

Other commenters noted the lack of formal consultation with Native American tribes by NRC prior to making decisions. They noted that consultation is necessary as both a federal legal requirement and to address Native American concerns. It was recommended that the GEIS describe the process for government-to-government consultation between NRC and potentially affected tribal governments and summarize issues identified and their resolution. Another commenter suggested that the GEIS include a section on Native American water rights and impacts that uranium milling may have on binding treaties between the U.S. government and Tribal governments.

Other commenters recommended that cultural resource and environmental justice evaluations in the GEIS include water supply, cultural, health, and other impacts on Native American tribes. The tribes identified included the Navajo, Sioux, Hopi, Yavapai-Apache, Shoshone, Northern Arapaho, Ute, and a number of Pueblo tribes. Some Navajo commenters indicated ongoing problems from past uranium mining including the lack of full monetary compensation to former Navajo uranium workers and families, the existence of un-remediated sites, and the lack of health studies in affected communities. Some commenters stated that NRC was insensitive to Native American concerns.

2.2.6 Surface and Ground Water

Surface Water: Some commenters expressed concerns about surface water. Specific issues identified in comments were changes to the chemistry of local surface water bodies from ISL surface water discharges and the potential to subsequent impact the chemistry of local ground water. One commenter recommended that the GEIS include information on surface water flows and the potential impact to local community surface water from proposed ISL operations. Commenters also recommended that surface water mitigation measures be described. Another commenter was concerned about the potential for mining interests to impact the Colorado River since the river is a key water resource for a number of western states.

Ground Water: A large number of commenters, both at the public scoping meetings and in written comments, expressed concerns about ground water contamination. In addition to general comments on ground water, commenters asked about ground water protection requirements and guidance, ground water restoration goals, restoration techniques, specific local ground water conditions, and ground water issues at existing milling sites.

A general ground water concern expressed by numerous commenters was contaminant migration away from the uranium recovery site during operations, and the mitigation measures taken once contaminant migration had been detected to control that migration. Some commenters noted that ISL operations are conducted only in portions of an aquifer that are exempted by EPA and therefore not considered to be suitable for use as drinking water due to poor water quality. One commenter was concerned about the criteria used to assess the potability of water supplies. Another commenter noted that ISL operations are conducted between horizontal confining layers of rock to limit potential vertical migration of contaminants.

Other commenters were concerned about water use impacts given that water is a limited resource in western states. Some recommended that the GEIS estimate the quantity and quality of water used and the potential impact to local area users and natural resources. Another commenter noted that ISL operations are not large water consumers, particularly compared to conventional uranium milling. Still other commenters were concerned about the potential for increased water usage during the ground water restoration phase of the ISL lifecycle.

Some commenters noted that heavy metals and other minerals in addition to uranium are released from the ore body by the injection of lixiviant or other re-injection fluids. These commenters recommended that the GEIS evaluate impacts of the release of these metals and minerals, with one commenter recommending NRC consider the impacts from past and existing Superfund mining sites as a point of comparison for the analysis of impacts from ISL sites.

Other commenters provided detailed technical comments in recommending that the GEIS include hydrologic flow data and assess the potential impacts on local communities where proposed facilities would be located. Another commenter recommended that the GEIS include hydrologic and biogeochemical information needed for site-specific conceptual models, data input requirements, model and parameter uncertainty, variability of interpretations, and risk assessments.

<u>Ground Water Protection Requirements and Guidance:</u> Some commenters questioned the requirements for restoring ground water after ISL operations end, noting that NRC discussed that restoration to pre-operational baseline conditions is required, but yet granted some sites approval of alternate concentration limits that were above baseline water quality conditions. Another commenter recommended that the GEIS describe the applicable standards (including the Navajo Nation's drinking water standards) and the agencies responsible for ensuring compliance with the restoration requirements. Other commenters noted that some NRC-approved alternate concentration limits were too high above baseline levels, while other commenters stated that NRC's authorizing of alternate concentration limits merely allowed the restoration of still contaminated sites.

A few commenters focused on the aquifer "class of use" designation (i.e., the use(s) to which the aquifer water could be put). One commenter recommended that the GEIS identify the "class of use" for each aquifer potentially impacted by ISL licensing, while another commenter was opposed to "class of use" cleanup goals in place of current regulations (noting this would abridge current standards). One commenter asked NRC to re-evaluate the practice of allowing applicants to average ground water quality within a proposed well field area to establish baseline water quality (suggesting that averaging the poorer ore zone waters with outlying cleaner water skews the average toward higher levels of contamination).

<u>Restoration Goal:</u> Some commenters recommended using pre-operational baseline water quality as the appropriate restoration goal (i.e., returning the water quality after operations to its pre-uranium extraction state). A commenter noted that the Wyoming Department of Environmental Quality standards require restoration to baseline. Another commenter recommended that the drinking water standards as the appropriate restoration goal. One commenter noted that at a NRC regulated facility, the uranium concentration following

restoration was 100 times the EPA drinking water standard for uranium. Some commenters stated it was not possible to restore ground water to baseline water quality conditions and claimed no ISL sites have been restored to baseline. One commenter referred to an NRC report that showed restoration at two ISL sites was not to baseline conditions. Another commenter recommended that the GEIS include site examples where ground water had been restored to baseline conditions.

Restoration Techniques: Comments were also received on the techniques of ground water restoration. One commenter recommended that the GEIS provide assurance that ground water can be restored. Another commenter suggested the GEIS discuss surface and ground water restoration procedures and include protocols to establish background concentrations for radioactive and hazardous constituents. One commenter suggested the use of bioremediation technologies be addressed in the GEIS. Another commenter noted that a recent Texas A&M seminar on uranium mining had concluded that the technology is not available to restore ground water to baseline conditions. Another commenter recommended that the GEIS describe past failures in ground water restoration.

A few commenters also identified geochemical issues. One commenter was concerned about increases in post-restoration ground water contaminant levels resulting from oxidation due to infiltrating oxygen-rich waters. Another commenter recommended that the GEIS include information on the variable rates of mineral oxidation/reduction to estimate the time required for aquifer conditions and dissolved mineral concentrations to return to baseline conditions. The same commenter stated the GEIS should consider changes in geochemical conditions, including issues such as carbon loss, pyrite oxidation, and other reactions.

Local Ground Water Conditions: Some commenters described local ground water conditions, focusing particularly on the water quality of local aquifers and the uses of these aquifers. A commenter expressed concern that uranium exploration wells located west of Mt. Taylor in New Mexico could potentially provide a pathway between contaminated and uncontaminated aquifers. Another commenter indicated that ISL milling could impact water supplies such that some communities might be forced to move their existing water supply wells as a result.

2.2.7 Land Use

Some commenters were concerned about land use. One commenter noted that ISL facilities typically are sited in remote areas where livestock grazing and oil and gas exploration occur. Another commenter recommended that the GEIS evaluate the impacts to ranching activities, livestock, and wildlife from both the operation of ISL facilities and of other local mining activities. Another commenter noted that unique land tenure circumstances (e.g., emphasizing split estate lands, public lands, and Native American lands) were not specifically addressed in NRC's notices of scoping. The impact of ISL facilities to local property values was also discussed by some commenters. A number of other commenters questioned the acquisition of uranium leases and how landowners with only surface rights (and no mineral rights) would be impacted. Another commenter suggested land use mitigation measures be described in the GEIS and it was suggested that land reclamation for surface disturbance include both topsoil specifications and re-vegetation success standards.

2.2.8 Ecology

Some commenters were concerned about potential ecological impacts and how they would be considered in the GEIS. One commenter recommended that the GEIS consider surface disturbance impacts to wildlife and vegetation, including sensitive and endangered species. A few commenters were concerned about the potential harm to wildlife from uranium and other metal concentrations in the water extracted during ISL operations. Another commenter suggested that the GEIS analyze habitat fragmentation on the sage grouse and other species of concern from ISL operations. One commenter noted that ISL operations are minimally intrusive, have a small surface footprint, and therefore would result in small disturbances to ecology.

Other commenters provided examples of protective measures that could be taken to protect wildlife. These included ensuring that open water bodies (e.g., pits, ponds, tanks, lagoons) that could attract wildlife were covered, screened, or netted; that coverless impoundments include escape ramps operable at any water level; and that fences, roads, overhead power lines, and trenched piping be constructed to minimize adverse impacts to wildlife.

Other commenters expressed concern about the concentrations of selenium in wastewater from ISL operations and the potential impact of selenium on waterfowl using evaporation ponds, as well as concerns about the bioaccumulation of chemical constituents in biota from the land application of treated waste waters. A commenter noted that selenium co-exists with uranium deposits and could be mobilized by lixiviant from ISL operations. Technical information was provided on those metal concentrations associated with wildlife impacts.

The New Mexico Department of Fish and Game provided construction guidelines which they recommended be included in the GEIS. A commenter recommended that NRC work with both the Navajo Department of Fish and Game and the U.S. Fish and Wildlife Service to assess potential impacts to wildlife. Another commenter stated that native plants and trees should be restored in compliance with Executive Order 13112 on invasive species.

2.2.9 Site-Specific Analyses

A number of comments addressed either the relationship between the GEIS and the performance of site-specific licensing reviews or requested clarification of what topics would be addressed generically in the GEIS and which would need to be considered in site-specific reviews.

Over 90 percent of the written comment letters expressed a concern that site-specific issues could only be addressed by a site-specific environmental impact statement. These commenters were concerned about the usefulness of a GEIS given the site-specific nature of ISL operations. These commenters were also concerned that because of the GEIS, the site-specific NEPA review documents would be environmental assessments (EAs), which would have the effect of limiting public participation in the NEPA process by those potentially affected. These commenters also stated that the preparation of an EA involves less stringent environmental analyses and public participation requirements than would occur if an environmental impact statement (EIS) were prepared. One commenter requested that the GEIS clearly state the form of the site-specific analysis and associated public participation that would be conducted for any site-specific NEPA reviews tiered from the GEIS. Another commenter recommended that the GEIS include the decision-making criteria for preparing a site-specific EA versus an EIS.

Another commenter recommended that the GEIS clarify the environmental topics that would be resolved by the GEIS versus those that would be addressed in site-specific reviews. Other commenters provided opinions on topics they believed were site specific and, therefore, could not be analyzed in a GEIS. These topics included: transportation, geology, water resources, hydrology, local water quality, geochemistry, ecology, special status ecological species, critical habitat, socioeconomics, agricultural impacts, cultural properties, and cumulative impacts. Still other commenters were unclear as to whether any site-specific NEPA analyses would be done. One commenter suggested that preparation of the GEIS would eliminate the requirement for NEPA studies on individual ISL projects. A few commenters felt that preparing the GEIS would limit both the preparation of site-specific EISs and the public participation associated with this process; while another commenter disagreed, claiming that the GEIS would not preclude preparing site-specific EISs. Still another commenter expressed their opinion that, with the GEIS, EAs would be sufficient for site-specific ISL licensing. Finally, one commenter strongly recommended that NRC prepare individual EISs for all applications for uranium milling in NM.

2.2.10 Operational Safety and Emergency Response

A number of the individual written comment letters expressed general concerns about public safety at ISL facilities, environmental impacts, and worker safety. Some commenters requested that the GEIS consider specific types of operational impacts including the potential contamination of soil, surface water, air, ground water; the release of radon gas; the potential for either well field or other spills; the potential risk to children, and the potential risk associated with exposure to various processing solutions and processing resins. One commenter recommended that ISL facilities be required to install leak detection systems in injection and production wells. Another commenter questioned how NRC will ensure that ISL plants are constructed in a sound manner and not prone to failure.

Other commenters offered opinions on operational conditions at ISL facilities. One commenter recommended that the GEIS not assume that ISL facilities would be in remote areas, noting that experience in Colorado was contrary to this assumption. Another commenter noted that in Wyoming ISL facilities were typically located away from high population areas and designed to reduce risks. The commenter also noted that ISL facilities neither have ore stockpiles nor tailings impoundments, which reduces airborne emissions compared to conventional milling facilities, and that because of the common use of rotary vacuum dryers at ISL facilities for yellowcake drying operations, there were no particulate uranium emissions.

Safeguards and security concerns were also raised by a few commenters. Some commenters were concerned about the inclusion of credible accident scenarios, including sabotage and terrorism, in the GEIS and the evaluation of the emergency response to such scenarios. Another commenter was concerned about how information would be disseminated to local communities in the event of ISL facility contamination or release incidents.

2.2.11 Decommissioning and Waste Management

Some commenters were concerned about decommissioning and waste management. Some of the topics discussed in this section were also identified as issues discussed in Section 2.2.4 (History and legacy of uranium mining).

One commenter suggested that the availability of NRC licensed sites for the disposal of ISL radioactive wastes is limited and that the GEIS should include a discussion of this concern.

Another commenter recommended that the GEIS also identify and discuss the disposition of wastes generated by construction, operation, and decommissioning, and explain the handling and disposal practices for such waste, including: annual waste volumes generated, disposal location, transportation routes to disposal locations, regulatory requirements for storage and disposal, and discussing whether the waste would be classified as hazardous under federal or tribal law. Another commenter noted that wastes produced by ISL facilities are considered 11e(2) byproduct material and produced in smaller quantities as compared to the amounts produced by a conventional uranium mill.

Other commenters had specific concerns with particular waste treatment or disposal methods. One commenter stated the GEIS should evaluate the potential impact to surface and ground water from discharges from an ISL facility; identify specific discharges and needed National Pollutant Discharge Elimination System (NPDES) permits; and also consider the impact to both current and future water users. Another commenter recommended that the GEIS include information concerning the risk to the public and the environment from the use and availability of Underground Injection Control (UIC) deep well injection of waste waters in relation to the depth and location of public water supply wells.

2.2.12 Socioeconomics

A few comments on potential socioeconomic impacts were received. One commenter recommended that the GEIS evaluate social and economic impacts to communities both during operations and after decommissioning. Another person commented on the cost-benefit of ISL facilities with respect to creating jobs. Another commenter noted that ISL facilities are not large employers and that their operation would not have the same magnitude of impact as coal bed methane operations or oil and gas operations in the State of Wyoming. Another commenter stated the GEIS should assess impacts to overburdened communities already affected by oil, gas, and coal development, noting in particular the potential impact on the infrastructure such as roads, police, emergency response, the effect on housing costs and labor supply, and the effect on crime and drugs use. A few commenters noted that ISL milling would bring economic stimulus to the region by expanding the tax base for communities.

2.2.13 Environmental Justice

Comments related to the topic of environmental justice generally pertained to whether the issue should be analyzed in the GEIS. Additionally, commenters provided views on how the environmental justice analysis should be done, and discussed the potential consequences of assessing environmental justice in the GEIS.

Some commenters believed environmental justice should be analyzed in the GEIS, while other commenters stated it should be assessed for each license application on a site-specific basis. One commenter stated that environmental justice could not be evaluated generically and that if it were analyzed in the GEIS, this would eliminate the need for further site-specific environmental justice reviews. The commenter further stated that NRC's environmental justice policy indicates meaningful analysis would be unlikely in the GEIS, even though NRC's public scoping notices identifies the issue of environmental justice as being addressed in the GEIS. Another commenter noted that since an environmental justice analysis is not required for an NRC environmental assessment, the analysis in the GEIS could be the only one performed to support site-specific licensing reviews. Another commenter stated that the concept of

environmental justice assumes there is a choice for locating facilities; however, uranium recovery facilities must be located where the ore deposits occur.
A number of commenters provided recommendations regarding how to conduct an environmental justice evaluation in the GEIS. One commenter advised following the Council on Environmental Quality's guidance on environmental justice. Another commenter suggested that NRC provide opportunities for affected communities to participate in the NEPA process. It was further suggested that information and materials on the GEIS be provided in the Navajo language. Another commenter recommended that the GEIS document the existing health and environmental risks to affected communities. One commenter stated that an environmental justice analysis should consider the rights of indigenous groups under international law, impacts on lifestyle, economy, and disruption to property and cultural practices. Another commenter suggested the GEIS consider environmental justice impacts to Navajo people and ranchers. Commenters also stated that the GEIS needed to consider potential environmental justice mitigation measures for community disruption (including those communities that could be displaced or relocated), changes in existing transportation routes, and changes to water access. One commenter noted that a past NRC environmental justice evaluation for a particular site had not considered impacts from past contamination.

2.2.14 Historic and Cultural Resources

Comments relating to the issue of historic and cultural resources recommended that the GEIS comply with the requirements of the National Historic Preservation Act to protect historic properties located on tribal lands. Another commenter stated the GEIS should describe the notification process for local communities in the event that historical or cultural artifacts were found at an ISL facility. A commenter wondered how tribal cultural sensitivity would be considered in the NEPA process, what recourse local communities would have in that process related to cultural matters, and what importance any feedback from these communities would have in the NEPA process.

Other cultural resources comments are described in section 2.2.5 Native American Concerns.

2.2.15 Transportation

Transportation comments were related to the safety of transporting uranium from mill sites. Comments related to safeguards, security, and terrorism during transportation of yellowcake uranium was identified as a concern. Another commenter stated the GEIS should describe all proposed uranium facilities and the miles of new road that would be required to support them. Dust generation from increased road use was also discussed, and the use of speed limits and dust suppression methods were identified as mitigation measures, along with the suggestion for ISL companies to work with local governments on solutions. Another commenter recommended that the GEIS not assume processing facilities would be located near well fields, citing a Colorado site that ships uranium solutions 250 miles for processing, and another company which proposed to ship uranium-loaded ion exchange resin beads from Colorado to Wyoming for further processing.

2.2.16 Visual and Noise Impacts

A few commenters expressed concern over the potential for visual impacts from ISL facilities, and also noted that noise impacts were low at ISL facilities.

2.2.17 Bonding / Surety

A range of comments were provided on the topic of financial assurance and bonding. A few commenters suggested the GEIS should describe and assess bonding for the complete restoration of ground water and land. Another commenter recommended that the GEIS describe the NRC formula used to calculate ground water restoration costs, which include ground water sweep, reverse osmosis, and other methods to return ground water to baseline conditions. A few commenters were concerned about past regulation of bonding (surety) for the clean up of sites and provided examples where the cleanup costs exceeded estimates. One commenter stated NRC should reconsider its policy of allowing the surety amounts for ground water restoration to be phased to match well field development. Another commenter recommended that the bonding analysis be based on either the greater of the worst case or 150 percent of the estimated clean-up costs. A bonded evaluation period for reclamation was also recommended. The role of state programs in restoration and avoiding duplication of effort were also mentioned as a cost factor. One commenter asked whether background checks are conducted to ensure that "bad companies" do not manage an ISL facility.

2.2.18 Alternatives Considered

Opinions on the alternatives included in the scoping notice for the GEIS were provided, however, most comments recommended additional alternatives for consideration in the GEIS.

One commenter stated that comparing ISL milling and conventional uranium milling as alternatives is flawed, because both are not usually applicable alternatives for a given site or for the type of uranium ore deposit to be exploited. Additionally, the commenter stated that both methods are not mutually exclusive alternatives since the uranium-rich lixiviant from the ISL facility can be processed at a conventional mill. The commenter recommended separate evaluations for each milling method (ISL and conventional mill). A few commenters supported analysis of conventional mills in the GEIS. Another commenter suggested that additional alternatives be included in the GEIS analysis, noting that NEPA requires a reasonable range of alternatives to be considered (even those outside the jurisdiction of the lead agency) and that rationales be provided for those considered but not evaluated in detail.

Recommendations for considering other alternatives in the GEIS included a variety of suggestions. A commenter recommended that alternative sources of uranium processed at ISL facilities be considered in the GEIS, including reprocessed spent fuel, drinking water treatment residuals, and uranium in sea water and phosphates. Another commenter suggested the use of government stockpiles of uranium to meet the nation's needs rather than milling as an alternative.

Other commenters recommended that the GEIS analyze variations in the ISL process. These variations touched on

- alternative leaching solutions (e.g., the use of sulfuric acid or hydrogen peroxide lixiviants) based on local mineralogy or other geologic factors,
- alternative ISL techniques of uranium recovery, such as the artificial flooding of unsaturated zones
- well field restoration methods,
- transportation modes and routes,
- well field sizes, configurations and access methods,

- locations and types of processing facilities, and
- treatment and disposal of process-related waste water.

Commenters also recommended that the GEIS consider establishing limitations on where ISL milling would be allowed (e.g., based on the types of aquifers and geology involved). A related comment recommended not allowing ISL operations in aquifers that are used or possibly could be used as a source of public drinking water.

A few commenters also recommended that the GEIS include consideration of alternative energy sources that they considered are less damaging to the environment, as well as alternatives to nuclear power that creates the demand for uranium and uranium milling.

2.2.19 Cumulative Impacts

Commenters also suggested topics that should be included in the GEIS analysis of cumulative impacts. The assessment of cumulative impacts involves assessment of the incremental impacts from the current action when added to those from past, present, and reasonably foreseeable future actions.

A commenter stated the GEIS should consider the environmental impacts from both licensed and non-licensed activities from all past uranium recovery activities. Other commenters suggested the GEIS analysis of cumulative impacts should include the impacts from past uranium mining and milling legacy sites and the existing contamination in the vicinity of proposed ISL operations. Other commenters stated the GEIS analysis of cumulative impacts should consider the combined impacts from both proposed ISL facilities and proposed conventional mills.

Some commenters noted that the locations of ISL facilities in Wyoming would be near to existing and planned oil and gas development, coal mining, and coal bed methane operations (including aquifer dewatering), and these activities should be considered in the analysis of cumulative impacts. Other commenters noted past problems with types of mining other than uranium mining (e.g., oil and gas, copper). Still other commenters identified specific nuclear and non-nuclear facilities that they felt should be included in the evaluation of cumulative impacts. A few commenters expressed concern over the cumulative impacts to the quantity and quality of locally available ground and surface water, and to air quality.

2.2.20 Monitoring programs

A commenter recommended that the GEIS discuss the environmental monitoring programs that are designed to assess impacts from facility operations and the effectiveness of waste disposal technologies, including methods used and requirements for monitoring disposal and waste management plans. The commenter suggested that this discussion describe how monitoring would ensure that impacts are addressed and mitigated once the impacts are identified. The commenter further recommended that the GEIS discuss the use of adaptive management as incorporated into the monitoring protocols for each facility's environmental measures.

Another commenter expressed a concern that monitoring requirements are needed for the whole ISL mill process to limit the potential for ground water contamination from operations by helping to mitigate and prevent spills and ground water contamination before they happen. A commenter recommended that the time limits on restoration monitoring be extended to 20 years to ensure that there are no long-term impacts to the ground water. A few commenters recommended that the distance between ground water monitoring wells for an ISL well field reflect the geometry of the ore deposit so as to more effectively to detect the movement of the leaching solution from the well field during operations. Other commenters stated that there is a need for additional checks and balances on monitoring, and suggested the use of a third party to monitor and gather baseline ground water data so that local residents could be reassured that their water quality is not being impacted. A commenter also recommended that sampling requirements be established for monitoring oxidation-reduction conditions in the ore-bearing aquifer before, during, and after ISL operations.

2.2.21 Regulations and Guidance

A number of comments were provided that pertained to regulatory topics, including: comments on existing regulations, agencies involved in regulating uranium recovery facilities, existing guidance and practice, agreement state issues, and rulemaking activities.

Some commenters suggested that existing regulations and guidance are either outdated or should be improved and provided recommendations for making revisions. These included a suggestion to revise 10 CFR Part 40 and to proceed with a 10 CFR Part 41 rulemaking to address issues such as requirements for compliance location, ground water monitoring, compliance demonstration, surety, limiting excursions, remediation following excursion, and establishing pre-operational baseline ground water conditions. Other commenters recommended similar changes to regulations, but focused on single areas of interest such as monitoring, baseline conditions, or restoration. One commenter noted that the GEIS should clarify how any new ISL ground water restoration standards and the existing 10 CFR Part 40 will meet the Uranium Mill Tailings Radiation Control Act and 40 CFR Part 192 for a demonstration of how onsite or offsite water resources will be protected. Another commenter recommended that climate change be added to updated regulations, including consideration of impacts to ISL facilities from increases in storm events, changes in precipitation, and consideration of "carbon footprint" issues. One commenter expressed the opinion that current environmental standards for air, water, soil and waste are adequate.

A few commenters expressed confusion regarding the authorities and responsibilities of various local, state, and federal regulatory agencies in regulating uranium recovery facilities. They recommended that the GEIS clarify the roles of each agency. A few commenters asked who would be responsible for providing clean water to communities if ground water is contaminated by ISL operations and who would be responsible for the clean up of contamination once operations stopped. Another commenter recommended that the GEIS recognize the U.S. EPA role in regulating aspects of uranium extraction activities, including underground injection control. A commenter recommended that the GEIS include procedures for how licensing actions that span two states are addressed.

Others provided comments on existing regulatory guidance or practices. One commenter requested NRC identify and remedy any past regulatory assumptions or practices that have contributed to adverse environmental impacts from uranium recovery activities. A number of commenters expressed the opinion that the 1980 GEIS on conventional uranium milling was out of date and needed to be revised. Detailed suggestions were provided by a few commenters on how NRC should revise the 1980 GEIS, including using documents identified by the commenters in any update to that GEIS. Another commenter recommended that NRC amend its environmental justice policy to require a supplemental environmental impact statement analyzing environmental justice in every instance where an ISL operation is proposed in or near an environmental justice community. The commenter felt that this would to ensure that environmental justice is considered when a site-specific environmental assessment was prepared. One commenter stated that NRC's guidance concerning the disposal of certain materials in a conventional uranium mill's tailings impoundment was not final nor enforceable, because the definition of "ore" in the guidance was too broad and allowed particular materials that were not similar to uranium ore or tailings to be disposed in the impoundment.

Additional comments provided recommendations to change past or current regulatory practices. One commenter suggested the NRC position that pre-1978 tailings are outside the authority of the Uranium Mill Tailings Radiation Control Act should be clarified, perhaps by a rulemaking on conventional milling standards. Another commenter suggested the NRC policy of performance-based licensing has evolved into industry self-regulation (e.g., allowing major changes without appropriate oversight) and that the policy needed to be reconsidered. One commenter stated that the NRC practice of characterizing radiation from conventional mine waste on or near an ISL site as background radiation for the purpose of calculating ISL operational air impacts violates the plain language and intent of NRC regulations and ignores cumulative impacts from past and current milling activities. Another commenter recommended that NRC address problems with its fee-based regulatory structure. One commenter suggested that radiation dose standards be set for the most vulnerable individuals (e.g., women and children), while another mentioned that "reference man" standard used in the dose calculation was not representative of most people in New Mexico. Regarding the practice of limiting the number of waste sites by disposing of ISL wastes in existing conventional mill tailings impoundments, one commenter recommended that if such sites are not available, NRC should allow ISL sites to join together to construct a common 11e.(2) byproduct material disposal site that meets 10 CFR Part 40, Appendix A requirements. Another commenter recommended establishing laws and penalties for a licensee's corruption.

A few commenters expressed concerns regarding how NRC agreement states might be impacted by publication of the GEIS. One recommended that NRC recognize the effectiveness of non-agreement state regulations and recommended that NRC enter into a memorandum of understanding with non-agreement states so as to limit dual regulation of ISL facilities.

2.2.22 National Environmental Policy Act

A number of commenters expressed opinions about the GEIS in the context of the intent and requirements of the National Environmental Policy Act (NEPA). One commenter recommended that NRC explain how a GEIS meets the requirements of NEPA, which requires a site-specific analysis considering local impacts, mitigation measures, and public participation. The commenter further requested that NRC discuss examples of other GEIS's. Another commenter suggested that since the licensing of an ISL facility was a major federal action, an environmental impact statement was required. Other commenters claimed that the GEIS was inconsistent with the intent of NEPA, noting that a GEIS is similar to a programmatic environmental impact statement, which is only applicable to broad and similar actions. Another commenter noted that the GEIS is applicable due to similarities among ISL recovery processes among sites, and still another suggested the GEIS would allow consideration of redundant issues in ISL licensing.

One commenter suggested that NRC's approach in applying a generic, and therefore abstract, approach to the analysis of environmental impacts in the GEIS fails to meet the required "hard look" standard in NEPA concerning the review of individual licensing actions and their potential impacts. Another commenter claimed the language of the scoping notice that indicated NRC's intent to tier site-specific environmental assessments (EAs) to the GEIS actually pre-determined the outcome of the NEPA process (i.e., an EA and finding of no significant impact) and therefore indicates NRC's intent to avoid preparing site-specific environmental impact statements (EISs). Still another commenter recommended that NRC use tiering to examine program level decisions and apply the "hard look" review to site-specific actions, preparing an EA or EIS as necessary and allowing public participation in either case. One commenter recommended that the GEIS include the levels of coordination, analysis, and public outreach required for completion of the NEPA process for individual licensing decisions.

One commenter mentioned that NRC had not listed a number of potentially related actions to the GEIS in the scoping notice, and thus being inconsistent with an open decision-making process. The actions identified by the commenter included various uranium recovery rulemakings; the perceived "blanket approval" of pending ISL license applications and conventional mill restarts; and the establishment of a national radioactive source tracking system. Other commenters stated that the GEIS was unlawful in the context of NEPA, because the description of the proposed action in NRC's scoping notice failed to identify the specific licensing actions or rulemakings at issue, and therefore the proposed action to be evaluated was not clear.

2.2.23 Credibility of NRC

Some commenters questioned the credibility of NRC in its regulation of uranium milling, its execution of the scoping process, and in publishing a GEIS.

Some commenters mentioned that the way in which the scoping meetings were announced, it appeared that NRC was not interested in seeking public comment in good faith (e.g., "hoped no one would notice"). Another mentioned the NRC decision to develop a GEIS without public comment suggested that NRC was indifferent to the communities most affected by the decision. A number of other commenters claimed that NRC was more concerned about satisfying the uranium milling industry or lobbyists (one referred to NRC as "corporate lapdogs"). Several other commenters suggested that since NRC has failed to enforce regulations to ensure safety in the past, it could not be trusted for ensuring safety now.

2.2.24 Miscellaneous

A number of comments conveyed either general support for or opposition to the GEIS, to uranium milling, to nuclear power, to nuclear weapons, and to alternative energy sources.

3. SCOPE OF GEIS AND SUMMARY OF ISSUES TO BE ADDRESSED

The scoping process and the comments received during the public scoping period for the GEIS were used by NRC to aid in determining the scope of the GEIS. The following topical areas and issues will be analyzed in the GEIS:

- *Proposed Action and Alternatives.* The proposed action for the GEIS is the construction, operation, and decommissioning of and ground water restoration at ISL uranium milling facilities in regions of four western states where NRC is the licensing authority for uranium milling. These four states are Nebraska, South Dakota, Wyoming, and New Mexico. The boundaries of the regions were based on the presence of (1) uranium ore amenable to the ISL process, (2) ISL facilities previously licensed by NRC, and (3) potential future ISL facilities as identified to NRC by uranium milling companies. The GEIS will also address the no-action alternative to the proposed action. The no-action alternative is to not license additional ISL facilities in the identified milling regions.

- *Applicable Statutes, Regulations and Agencies.* Various applicable statutes, regulations, and implementing agencies at the federal, state, and local levels involved in regulating ISL facilities will be identified and discussed in the GEIS. The roles of the various agencies involved in ISL regulation will also be described.

- *Purpose of the GEIS and Use in Site-Specific Licensing Reviews.* The GEIS will provide a statement of purpose and include a description of the NRC licensing process and how NRC intends to use the GEIS to aid in its evaluation of potential environmental impacts in site-specific licensing reviews.

- *Opportunities for Public Involvement.* As part of the description of the NRC licensing process, the GEIS will include description of opportunities for public involvement in site-specific ISL reviews.

- *Applicable Rulemaking Activities.* The GEIS will be based on the existing regulations in effect at the time the GEIS is written. As appropriate, any applicable ongoing or planned rulemaking activities applicable to ISL facility licensing will be described.

- *Land Use.* The GEIS will discuss the potential impacts to existing land uses in the ISL milling regions associated with the construction, operation, decommissioning, and ground water restoration of ISL facilities. This will include potential impacts to ranching, grazing, recreation, industrial, and cultural activities.

- *Transportation.* The GEIS will discuss potential radiological and non-radiological impacts from ISL transportation activities during construction, operation, ground water restoration, and decommissioning. This includes shipment of supplies, yellowcake product, and wastes associated with each phase of the ISL facility lifecycle. Normal transportation and accident conditions will be considered. Potential non-radiological impacts to be evaluated include dust generation and impacts to infrastructure, such as roads and local traffic conditions. Potential radiological impacts considered will include direct radiation and potential release of radioactive material from accidents during shipment.

- *Geology and Soils.* The GEIS will describe the geology and the soils of the ISL milling regions. These descriptions will be used in support of the evaluation of potential impacts to surface and ground water from ISL activities. The GEIS will also address the potential impacts to the geology and soils from the different phases of the ISL facility's lifecycle.

- *Water Resources.* Potential impacts to surface water, wetlands, and ground water from construction, operation, ground water restoration and decommissioning will be assessed in the GEIS. The potential for ground water impacts, in particular, is noted as a key concern that historically has been a key area of focus in ISL licensing. The GEIS will address the potential impacts to surface and ground water quality and availability in the vicinity of an ISL facility, and this will include discussion of the requirements for and the process of operational ground water monitoring, the management of liquid wastes from the ISL process, and the methods used in ground water restoration.

- *Ecology.* The GEIS will assess the potential impacts of proposed ISL facility operations, construction, decommissioning and ground water restoration to ecology in the ISL milling regions. This will include consideration of potential impacts to terrestrial, aquatic, and threatened and endangered species from all phases of the ISL facility lifecycle.

- *Meteorology, Climatology, and Air Quality.* The GEIS will consider the potential impacts of proposed ISL facility construction, operations, ground water restoration, and decommissioning to local and regional air quality from both radiological and non-radiological emissions. Radiological emissions will include radon from well field, processing, and waste treatment operations and the potential for uranium particulate emissions from yellowcake drying operations. Non-radiological emissions include combustion engine exhausts from trucking and well drilling operations and fugitive dusts from a variety of activities.

- *Noise.* Potential noise impacts from proposed ISL facility construction, operations, ground water restoration, and decommissioning will be assessed in the GEIS. This includes noise from well field development, uranium processing activities, and trucking activities associated with all phases of the ISL facility lifecycle.

- *Historic and Cultural Resources.* The GEIS will discuss potential impacts from proposed ISL facility construction, operations, ground water restoration, and decommissioning to historical and cultural resources. Local and regional historic and cultural properties in ISL milling regions will be addressed. The process for consultations concerning historic and cultural resources will be discussed in the GEIS.

- *Visual Resources.* Potential impacts to visual resources in uranium milling regions from proposed ISL facility construction, operations, ground water restoration, and decommissioning will be assessed in the GEIS. Assessments will consider scenic vistas and how the ISL facility lifecycle could impact these resources.

- *Socioeconomics.* The GEIS will address the potential impacts of proposed ISL facility construction, operations, ground water restoration, and decommissioning to socioeconomic conditions in uranium milling regions. Local and regional characteristics pertaining to demographics, income, housing, employment, finances, and education will be considered.

- *Public and Occupational Health.* Potential impacts to public and occupational health from proposed ISL facility construction, operations, ground water restoration, and decommissioning will be assessed in the GEIS. This assessment will include both non-radiological (including chemical) and radiological effluents and releases under normal (routine) and accident conditions.

- *Waste Management.* The GEIS will consider impacts from waste management activities of proposed ISL facility construction, operations, ground water restoration, and decommissioning. Generation, handling, treatment, and disposal of process-related wastes and municipal wastes will be addressed.

- *Ground Water Restoration.* The restoration of the uranium ore-bearing ground water aquifer(s) following operations will be assessed in the GEIS. Hydrologic conditions in uranium milling regions will be considered as well as available restoration technologies and methods. Available data from aquifer restoration efforts at past and current ISL sites will inform the analysis. A discussion of regulatory requirements and the roles of various federal, state, and local agencies regarding ground water restoration will also be included in the GEIS.

- *Decontamination, Decommissioning, and Reclamation.* The GEIS will assess the potential impacts to the environment following the end of ISL operations, including removal of facilities and equipment, disposal of waste materials, cleanup of contaminated areas, and reclamation of lands to their pre-ISL facility condition.

- *Accidents.* Potential accident conditions will be addressed in the GEIS. This will include consideration of a range of possible accidents and estimation of their consequences, including: well field leaks and spills, excursions of the leaching solution beyond the well field, processing chemical spills, and ion exchange resin and yellowcake transportation accidents.

- *Environmental Justice.* The GEIS will discuss the potential for disproportionately high and adverse impacts on minority and low income populations from future ISL licensing in the uranium milling regions.

- *Cumulative Impacts.* The GEIS will discuss the cumulative impact of adding the potential environmental impacts from proposed ISL facility construction, operations, ground water restoration, and decommissioning to other past, present, and reasonably foreseeable future actions in the uranium milling regions.

- *Monitoring.* The GEIS will discuss various monitoring requirements and techniques used to detect and mitigate the spread of radiological and non-radiological contaminants beyond boundaries of the ISL facility.

- *Financial Assurance.* The GEIS will describe the requirements and practices designed to ensure that companies engaged in ISL uranium recovery will have sufficient funds set aside to close down operations, restore affected ground water, decontaminate and decommission facilities and reclaim lands.

4. ISSUES CONSIDERED OUTSIDE THE SCOPE OF THE GEIS

Some issues and concerns raised during the scoping process were not directly related to the assessment in the GEIS of potential environmental impacts from the ISL process, and for that reason, these issues and concerns will not be specifically addressed in the GEIS. However, the lack of in-depth discussion in the GEIS does not mean that an issue or concern lacks value. Issues beyond the scope of the GEIS either may not yet be ripe for resolution or are more appropriately discussed and decided in other venues.

Categories of issues outside the scope and therefore not analyzed in detail in the GEIS include:

- NRC's licensing process and the decision to prepare the GEIS
- General support or opposition for GEIS or uranium milling
- Requests for cooperation or agreements
- Matters that are regulated by agreement states
- Impacts associated with conventional uranium milling past or present
- Requests for compensation for past mining impacts
- Recommendations for changes to regulations or guidance
- Resolution of dual regulation issues
- Consideration of human induced climate change
- Analysis of all variations of ISL technology
- Alternate sources of uranium feed material
- Energy debate
- Expanded cumulative impact analysis
- NRC credibility

4.1 NRC's Licensing Process and the Decision to Prepare the GEIS

A number of commenters raised issues that involved NRC's process for licensing ISL milling facilities and NRC's decision to prepare the GEIS. These issues included (1) concerns about the lack of public input in the decision to prepare the GEIS; (2) comments on the scoping process for the GEIS that included the location and number of public meetings, the comment period duration, and the notice for the meetings; and (3) recommendations for types of analyses be done instead of the GEIS (e.g., an evaluation of deficiencies in the ISL licensing process, an evaluation of ISL milling performance and compliance by an independent third party).

NRC considers feedback on the scoping process important and made efforts to respond to public concerns by extending the public comment period several times and by adding a third public scoping meeting. NRC did not request public comment on the need for a GEIS, because NRC considers this to be an internal agency decision. The NRC staff was directed by the Commission to prepare the GEIS. Given the large number of expected ISL license applications, the NRC determined that the preparation of a generic EIS (other federal agencies use the term "programmatic EIS") was the most efficient use of agency resources. Additionally, while other types of analyses may be informative, NRC considers the GEIS to be the appropriate NEPA document to be prepared at this time.

4.2 General Support for or Opposition to the GEIS or to Uranium Milling

Some commenters stated general support for or opposition to the GEIS or to uranium milling activities in general. These types of comments are useful for understanding public opinions on the GEIS, but by themselves, do not impact the scope of the document.

4.3 Requests for Cooperation or Agreements

Some commenters representing federal or state agencies expressed requests for cooperation or specific cooperative agreements regarding the regulation of ISL facilities. These types of requests will be considered and addressed, as necessary, by NRC on a case-by-case basis. These are separate actions that do not relate to the scope of the GEIS.

4.4 ISL Licensing Regulated by NRC Agreement States

A number of comments were received pertaining to current or future uranium milling activities in NRC agreement states. These included requests that potential future ISL milling in states such as Colorado, Utah, and Texas be addressed in the GEIS. ISL licensing actions in NRC agreement states are outside the scope of the GEIS, because the licensing authority for such actions is the agreement state, and the purpose of the GEIS is to support NRC's licensing review for ISL facilities. This point will be further clarified in the GEIS.

4.5 Impacts Associated with Conventional Uranium Milling Past or Present

A number of commenters addressed conventional uranium milling topics. These topics included: (1) the GEIS on conventional milling (NRC,1980), (2) the legacy of past conventional milling activities, and (3) conventional mill waste management practices.

Because the need for the GEIS is to address NRC's licensing reviews for ISL facilities, topics related to conventional milling will not be addressed in the GEIS. The legacy of past conventional uranium milling will be identified in terms of cumulative impacts in the GEIS; however, a detailed cumulative impacts analysis is a site-specific evaluation.

4.6 Requests for Compensation for Past Milling Impacts

Some scoping comments requested the issue of compensation for past uranium milling impacts be addressed in the GEIS, including injured workers involved in uranium milling prior to 1971 and Navajo workers and families. Such compensations claims are outside the purpose and scope of the GEIS.

4.7 Recommendations for Changes to Regulations or Guidance

A number of commenters recommended changes to existing regulations or guidance. Public input on changes to regulations or guidance are outside the scope of the GEIS and are addressed in other NRC forums, such as comment periods associated with proposed rules and draft guidance documents or petitions for rulemaking.

4.8 Resolution of Dual Regulation Issues

Some scoping comments requested NRC resolve issues related to dual regulation of ISL recovery well fields. The GEIS will be based on the current regulations, authorities, and practices. Changes to regulatory jurisdiction or practice are addressed by other means and are outside the scope of the GEIS.

4.9 Consideration of Human-Induced Climate Change

One comment suggested NRC should include climate change in the GEIS. Natural climate variation is within the scope of the GEIS to the degree that it applies to the potential environmental impacts of the ISL facility lifecycle. Human-induced climate change is not considered in the GEIS because of the imprecise state of the science for making human-induced climate predictions and the relatively short time frame of the ISL facility lifecycle.

4.10 Analysis of All Variations of ISL Technology

One comment recommended that the GEIS assess impacts from each type of ISL technology. For practical reasons, the GEIS will emphasize commonly used technologies (including some variants) but all possible variants of ISL technology will not be addressed. Proposals to use technologies not addressed in the GEIS will be evaluated by NRC in a site-specific licensing review.

4.11 Alternate Sources of Uranium Feed Material

Some commenters suggested various options for alternative sources for uranium feed material, including reprocessing spent fuel from nuclear power plants, recovery of uranium from drinking water treatment residuals, extraction of uranium from sea water, and use of government stockpiles of uranium.

These alternatives are considered outside the scope of the GEIS, because the GEIS is focused on ISL facility licensing and is not intended to address the broader issues of how to meet the US demand for uranium or what sources of uranium should be used.

4.12 Energy Debate

Some commenters focused on the broader energy debate, including support for or opposition to nuclear energy, and suggestions to promote renewable energy sources, such as wind, solar, and tidal energy. The GEIS is focused on ISL facility licensing and is not intended to address the broader issues of what source of energy should be pursued.

4.13 Expanded Cumulative Impact Analysis

Another commenter suggested the scope of the cumulative impact analysis in the GEIS should include: nuclear testing, nuclear war, disposal of warheads, nuclear winter, proliferation, pre-emptive war, terrorist diversion, use of weapons in foreign conflicts, nuclear power and associated radioactive waste disposal, and mishandling of materials by other countries. These concerns are outside the scope of the GEIS, because they deal with topics unrelated to uranium recovery and to NRC's licensing reviews of ISL license applications.

4.14 NRC Credibility

Scoping comments that questioned NRC credibility are considered important and taken seriously by the staff. Therefore, these comments are incorporated into the GEIS in the documentation of concerns raised during the scoping period. However, the comments do not change the scope or content of the GEIS.

5. REFERENCES

NRC. NUREG-0706, Vol. 1, "Final Generic Environmental Impact Statement on Uranium Milling." Washington DC: NRC. September, 1980.

NRC. NUREG-1748. "Environmental Review Guidance for Licensing Actions Associated with Office of Nuclear Material Safety and Safeguards (NMSS) Programs, Final Report." Washington DC: NRC. August, 2003.

Table 1. Classification of Scoping Comments

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Marilyn Musgrave, United States House of Representatives, Colorado's Fourth Congressional District	X	X	X			X	X	X																
Jason Johnson, Governor, Pueblo of Acoma					X																			
Bill Richardson, Governor of New Mexico	X	X	X		X				X													X		
Lynda Lovejoy, District 22 State Senator New Mexico	X	X	X	X	X	X	X		X		X	X												X
Anne Norton Miller, United States Environmental Protection Agency	X	X	X	X	X	X				X		X	X	X	X		X	X	X	X	X			
Mike Stempel, Department of the Interior, Fish and Wildlife Service						X	X	X																X
Robert Specht, Department of Interior, Bureau of Land Management						X	X															X		X
Omar Bradley, Department of the Interior, Bureau of Indian Affairs Regional Director, Navajo Region	X	X	X		X	X		X			X		X	X	X			X	X					
Connie Young-Dubovsky, NEPA Coordinator Region 6																								X
Conrad Spangler, Commonwealth of Virginia, Department of Mines, Minerals and Energy, Division of Mineral Mining	X																							X

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Matthew Wunder, State of Mexico Department of Fish and Game	X					X	X	X	X						X									
Richard A. Chancellor, State of Wyoming, Department of Environmental Quality		X				X					X							X			X			X
John Etchepare, Wyoming Department of Agriculture							X	X				X			X				X					
Martha Rudolph, Colorado Department of Public Health and Enviornment	X		X	X		X						X			X									X
David Taylor, Navajo Nation Department of Justice	X	X		X	X	X	X		X			X	X	X										X
Eric D. Jantz, New Mexico Environmental Law Center on behalf of: Eastern Navajo Dine Against Uranium Mining, Southwest Research and Information Center, Bluewater Valley Downstream Alliance and the Haaku Water Office of the Acoma Pueblo	X		X			X		X	X			X	X	X					X			X	X	X
James W. Zion, on behalf of National Indian Youth Council and The Forgotten People													X											
Benjamin A. House, Eastern Navajo Allottee Association	X																							X
Leona Morgan, ENDAUM					X																			

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Eastern Navajo Dine Against Uranium Mining, Concerned Citizens of Tiistsooz Nideeshgizh and Southwest Research and Information Center					X																			
Rita Whitehorse Larson, Navajo Nation Environmental Protection Agency	X			X	X	X	X	X	X		X		X			X								
David Schneck, San Miguel County, CO-Environmental Health Director																						X		
Kelly B. Dennis, Crook County Land Use Planning and Zone Commission						X									X									
Michael Daly, McKinley County Water Board					X	X						X					X							
Katie Sweeney, National Mining Association	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X		X
Steven C. Borell, Alaska Miners Association	X					X	X														X	X		X
Marion Loomis, Wyoming Mining Association	X	X	X																		X			X
Elizabeth Cumberland, South Texas Opposes Pollution			X			X																X		
Carol Geiger, Public Citizen-Texas Office			X																			X		
Geoffrey H. Fettus, Natural Resources Defense Council	X		X	X	X	X	X		X		X	X	X	X								X	X	

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Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Chad Kamard, Colorado Environmental Coalition	X		X	X	X	X	X		X		X	X	X	X								X	X	
William J. Snape III, Center for Biological Diversity	X		X	X	X	X	X		X		X	X	X	X								X	X	
Ryan Demmy Bidwell, Colorado Wild	X		X	X	X	X	X		X		X	X	X	X								X	X	
Megan Corrigan, Center for Native Ecosystems	X		X	X	X	X	X		X		X	X	X	X								X	X	
Dusty Horwitt, Environmental Working Group	X		X	X	X	X	X		X		X	X	X	X								X	X	
Jim Riccio, Greenpeace	X		X	X	X	X	X		X		X	X	X	X								X	X	
Richard A. Parrish, Southern Environmental Law Center	X		X	X	X	X	X		X		X	X	X	X								X	X	
Betsy Loyless, National Audubon Society	X		X	X	X	X	X		X		X	X	X	X								X	X	
Mike Petersen, The Lands Council	X		X	X	X	X	X		X		X	X	X	X								X	X	
Velma Smith, National Environmental Trust	X		X	X	X	X	X		X		X	X	X	X								X	X	
Nada Culver, The Wilderness Society	X		X	X	X	X	X		X		X	X	X	X								X	X	
Tyson Slocum, Public Citizen's Energy Program	X		X	X	X	X	X		X		X	X	X	X								X	X	
Anna Aurilio, U.S. Public Interest Research Group	X		X	X	X	X	X		X		X	X	X	X								X	X	
Dave Hamilton, Sierra Club	X		X	X	X	X	X		X		X	X	X	X								X	X	
Cyrus Reed, Sierra Club-Lone Star Chapter	X		X	X		X	X	X																

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Post '71 Exposure Committee				X	X	X																	X	
Rebecca A. Miller, MWH Americas, Inc.	X					X																		
Cecilia Ann Miller, One Sisters of Providence						X																		
James G. Martinez, Juan Tafoya Land Grant Corp.																								X
Donna Jackson, Top End Aboriginal Conservation Alliance	X		X	X	X	X		X	X										X					
Shirley McNall, San Juan Citizens Alliance			X	X		X	X			X	X		X											X
Nancy Hilding, Prairie Hills Audubon Society		X	X		X	X				X	X	X	X		X	X	X	X	X	X	X			
Jihan R. Gearon, Indigenous Environmental Network Native Energy and Climate Campaign					X																			
Travis Stills, Energy Minerals Law Center	X	X	X	X	X				X						X		X				X	X	X	X
Oscar Paulson, Kennecott Uranium Company	X	X	X			X	X	X		X	X	X	X			X		X	X		X			X
Steven H. Brown, CHP	X		X	X					X	X	X													X
Robert Tohe, Sierra Club Environmental Justice			X	X		X	X	X	X		X								X					
George Byers, Neutron Energy Inc.						X																		X

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Michael Jensen, Amigos Bravos	X	X	X	X	X																			
Sister Rose Marie Cecchini, Office of Peace, Justice and Creation Stewardship	X			X	X	X			X		X		X											X
Paul Gunter, Beyond Nuclear			X																			X	X	
Mary Varson Cromer, Southern Environmental Law Center	X																							X
JK August, Core Inc.										X		X								X	X			X
Kay Cumbow, Citizens for Alternatives to Chemical Contamination	X		X						X			X	X					X				X		
Jill Morrison, Powder River Basin Resource Council	X	X			X	X	X	X	X	X	X	X	X		X	X	X	X			X	X		X
Geoffrey Fettus, Natural Resources Defense Council	X		X			X							X				X							
Steve Cone, Electors Concerned about Animas Water	X	X	X			X	X	X	X														X	X
Don Steuter, Sierra Club-Grand Canyon Chapter			X			X			X													X		
Donna Wichers, Energy Metals Corporation																						X		X
Glen Catchpole, Uranerz	X								X															X
Wayne Heili, Ur-Energy USA Inc.	X																							X
Geoffrey Fettus and Christopher E. Paine, Natural	X	X	X	X	X	X			X	X	X	X	X	X			X	X	X	X	X	X	X	X

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Resources Defense Council																								
Sarah Fields, Sierra Club-Glen Canyon Group	X	X	X	X		X	X		X									X				X	X	X
Sharyn Cunningham, Colorado Citizens Against Toxic Waste, Inc.	X		X	X		X	X				X											X		
Rebecca A. Miller																								X
Donna Hoffman			X			X																X		
Lindsey Reed			X																			X		
Rose Sparkman				X		X							X							X	X			
Philip V. Egidi	X	X		X		X					X	X	X		X			X	X		X			
Harold One Feather		X	X	X	X	X				X							X			X	X			X
Karen B. Maute	X		X																					
Cole Crocker-Bedford						X																		X
Dick Artley	X								X													X		
Charles Jacobs																								X
Marcus Higi					X	X																		
Mary Ann Gutzwiller																		X						
Teresa Bessett			X																					
Penny Lynn and James E. Dunn																								X
Gerard Rohlf											X													
Tami Rund						X																		

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Lydia Perry											X													
Patricia Layden																								X
Charles Gillard												X	X											
Elizabeth Barger						X																		
Mallory Sanders																								X
Ian Cree			X			X																		X
Betty Walters						X																		
Kunda Lee Wicce																								X
Sharon Young						X																		
Rochelle Becker			X																					
Mary Barreda						X																		
Ward Hodge			X															X						
Rose Chilcoat												X										X		
Emilie Pechuzal						X					X													
Larry Bernard						X																		
Jade Lai																		X						X
Joan Parr									X															X
Nancy Freeman						X			X															
Nancy Florsheim			X			X																		
K Dixon					X	X																		
Mel Langdon	X		X																			X		

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Dusty Miller																						X		
Rosemary Blandchard, California State University Sacramento			X		X	X																		X
Nathan Smith						X			X															
JG McCue			X																				X	X
Jim M									X															
Ellen Heath																								X
Teresa Foster and Steven Jakobs	X					X	X		X												X			
Joanne Barstow									X															
Paul Rizzo	X			X					X															
Jeffrey Means		X									X													
Robyn Jackson					X																			
Natalia Yazzie					X																			
Roland Begay					X																			
Shannon Rawls					X																			
Ambrose Teasyatwho					X																			
William L. Dam	X		X	X		X			X	X							X	X						
Hazel James			X	X		X	X	X	X		X								X					
Sharon Gross									X															
Teo Saenz						X			X		X													X
Perry H. Rahn						X					X													

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
B. Geary			X						X															
Elizabeth Hudetz						X																		
Randy Brich	X																							X
Paul James Poppe	X		X			X	X		X															
Jerry Ellinghuysen	X		X						X															
Philip Barr	X					X			X															
Paula Gottlieb			X						X															
Jake Culver																								X
Karen Lee-Thompson			X										X											
Mary Beath and Christopher French	X			X	X				X				X	X						X				
Randy Kind and Robin Davis						X																		
Robert John Pennyfather	X					X			X															X
D. Viggiano						X																		
Jeffrey Christian																							X	X
William Gross, University of New Mexico	X		X			X			X															X
Arnold Frogel	X					X																		
John Allison	X																							
Carl Hansen	X		X			X	X					X		X										
Catherine Ralston			X																					
Nancy Seewald			X																					

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Sue Small			X			X							X											
Tom Budlong	X		X			X																X		X
Patricia L. Kutzner	X		X			X			X															
Gladys Brodie					X																			
David Wyatt	X		X		X	X																		
Sally Greywolf																								X
Wendell Harris						X																		
Ian Ford						X						X	X											
Sidney J. Goodman			X																					
Sheldon Chee, St. Michael High School	X				X	X																		
Teddy Nez			X	X	X				X			X		X										
Allison Clough				X	X		X				X			X	X									X
Denise Arthur						X	X																	
Douglas Stambler, Western Coalition for Sustainable Living	X																							X
Various Individuals and Entities, 1246 Form Letters	X	X	X			X	X		X			X		X								X		X

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Casper, Wyoming Scoping Meeting																								
Nancy Hunter on behalf of Marilyn Musgrave, House of Representatives, Colorado's Fourth Congressional District						X																		
Richard A. Chancellor, State of Wyoming, Department of Environmental Quality						X															X			X
Wayne Heili, Ur-Energy USA Inc.	X								X															X
Suzanne Lewis, Biodiversity Conservation Alliance	X		X	X		X			X					X					X					
Donna Wichers, Energy Metals Corporation	X																							X
Mike O' Brien, Cook County Land Use and Zoning Commission						X											X			X				
Glen Catchpole, Uranerz Energy Corporation	X	X									X													
Jill Morrison, Powder River Basin Resource Council	X	X	X	X		X	X	X									X			X	X			X
Marion Loomis, Wyoming Mining Association	X								X															X
Linda Layman										X														X
Echo Moore-Klaproth						X	X								X									
Dustin Bleizeffer, Casper Star Tribune			X						X															
Deidre Elder						X														X				

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Bill Kunerth						X												X						
Enoch Baumgardner															X									X
Albuquerque, New Mexico Scoping Meeting																								
David Ulibarri, New Mexico State Senator										X														X
Sandy Brewer, Bluewater Valley Downstream Alliance	X					X			X															
George Byers, Neutron Energy Inc.	X		X						X	X		X												
Ernest Becenti, McKinley County Commissioner	X																							X
Paul Robinson, Southwest Research and Information Center	X	X	X	X		X			X											X	X			
Cassandra Bloedel, Navajo Nation Environmental Protection Agency				X	X	X															X			X
Robert Tohe, Sierra Club	X	X	X		X	X	X		X															
Alvin Rafelito, National Indian Council on Aging	X			X		X														X	X			
Loren Setlow, US Environmental Protection Agency			X	X	X	X					X	X	X	X				X						
James Martinez, Juan Tafoya Land Grant Corp.						X																		

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Jerry Slim, Eastern Navajo Allottee Association	X											X												X
Mel Stairs, Independent Miner										X										X	X			
Tomi Jill Folk, Hunger Grow Away						X	X																	
Mike Bowen, New Mexico Mining Association	X																							X
Rosamund Evans		X	X	X		X						X												
Cynthia Ardito, INTERA, Inc.	X																							X
Floy Barret, Staffer for Governor Richardson	X	X	X		X																X			
Chris Shuey	X		X		X	X	X		X														X	X
Eric D. Jantz, New Mexico Environmental Law Center	X	X	X		X	X	X	X	X				X	X										
Joni Arends, Concerned Citizens for Nuclear Safety		X	X			X														X	X			X
Michael Jensen, Amigos Bravos				X								X												X
Ruth Armijo, Juan Tafoya Land Grant Corp.																								X
Melvin Capitan, HRI Energy					X																			X
Rosemary Blanchard, on behalf of Nation Indian Youth Council			X			X							X											X
Benjamin A. House, Eastern Navajo Allottee Association	X				X		X					X												X
Danny Charley, Allottee				X								X												X

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Steve Cabaniss						X																	X	
Paul Frye, Navajo Nation Attorney General's Office	X			X	X	X	X	X	X		X	X	X					X					X	
Leona Morgan, ENDAUM	X	X		X	X	X	X	X	X				X	X				X						X
Hildegarde Adams					X																			X
Shrayas Jatkar, Center for Economic Justice	X					X							X					X	X					X
Laura Watchempino, Pueblo Acoma					X	X							X	X								X		
Esther Yazzie-Lewis						X																		X
Annie Sorrell, Crownpoint Allottee					X	X						X												X
Anna Frazier, Dine CARE	X	X	X	X	X	X											X							
Amadeo Martinez, Juan Tafoya Land Grant Corp.	X					X	X	X																X
Jim Greenslade						X				X		X												X
Gallup, New Mexico Scoping Meeting																								
George Arthur, Navajo Nation Council					X																			X
Joe Murrietta, Mayor of the City of Grants												X												
Danny Charley, Allottee					X	X						X											X	X
Jay Charley																								X
Rick Van Horn, HRI	X			X					X															X

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	Decommissioning and Waste Management	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
George Byers, Neutron Energy Inc.				X		X	X	X				X												
Cal Curley on behalf of Congressman Tom Udall				X	X	X				X				X						X				
Larry King	X				X	X							X											
Stephen Etsitty, Navajo Nation Environmental Protection Agency			X	X	X	X			X				X					X						X
James Martinez, Puerta Villa Land Corp.	X											X												X
Benjamin A. House, Eastern Navajo Allottee Association	X				X					X								X						
Chee Smith Jr., ENDAUM board					X	X								X										
Art Gebeau, Blue Water Valley Down Stream Alliance						X														X				X
Rhilla Vasquez, Blue Water Down Stream Alliance	X					X																		X
Jay Tonny Bowman					X							X												X
Chuck Wade																		X						
Teddy Nez						X																		X
Derrith Watchman–Moore, State of New Mexico, Office of Governor Bill Richardson and the New Mexico Environment Department		X	X		X				X					X										
Annie Sorrell, Crownpoint Allottee												X												

Table 1. Classification of Scoping Comments (continued)

Commenter and Affiliation (if given)	Need for GEIS and Scope	Scoping Process	Public Involvement	History and Legacy of Uranium	Native American Concerns	Groundwater and Surface Water	Land Use	Ecology	Site-specific Analyses	Operational Safety and Emergency Response	*Decommissioning and Waste Management*	Socioeconomics	Environmental Justice	Historic and Cultural Resources	Transportation	Visual Impacts and Noise	Surety	Alternatives Considered	Cumulative Impacts	Monitoring Programs	Regulations and Guidance	NEPA	Credibility of NRC	Miscellaneous
Michael Daly, McKinley County Water Board						X																		
Eric Jantz, New Mexico Environmental Law Center					X	X																		
Jerry Pohl, Cebolleta Land Grant						X						X												
Terry Fletcher, New Mexico Mining Association President	X											X												X
Rose Marie Cocchini, Office of Peace, Justice, and Creations Stewardship for the Diocese of Gallup				X		X	X	X										X						
Melvin Capitan, HRI Energy	X				X							X												X
Sarah Nemio-Adeky, Eastern Navajo Agency Allottee					X		X							X										
Chris Kenny					X													X						
Phil Harrison, Navajo Nation Council Red Valley co-chapter					X																			X
Leona Morgan, ENDAUM				X	X		X		X					X				X						
Linda Evers, Post 71 Uranium Committee						X																	X	X

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail

Aaron Frank	Abels Kevin	Abraham Eric	Adamson William
Adelsman Stephen	Aderhold Steven	Adkisson Holly	Aeschliman Daniel
Alderson Steven	Alfred Lynda	Alinement Internatural	Almazan Annette
Alonso Raquel	Altman Tim	Alvarado Greta	Alvarez Ana
Anderholm Jon	Anderson M	Anulis Inga	Aranguren Ana Belen
Arcure Barbara	Arena Eileen	Arenas Bianca	Arenas Mauricio
Arevalo Eric	Argani Sholey	Armstrong Alice	Armstrong James
Arnold Marge	Arribas Raul	Arrigo Diane D	Asselin Neil
Attas Mel	Audenaert Bart	Augenstern Joy	Austin Donna F
Ayer Jude	Bagozzi Jennifer	Bailey Charmaine	Baker Niklas
Baker Rachel	Baker Steve	Balder James	Balint C
Bammert E J	Bandy Christopher	Banks Jerry	Barkley-Edwards D P
Barnes Kathryn	Barnett Eli	Barr Deb	Barrett James
Bartell Ann	Bartter Martha	Bastron Malcolm	Bauer Lyndsey
Bayon Israel Garcia	Be Maya	Beadman Hannah	Beavers Nancy
Beckham David	Bedendo Emanuela	Beegle Margaret	Belaski Anthony
Belisle Joseph	Belleau Cindy	Belling Teri	Bennett LeeAnn
Bennigson Barbara	Benya Lilo	Berg Kurt	Berg Ricardo U
Berger Leah	Berggren Richard	Berkowitz Henry	Bernard Doris
Bernikoff Sarah	Bernikoff Vance	Bernstein Marcia	Bernstein Scott
Bescript Ruth	Beves Peter	Bevilacqua Elaine	Bignell Rachel
Bishop Melissa	Black Daryl	Blackwood Jean	Blair William

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Blake Seana	Bleckinger Dana	Bloch Julie Hagan	Blochwitz Angelika
Bloomer Jerry	Blubaugh Kim	Blumenfeld Jacob	Boccagna Emilia
Boen Randy	Bohler Judith	Bollag Sascha	Bonilla-Jones Carmen
Bonner James	Bonner Patrick	Booth Richard	BorskeCindy
Bosworth Donald	Boulan Cassidy	Boulter Wyndham	Boutcher Amanda
Bouwman Stuart	Bower JC	Bowling Beth	Bowman Florine
Bowman Jason	Boyd P W	Boyne Hal	Bradburn-Ruster Michael
Bradley JoAnn	Bradshaw Sara	Bragonier Emily	Bramstadt Jason
Brandariz Anita	Brast Dave	Bratvold Gretchen	Brautigan Julie
Brennan Ingrid	Bressack Celia	Briggs Jini Coolen	Brinker Erica
Brisbane Lucinda	Brockway Donald	Broder Carley	Brokaw Colleen
Bronk Gabriel	Brookstone Jon	Broudy David	Brower Diane
Brown James	Brown Louise	Brown Mary	Brown Sandra
Brown Vera	Brownell Deirdre	Brumson April	Bryant Sally
Budlong Tom	Buller Brian	Bundt Phyllis	Burbridge Scott
Burch David Paul Xavier	Burns Cecilia	Burwell Julia	Buschbaum Aviva
Bushnell Martha W	Buslot Chantal	Buswell Colby	Byington Ruth
Cabello María Josefa	Cadora Eric	Calabro Richard A	Callen Peter
Callicott Burton	Calvillo Lucy	Cameron Janet	Cameron-Wolfe Carmen
Cangemi Sandra	Capizzi Liz	Carafa Missy	Cardella Richard
Cardella Sylvia	Cardiff Scott	Carey Thomas	Carlson Cheri
Carnahan Marge	Carter James	Casey Mary	Casilli Christopher

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Cayford David	Cecil Jon	Chadwick Jeanne	Chambers Donald
Chastain David	Checa Michael	Cheeseman Ted	Cheever Jenell
Chen Aluna	Chen Dan	Chen Tony	Chesnut Patricia
Chilcote Marilyn	Chischilly Jane	Chitwood Melissa	Chrostowski Lenny
Ciavarella Theresa	Cinquemani Dorothy	Ciocan Robert	Claparols Javier M
Clark Loralee	Clark Louise	Clark Pamela	Clark Rick
Clay Metric	Clemens Kimberly	Clifford Angela	Clifton Brian
Clymer Bill	Coakley John Paul	Cobb Sandra	Cockerill Joanne
Coco Joseph	Coebergh Philip	Cofran Sandra	Cohen Bruce
Cohen Howard	Cohen Sydney	Colburn Matt	Cole Kathleen
Cole Mark	Collier Fran	Collins Stefanie	Colon Juana M
Connelley Dorian	Connor Thomas V	Conrad Kristie	Cook David & Sara
Cook Ginger	Cook Marylou	Cooke Samuel	Coolidge Joanna
Corbin James	Cordeau Stephanie	Cordes John	Cording Carl
Corrales Ana	Corrales Ana	Cortijo Monica	Corzine Virginia
Cosgriff Mark	Costa Francisco	Coulter Sara & Will	Countryman Chuck
Courter Matthew R	Coveny Richard	Coviello Gina	Cowen Helen
Cozens Michael	Craig Kristin	Cramer Mary Ann	Crane Elisabeth
Crawford David	Crespi Daniele	Cresseveur Jessica	Creswell Richard
Croll Tamara	Cronin Chris	Cross Alfred	Cruz Ara
Cruz Marian	Curley Joanna	Curnow Connie	Curotto John
Curtis Charles	Cushing Catherine	Dahl Kristiana	D'Ambra John
Daniels J Scott	Daniels Joan	Dankanyin Dorothy	Danny Asher
Danu Sandra	Das Anita	Daskarolis Kaymaria	Davis Todd

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Day Charlie	De Jesus Monique	De Robbio Elisabetta	De Sart Marci
de Souza Philip Neri	De Trinis Bonita	Dean Mary	DeAntoni Carol
Degorce Pascale	Delker Jennifer	Delles Susan	Dellinger Kay
DeMartin Renee	Dengel Julia	Denny Rachael	DePauw Donna
Desreuisseau Judy	Detmers Peggy	DeTora Danny	Di Cecco Adriana
di Mdina Owanza	di Poppa Francesca	Dick M	Dimock Wynne
Dishman Benjamin	Disque Melinda	Dix Shirley	Dlugosz Janice
Dlugosz Janice	Dodson Paula	Doft David	Doherty Killian
Doinakis Dimitrios	Dolney Renee	Dolney Renee	Doman Geoffrey
Domnick Renate	Donald Meghan	Donnelly Stephen	Doubet David
Doucet Lisha	Draper Glen	Driss Irene	Drucker Beverly
Dudley Julie	Duffey Michael	Dunkleberger David	Dwyer Prudence
Dykoski William Skip	Eagle Diane	Eaton Lecia	Eby Therese
Edwards Barbara	Edwards Michael	Egger Mark	Elgin Elizabeth
Elias Kyle	Ellison Shawn	Emerson Bartt	Emmerich Leah
Emmert David	Erwin Jeffrey	Estes Douglas	Esteve Gregory
Evans Alma	Evans Dinda	Evans Michael W	Everett Theresa
Evilsizer Susan	Ewing Barbara E	Fairchild Stephanie	Faith-Smith Bonnie
Faria Adriana	Fenske Jill	Ferguson Joanne	Ferguson Tom
Ferhani Laurie	Fields Nicole	Filocamo Kevin	Fiore Mark J
Fiscella Paul	Fischer Cynthia Knuth	Fischer Kimberly	Fisk William & Donna
Fitze Charles & Kathleen	Flinchbaugh Betty	Flowers Bobbie	Foisy Mark
Foley Erin	Fong Christina	Foppe Paul	Ford Julie

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Foskett MaryAnna	Foss Janice	Foster Willis	Fotos Janet
Fowler Juli	Fox John	Fox Kristi	Fox Robert
Frame Laura	Franco Paige	Frang Robert	Frank Harriette
Franken Kevin	Fraser William	Frazier Sabrina	Frederick Roger
French Robert	Friar Christopher	Friswell Jessica	Frost Chris
Frost Vicki	Frutchey Karen	Fuller Roy	Fulmer Amanda
Fulmer N J	Fung Anita	Gairo Regina	Galati Fabio
Galdamez Alicia	Gamboa Margerite	Gambocorto M Sharon	Gandhi Vishal
Garces Laurence	Garcia Jeffery	Garcia Yolanda	Garden Rebecca
Garner Michael	Garner Patrick	Gartin Courtney	Gary Lene
Gausman Jennifer	Gauthier Donald	Gay Nancy	Gazzola Linda
Gebhard Mary Frances	Gedicks Al	Geiger Laura	Geiger Maureen
Geno Debbie	Gerbasi Joyce	Gibbons Brian	Gilbert Vivian
Giller Geoff	Gilmore Timothy	Gindele Abigail	Ginder Hannah
Giuliani Rachelle	Glass Suzanne	Glazer Steve	Gleason Christina
Glendinning Garrett	Glock-Molloy Victoria	Glum Karen	Glynn Martin & Lavonne
Goad Jacob	Goitein Ernest	Golden Jay'me	Gomez Maria
Gong Sherry	Gonzales Greg	Good Caroline	Goodman Laura
Gordon Terri	Gorringe Richard	Gorsline Sally Marie	Gotterer Rebecca
Gottlieb Maryke	Gowell Michael	Grady Anne	Graham Kimberley
Grant David	Grant Gordon	Grassi Catherine	Grathwohl Harrison
Gravel A Joan	Gray Gail	Greco Claudia	Greene David
Greene Howard	Gregor Alex	Gregory Claire	Grenard Mark Hayduke

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Grier Rosemary	Griffin-Lewin Anne	Grigg Jamin	Griggs Brenda
Grindle Kathryn	Grindle Russell	Grisco Mary	Grover Ravi
Grueschow Jr Kenneth	Gunter Karlene	Guyette Caitlin	Ha Gerhard
Hadda` Ilse	Hadley Virginia	Hahn Todd	Haltenhoff Ken
Haltom Aubrey	Hamilton Traci	Hamze Jill	Hance Maria
Hansen Ken & Val	Hanson Art	Hanson Natalie	Harbutt Alberta
Harding Kevin	Hargesheimer Linda	Harkins Hugh	Harris Jennifer
Harris Paul	Harris Zoe	Hart James	Hart Katrina
Haslett Dora	Hassan Khadija	Hatziavramidis Ted	Hauck Molly
Havens Pauline	Havercamp PhD Michael	Hays John	Head Jim
Hefferon Michael	Hegeman E	Heidebroek Francoise	Hein Gary
Heller-Gutwillig Annie	Henderson Holly	Henri Lyn	Henry Norma
Herman Shawn	Hibshman Steve	Hickey Mary	Hiestand Nancy
Hilgartner C A	Hill Anna	Hill Robert	Hills Sally
Hirsch Catherine	Hittmeyer Gary	Hoare Danny	Hodes Elizabeth
Hoffman Lilli	Holt Amy	Holt Rhonda	Holt Robert & Joan
Holzweiler Deirdre	Hoover Susan	Hopkinson Patty	Houseworth Bradley
Howe Linda	Howenstein David	Hoyt Jennifer	Hoyt Linda
Huculak Danielle	Hudgens Raymond	Hudgins William	Hudyma Tom
Huerta Ernest	Hughes Brendan	Hulett Mark	Hult Philip
Hunt Dee	Hunt Jim	Huston Ed	Hyers Jocelyn
Ickes Henry	Inouye Laura	Inskeep Mona	Isaacs Susan
Ishii Jeanine	Izikoff Rose	Jackson Robert	Jacobs Patricia

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Jacobson Russell	Janicki Joyce	Janusko Robert	Janzen Gayle
Jazzborne September	Jebens Britta	Johnson Kim	Johnson Kim
Johnson Michael	Johnson Richard Earl	Johnston Denise	Johnstone Penelope
Jones David H	Jones Roslyn	Jones Vickie	Joos Sandra
Jordan Michelle	Jordan Michelle	Jordan Susan	Jorgensen James H
Jorgensen Lesley	Joyce Mary Anne	Judd Martin	Kaehler Linda
Kaehn Max	Kaeser Anne	Kaggen Marilyn	Kahney Pauline
Kaplan Brittany	Kazak Ilene	Keeling Raymond	Kefauver Lee
Kegle Jennifer	Keiser Robert	Kelly Wayne	Kemmerer Carol
Kemmerer David	Kennedy Katya	Kennedy Nellis	Kesselman Barry
Key Lynda	Kile Beverly	Kilgore John	Kimpston Charles R
Kingsley Susan	Kinney Carleton	Kirschenheiter Aicia	Kiver Eugene
Kleinau Siegfried	Kliegman David	Knabe Kari	Kochert Marlene
Kohn Carolyn	Kohn Marilyn	Kolb Marcia	Koper Marie
Koplik Mark	Kopp Helen	Koross Laurence	Kosiorek Kylie
Kostmayer Martha Ferris	Kovarik Dina	Kowalczyk John	Kozlovsky Thomas
Kraan Aletta	Krawisz Bruce	Kreib Brian	Kreiss Kevin
Kreneck Jim	Kring Juli	Kruse Katherine	Krush Aileen
Kuhns Betty	Kulesa Tamara	Kulik Mariellen	Kunkel Michael
Kunz Kevin	Kutnyak Cary	Kyrala Judith	La Zarr Mailie
LaCognata Dale	Lafollette Doug	Lahey Daniel	Lahren Rodney
Lambeth Larry	Lang Sophia	Langley Tom	Larson Monty
Larson William	Laser Gemma	Lauchlan Susan	Law Patricia

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Lee Courtney	Lehmkuhl Kimberly	Lemke Melissa	Lenz Dennis J
Leonard Richard	Leslie-Dennis Donna	Letterly Elizabeth	Levin Brian
Levin Ilana	Lewis Anne	Light Lillian	Linarez Karen
Linarez Karen	Lindsay Tammy	Lippel Wolfgang	Litel Alex
Little Larry	Livesay Corinne	Lloyd Susan	Lochner Jan
Lockkhart Mary Ann	Lockwood Peter	Loew Brenda	Logue Terrence
Lopez Gina	Lopez Maria	Love Margaret	Loyd Joy
Lu Yi-Mei	Lubofsky Nicholas	Lyle Ferris	Lyon Suzanne
M Stacey	MacDonald Myra	Mackanic Janice	MacKenzie Meghan
Mackey Bill	Maddock V	Maddux Carolyn	Maffey Shanti
Magnuson Paul	Mahmood Nicholas	Maki Jessica	Makortoff Kalyeena
Mallardi Nicholas	Maloney Ken	Mann Jason	Mannsfeld Bjoern
Marcus Paul	Maria Feleki	Marshall Katherine	Martinez Candace
Martinez Rodrigo	Mastascusa Noreen	Matthes Barb	Matthew Elaine
Mattingly Michele	Mattozzi Dave	Mayerat Robin	Mazar Laura
Mazzetti Michael	McAleer Janice	McCabe Eileen	McCannon Bryan
McCarthy Elizabeth	McCool Melissa	McCullagh Lenore	McDowell Malcolm
McDuffie Holly	McFarland Mary Ann	McGettigan Timothy	McGill Ann C
McGovern Donlon	McGowan Cathy	McGowan Susan	McGuinness Susan
McIntosh James	McKnight Vanessa	McLean Alex	McMahon Mary
McMullen Penelope	McMullin William	McPhelin Eileen	McTague Melissa
McVan Kevin	Mead Cythia	Medina Arcelia	Mehrotra Siddharth
Meier D	Meier Felisa	Mejia Manuel	Meldrum David
Mendieta Vince	Mesman Peggy	Meyer Bonnie	Meyer Chris

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Meyer Laurie	Michalets Ellen	Michel Thomas Andreas	Micou Johnny
Mier W	Mika Damian	Mikalson Claire	Miller Betsy
Miller Ruth	Mills Ashea	Mitchell Joan	Moeller Elke
Moldenhauer Lenore	Monson Ronald	Mont-Eton Jean	Moodie David
Moon Giles	Mooney Kimberly	Moore Jacinda	Moore Yolanda
Moriarty Paula	Morris Kathleen	Morrison Carol	Mosimann Ed
Moss Mikasa	Moss Paul	Mourant Wanda	Moylan Carrie Lynn
Moynihan Kathryn	Mullikin George	Murphy Bonnie	Myers Robert
Nair Rajesh	Nam S	Nash Barbara	Naughton Mark
Nava Margarita	Nealy Carol	Necker Adam	Neff Rachel
Neidell Merle	Nelson Beth	Nelson Jennifer	Nelson Patricia
Nichols Nick	Nickels Oliver	Nickerson Nancy	Nicol Laura
Niemi Scott	Nigrosh Ellen	Nissen Ida	Nissen John
Nolan Sherril	Nooyen Fleur	Norris Glenda	Novak Peter
Nylander Susanna	O'Brien Leanne	O'Broin Steven	O'Connor Maura
O'Donnell Kelly	O'Sullivan Joseph	O'Flynn Katie	Ofshinsky David
Olney-Rattel Wendy	Olsen Corey E	O'Neill Robert	Orich Suzanne
Ortiz C	Oser Wendy	Ostoich Julie	Ostrowski Steffanie
Ottenbrite Shelley	Ouellette Tracy	Overbeck Bob	Owen Alison
Oxyer Jim	Paape PhD Joyce	Pacic Thomas	Pacifico Chris
Pagel Lyn	Pandit Sudhir	Panemangalore Myna	Parent Stacey
Parker Cindy	Parker Erika	Patch Frances	Paton Peter
Patrick A A	Patsis Elizabeth	Patsis John	Paul Gloria
Pavao Jennifer	Paven Melissa	Payne Lisa	Payne Lisa

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Peets Jehu	Peirce Sumner	Pelleg Joshua	Pena Debra
Pendergast Jerry	Perez Martha	Perez-Lockett Katharine	Perlman Frances
Pernot Pamela	Person Amy	Pescott Oliver	Pestel Niki
Peters Sarah	Peterson Kimberly	Petruccelli Rita	Pflug Maria A
Phillips Patricia	Phillips Scot	Phoenix Susan	Pic Sara
Pickering Amy	Pistor Christiane	Plummer John	Plyler Billy
Policht Veronica	Polski Michael	Ponza Jennifer	Pooler Kristi
Poos Carin	Poos Sebastiaan	Poplawski Terry	Popolizio Carlo
Porter Alisa	Porter Melody	Powers Brendan	Prentiss Jillian
Press Roland	Priest Maxine	Probola Eric	Proctor David
Proenza Lynn	Provenzano James	Pruitt Dykes	Puca Laurie
Puetz Dan	Pulliam Pat	Purkaystha Mohsena	Pusel Joyce
Quinn Michael	Quitiquit Wanda	Raab W Arthur	Radany Molly
Rakocy Elizabeth	Ramaker Julianne	Ramsey Laverne	Rancher John
Randazzo Andrew	Randrup Ross	Ransom Jill	Ratliff Margaret
Read Magie	Redish Maryellen	Reed Herbert	Reed Lorna
Reed Mary S	Rees Hannah	Rees Janet	Register James
Reichert Christina	Resotko Karen	Reynolds Dolores	Rhoads Kirk
Rhys Victoria	Rice Ann	Rice Daryl	Ricevuto Chuck
Rich Nathan	Richardson Don	Richardson Roberta	Richman Beth
Rieckmann Evelyn	Riggar Karen	Riley Kelly	Rindfuss Allen
Rio Robert	RisvoldCindy	Robbins Mary	Roberts Barbara & Frank
Roberts Cristina Abeja	Roberts James	Robertson John Mark	Robinson George

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

RoccoPeter	Rochel Christof	Rockwell Beth	Rodack Soretta
Rodgers Julie	Rodin NIck	Rodrigue Jim	Rodrigues Lannette
Rojas Jessica	Rolnick Adeline	Root Charlene	Rorvick Shelley
Rosen Judith	Rosenstein Richard and Carolyn	Rosenwinkel Earl	Ross Adrienne
Ross Susan	Rossi Patricia	Roth David	Rouhana Alexander
Rowe Richard	Royer Erica	Rubin Marc	Rudnick Iris
Rush Charlene	Ryan Elizabeth	Ryder Samantha	Ryk Jon
Saia Chris	Sakoda Fumiko	Salamon Mark	Salter James
Sams Donna	Sanborn Hugh	Sanders Richard	Sands Arthur
Sands Pamela	Sands Weston	Santarelli Mark	Saperia David
Saslow Randi	Saundra	Savage John & Patricia	Scaff Beverly
Scalise Janet	Schafer Laura	Schaktman H	Schall Donna
Scheffert Rick	Schmeisser Bernadette	Schmittauer John	Schmitz Gladys
Schneider Greg	Schneider Lynn	Schochet Gordon	Schreiber Lori
Schulsinger Herb	Schulte Helen	Schultz-Ahearn Melissa	Schumann Barbara
Schumann Larisa	Schussler Bob	Schustereit Kenneth	Schwartz Tamar
Schwarz Kurt	Scott Lloyd	Searfos Polly	Seeliger Ruth
Seeman Joan	Segal Evalyn F	Sell Angie	Selnes Carl & Georgia
Sena Isabel	Sessine Linda	Severn Percy	Sewall Christopher
Seymour Stephanie	Shafchuk Patsy	Shafransky Paula	Shalley Sheldon
Shanabarger Paul	Shanker Vidhya	Shapiro Milton	Sharkey-Miller Kerry
Sheline Jonathan	Shelly Charles	Shepard Dodie	Sherwood Anne

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Shivar Marcia	Shively Daniel	Shively Daniel	Shmigelsky Matthew
Shohan Doug	Shomer Forest	Shpiller Natasha	Shulman Joseph
Sickafoose Jim	Siddens Gianna	Siefken Josie	Siegel Karen
Siemion Bob	Silan Sheila	Silveira Luciano	Silverman Ruth
Silverman Seth	Simon Tomas	Simpson Sally	Singer Barbara
Siri Patricia	Sitomer Joan	Sively Susan	Skidmore Mike
Slater Stephanie	Sloan Adam	Slominski Jeanne	Smerbeck Audrey
Smith Cynthia	Smith Deborah	Smith Julie	Smith Michele
Smith Robert	Smith Sharon	Smolinski Barbara	Sneeringer Rosemary
Snider Marilyn J	Snider Ronda	Snyder Amy	Snyder Steve
Sobel Scott	Sorochan Bill	Sotos Mary	Souza Michael
Soyama Takuji	Spar Jon	Spears Jesse	Spears Nancy
Spector Loren	Spotts Richard	Stahl Charlotte	Stallybrass Samantha
Stark Carol	Start Jeremy	Stefenel Rudy	Steinbrecher Klaus
Steiner Lauren	Stembridge Megan	Sterner Elizabeth	Stevens Donald
Stewart Cynthia	Stewart Frances	Stewart Janet	Stewart Scott
Stoffel Patrick	Story Nicola	Strauss Arthur	Strebeck Robert
Stuart Norberto A	Stucker Patricia	Studer Madeline	Stuhldreher Christy
Summers Jessica R	Summers Steve	Sutton Christina	Szymanowski Paul
Tabib Michael	Talmadge Tammy	Tan Frances	Tansley Denise
Tapp Elizabeth	Taranowski Heath Ashli	Tashjian Randy	Tate Pamela
Tatum Beth	Taylor Diane	Taylor Sarah	Teolis Simon
Terry Terelle	TeSelle Eugene	Thaler Gary	Thomas Ben

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

Thomas Deborah	Thomas Dennis	Thomas Kat	Thomas Leslie
Thompson Caroline	Thompson Chad	Thompson Nina	Thomsen Zack
Thomson Arran	Thorbjornsen Brian	Thorbjornsen Dylan	Thorbjornsen Richard
Todak Paul	Tondro-smith Dondi	Torres Paola	Towers Terry
Tracy Kyle	Tran Thu Ha	Travis Ed	Trent Joseph
Triplett Tia	Trumbull Terry	Tucker Barbara	Tully Maryann
Turek Gabriella	Turner Mike	Turnipseed Dale	Turnoy David
Tyndall Carl	Ulmer Gene	Ulrey Timothy	Units Jessica
Urist Daniel	Van de Grift Julia	Van Deelen Gerard	Van Der Leest Felieke
van Nifterik Ellen	Vandervest Sister Martin	Vandiver Toby	Vandivere Stephen
VanEtten Margot	Varellas Barb	Varney C Jean	Vassilakidis Sophia
Vertova Livia	Vesely Sakura	Vetter Allison	Vicioso Francina Grillo
Viglia II Peter	Vonderplanitz Aajonus	Voorhies Bill & Marilyn	Vosk Elizabeth
Wade Norman	Wagner Bernadette	Wagner Jim & Virginia	Wagner Sandra
Wahosi M	Walder E Gail	Waldrop Catherine	Walker Lynn
Walker Tatjana	Wallace Jeremy	Wallon Linda	Walter Sandrea
Walther Regina	Walton Peggy	Wang-Helmreich Hanna	Ward Sheila
Watchempino L	Waterman Glenna	Watson Chris	Webb Brad
Webb Pat	Wedow Nancy	Weiner Judi	Weinstock Jonathan
Welke Margaret	West Alice	West Angela	West Eric
West Mary	Wheeler Jeanne	Whetstone Joe	White A E

Table 2 Names of Individuals and Entities Submitting Duplicate Scoping Comments Via E-Mail (continued)

White D	White Jodie	White Lonnie	White Sharlene
Whitmore Rosemary	Wickline Glenna	Wiessbuch Brian Wie	Wiles Jeffrey
Wiley Andrea	Wilkens Patricia	Williams Charlie	Williams Diane
Williams Holly	Williams Lora Marie	Williams Mary	Wilsnack Jonathan
Wilson Ellery	Wilson Jerry	Wilson John	Wilson Michael
Winer Shirley	Winkle Celeste	Winter Michael	Winters Nicholas
Wishart Tiffany	Wolcott Betty	Wolf Rachel	Wolf Robert
Wolfe Ellen	Wolfe Jody	Won Alex	Woodman Jean
Woods Terry	Wright Alan	Wroblewski Kathleen	Wyatt Aimee
Wynn Patricia	Yeager Will	Young Betty	Young Marvin
Youngson Paticia	Yu Edward	Zaber Pamela	Zack Albert
Zai III Robert	Zimmer Sister Dianne	Zurcher Naomi	

APPENDIX B

POTENTIALLY APPLICABLE FEDERAL STATUTES, REGULATIONS, AND EXECUTIVE ORDERS

B. POTENTIALLY APPLICABLE FEDERAL STATUTES, REGULATIONS, AND EXECUTIVE ORDERS

B1.1 Federal Statutes and Regulations

Numerous Federal statutes and the implementing regulations for different Federal agencies may be applicable to environmental reviews of the construction, operation, decommissioning and groundwater restoration of an *in-situ* leach (ISL) milling facility. The following list is not intended to be exhaustive, but it provides a general overview of the kinds of statutes and regulations that should be considered in subsequent environmental reviews tiered from this generic environmental impact statement (GEIS). Specific details on the federal and state permitting processes are included in Chapter 1 of this GEIS.

B1.1.1 The American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996)

This Act reaffirms American Indian religious freedom under the First Amendment and establishes the policy to protect and preserve the inherent and constitutional right of American Indians to believe, express, and exercise their traditional religions. This law ensures the protection of sacred locations and access of American Indians to those sacred locations and traditional resources that are integral to the practice of their religions.

B1.1.2 The Archaeological Resources Protection Act, as Amended (16 U.S.C. §470aa et seq.)

This Act requires a permit to excavate or remove archaeological resources from publicly held or American Indian lands. Excavations must further archaeological knowledge in the public interest, and the removed resources are to remain the property of the United States. If a resource is discovered on land that an American Indian tribe owns, the tribe must give its consent before a permit is issued, and the permit must contain terms or conditions the tribe requests.

B1.1.3 The Atomic Energy Act of 1954, as Amended (42 U.S.C. §2011 et seq.)

This Act gives the U.S. Nuclear Regulatory Commission (NRC) authority to license and regulate possession, use, storage, and transfer of byproduct and special nuclear materials to protect public health and safety and the common defense and security.

B1.1.4 The Bald Eagle Protection Act (16 U.S.C. § 668, 668 note, 668a-668d)

This Act prohibits wantonly possessing, selling, transporting, or trading of bald or golden eagles or eagle parts, alive or dead. The statute authorizes searches, seizures, and arrests for enforcement purposes. The Secretary of the Interior can issue a permit for taking, possessing, and transporting bald and golden eagles for scientific, exhibition, and religious purposes, and may permit the taking of golden eagle nests if they interfere with resource development or recovery operations [916 U.S.C. 668(a)]. Opportunities to protect bald and golden eagles may be possible as part of ecosystem restoration initiatives or as part of natural resource management initiatives, including mitigation planning

B1.1.5 The Clean Air Act, as Amended (42 U.S.C. §7506 et seq.)

This Act establishes regulations to ensure air quality and authorizes individual states to manage permits. Nonradiological emissions requirements are described in 40 CFR Part 52. Radiological emissions to the air are regulated directly through the U.S. Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants requirements in 40 CFR Part 61.

B1.1.6 The Clean Water Act, as Amended (33 U.S.C. §344 et seq.), Section 402(a)

This Act establishes water quality standards for contaminants in surface waters. The Clean Water Act requires a National Pollutant Discharge Elimination System (NPDES) permit before discharging any point source pollutant into U.S. waters. EPA can delegate permitting, administration, and enforcement of the NPDES program to individual states.

B1.1.7 The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as Amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. §§ 9901–9675)

This Act provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and cleanup of inactive hazardous substance disposal sites. Parties responsible for the contamination of sites are liable for all costs incurred in the cleanup and remediation process. In addition, CERCLA and related regulations at 40 CFR Part 302 encompass spills of reportable quantities of hazardous substances.

B1.1.8 The Endangered Species Act, as Amended (16 U.S.C. §1531 et seq.)

This Act is intended to prevent the further decline of endangered and threatened species and to restore these species and their habitats. The Act is jointly administered by the U.S. Departments of Commerce and the Interior. Section 7 of the Act requires consultation with the U.S. Fish and Wildlife Service to determine whether endangered and threatened species or their critical habitats are known to be in the vicinity of the proposed action. NRC will consult with the U.S. Fish and Wildlife Service as part of supplemental site-specific environmental reviews.

B1.1.9 The Farmland Protection Policy Act (7 U.S.C. §§ 4201 et seq.)

This Act amended the Agriculture and Food Act of 1981. This Act minimizes the extent to which federal programs (including license approvals) contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses and assures that federal programs are administered in a manner that will be compatible with state, local government, and private programs and policies protecting farmland. The Act instructs the Department of Agriculture, in cooperation with other departments, agencies, independent commissions, and other units of the federal government, to develop criteria for identifying the effects of federal programs on the conversion of farmland to nonagricultural uses. Minimizing impacts on prime and unique farmlands is especially emphasized. Contact with the Natural Resources Conservation Service (NRCS) to identify prime or unique farmland that might be affected is required.

B1.1.10 The Federal Land Policy and Management Act of 1976 (43 U.S.C. § 1701 et seq.)

This Act establishes the public land policy and guidelines for the administration of public lands by the U.S. Department of the Interior through the Bureau of Land Management (BLM) and gives the BLM mission statement. The Act directs other agencies that undertake activities that would result in the "withdrawal" of such public lands. As paraphrased from the Act, "withdrawal" means withholding an area of federal land from settlement, sale, or entry, for the purpose of limiting activities or reserving the area for a particular purpose or program (43 U.S.C. 1702).

B1.1.11 The Hazardous Materials Transportation Act of 1974 (49 U.S.C. §§ 1801–1819)

This is the federal legislation that governs the transportation of hazardous materials in the nation. It was last amended in November 1990. Congressional policy is to improve the regulatory and enforcement authority of the Secretary of Transportation to adequately protect the nation against the risks to life and property that are inherent in the commercial transportation of hazardous materials. Accordingly, the transportation of hazardous materials, including, but not limited to, solvents, asbestos, polychlorinated biphenyls, paints, pesticides, hazardous wastes, and more, is addressed by this legislation. Persons transporting hazardous materials, including hazardous wastes, must comply with the U.S. Department of Transportation requirements for shipping papers, container marking and labeling, vehicle placarding, record keeping, and all other requirements associated with the safe transportation of hazardous materials.

B1.1.12 The Migratory Bird Conservation Act (16 U.S.C. § 715 to 715s)

This Act established the Migratory Bird Conservation Commission consisting of the Secretary of the U.S. Department of the Interior, the Secretary of Agriculture, two members of the Senate, and two members of the House of Representatives (16 U.S.C. 715a). The committee is authorized to consider purchasing or renting land, water, or transitional areas that the Secretary of the Interior has determined are necessary for migratory bird conservation (sanctuaries, preservations, refuges). The Secretary of the Interior must consult with the county or local government and the Governor of the state where the property is located (16 U.S.C. 715c). The Migratory Bird Conservation Fund was established to acquire lands for conservation, to maintain acquired lands for habitat preservation, and for any expenses necessary for the administration, development, and maintenance of such areas including constructing dams, dikes, ditches, spillways, and flumes for improving habitat and mitigating pollution threats to waterfowl and migratory birds (16 U.S.C. 715k).

B1.1.13 The National Historic Preservation Act of 1966, as Amended (16 U.S.C. §470 et seq.), Section 106

This Act places sites with significant national historic value on the National Register of Historic Places. No permits or certifications are required. The Act and its implementing regulations in 36 CFR Part 800 protect cultural and historic resources. If a particular federal activity may affect historic properties, NRC must consult with the State Historic Preservation Officer to ensure that potentially significant sites are properly identified and appropriate mitigative actions implemented. NRC will conduct such consultations as part of supplemental site-specific environmental review.

B1.1.14 The National Trails System Act (16 U.S.C. 1241–1251)

This Act acknowledges the increasing popularity of outdoor recreation and the need to promote access to and enjoyment of outdoor areas of the nation, both near urban areas and in more remote scenic areas. It established the National Trails System, composed of recreation trails, scenic trails, historic trails, connecting or side trails, and uniform markers. National historic trails generally follow original trails or travel routes that are significant to our nation's history. They can include land and water components as well as historic artifacts. Recreation and connecting and side trails can be established by the Secretary of the Interior or the Secretary of Agriculture with the consent of the federal agency, state, or political subdivision that has jurisdiction over the lands involved. National scenic trails are extended trails specifically located to conserve nationally significant scenic, historic, natural, or cultural qualities of certain areas and allow citizens to enjoy these areas.

B1.1.15 The Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001)

Through this Act, the Secretary of the Interior guides the return of federal archaeological collections and collections that are culturally affiliated with American Indian tribes and held by museums that receive federal funding. Major provisions of this law include (1) establishing a review committee with monitoring and policymaking responsibilities, (2) developing regulations for repatriation that include procedures for identifying lineal descent or cultural affiliation needed for claims, (3) overseeing museum programs to meet the inventory requirements and deadlines of this law, and (4) developing procedures to handle unexpected discoveries of graves or grave artifacts during activities on federal or tribal land.

B1.1.16 The Noise Control Act of 1972 (42 U.S.C. 4901–4918)

This Act established a national policy to promote an environment free from noise that jeopardizes Americans' health and welfare. The Act provides a way to coordinate federal research and activities in noise control, authorizes the establishment of federal noise emissions standards for commercially distributed products, and provides public information about noise emissions and noise reduction characteristics of such products. The Act authorizes federal agencies, to the fullest extent of their authority under the federal laws they administer, to carry out the programs within their control in a way that furthers the policy in 42 U.S.C. 4901.

B1.1.17 The Occupational Safety and Health Act of 1970, as Amended (29 U.S.C. §651 et seq.)

The purpose of this Act is to enhance safe and healthy workplaces throughout the United States. It is administered and enforced by the Occupational Safety and Health Administration, a U.S. Department of Labor agency. The Occupational Safety and Health Administration jurisdiction is limited to safety and health conditions that exist in the workplace environment (published in Title 29 of the U.S. Code of Federal Regulations). According to the Act, each employer must furnish all employees with a workplace free of hazards that could cause death or serious physical harm. Employees have a duty to comply with the occupational safety and health standards and all rules, regulations, and orders issued according to the Act.

B1.1.18 The Resource Conservation and Recovery Act (RCRA), as Amended (42 U.S.C. §692 et seq.)

This Act requires EPA to establish standards for hazardous waste generators. As noted in 40 CFR Part 272, the 10 states considered in the GEIS comply with the state requirements for permission, administration, and enforcement of RCRA.

B1.1.19 The Safe Drinking Water Act, as Amended [42 U.S.C. §300 (F) et seq.]

The purpose of this Act is to protect the quality of the public water supplies and sources of drinking water. The implementing regulations, administered by the EPA unless delegated to the states, establish public water system standards. Other programs established by the Safe Drinking Water Act include the Sole Source Aquifer Program, the Wellhead Protection Program, and the Underground Injection Control (UIC) Program. The UIC Program is addressed in this GEIS.

B1.1.20 The Soil and Water Resources Conservation Act of 1977 (16 U.S.C. 2001–2009)

This Act directs the Department of Agriculture to develop a National Soil and Water Conservation Program and to appraise the nation's soil, water, and related resources every 5 years. The Soil and Water Conservation Program and the appraisals cover activities and resources under the jurisdiction of the Soil Conservation Service, now called the NRCS. The appraisals involve compiling data on the quantity and quality of soil and water, state and federal laws regarding development and use of these resources, and costs and benefits of alternative conservation techniques. The Soil and Water Conservation Program is a guide for carrying out NRCS activities, taking into account current and future needs of the nation, landowners, and land users.

B1.1.21 The Solid Waste Disposal Act (42 U.S.C. 3251 et seq. 6901 et seq.)

This Act initiated national research and development programs for new and improved methods of solid waste disposal, with provisions for recovery and recycling. Technical and financial assistance are provided to state and local governments in the development of these programs. This Act was amended by the Resource Recovery Act of 1970 (Public Law 91-512) and later by RCRA (42 U.S.C. 6901, et seq.). Subtitle D of RCRA, as last amended in November 1984 by 42 U.S.C. 69-41-6949a, established federal standards and requirements for state and regional authorities regarding solid waste disposal. Current federal requirements for solid waste management are found in RCRA, Subtitle D, Sections 4001–4010.

B1.1.22 The Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201–1328; 18 U.S.C. 1114)

This Act established a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations and to set forth reclamation guidelines for surface coal mining areas. Under Title V, Section 502 (30 U.S.C. 1253), states with surface coal mining operations on non-federal lands must develop programs that provide environmental regulations, establish permit programs, and enforce state program requirements. In conjunction with the states, similar programs are to be developed by the U.S. Department of the Interior for surface mining operations on federal lands (30 U.S.C. 1273). For permits issued to surface mining operations, environmental performance standards are required to maximize utilization and conservation of the resources recovered and minimize future land disturbance from surface mining (30 U.S.C. 1265). The standards also include requirements for restoring the affected land (30 U.S.C. 1265), including surface area stabilization/erosion control, revegetation, creating impoundments for water quality, minimizing disturbance to original hydrologic balances, and proper disposal of mine waste products. There are also standards and criteria for regulating the design, location, construction, operation, maintenance, enlargement, modification, removal, and abandonment of new and existing coal mine waste piles when used as dams or embankments (30 U.S.C. 1265(f)).

B1.1.23 The Uranium Mill Tailings Radiation Control Act of 1978 (42 U.S.C. §7901 et seq.)

This Act established programs to stabilize and control mill tailings at uranium or thorium mill sites, both active and inactive, to prevent or minimize, among other things, the diffusion of radon into the environment. Title II of the Act gave NRC regulatory authority over uranium mill tailings at sites licensed by NRC on or after January 1, 1978. Currently, NRC does not have a specific regulation for ISL milling facilities; however, NRC regulation 10 CFR Part 40, Domestic Licensing of Source Material, applies broadly to all facilities that receive title to, receive, possess, use, transfer, or deliver source or byproduct material. ISL technology, for the most part, evolved after 10 CFR Part 40 was enacted. The ISL process produces wastes that 10 CFR Part 40 classifies as byproduct material. Appendix A to 10 CFR Part 40 provides criteria for conventional uranium mill operation and for disposal of mills' tailings and waste. The final stages of the ISL process produce yellowcake using the same drying process as conventional recovery and milling. However, other aspects of the ISL process are substantially different from conventional uranium ore processing. The regulatory requirements at 10 CFR Part 40 address yellowcake drying and the wastes produced from ISL operation but do not govern other aspects of the ISL process, including the aquifer restoration. In practice, NRC license conditions for ISL facilities have established the requirements necessary to protect public health and safety and the environment.

B1.1.24 The Watershed Protection and Flood Prevention Act (16 U.S.C. 1001 et seq.; 33 U.S.C. 701b)

This Act authorized the Secretary of Agriculture to cooperate with states and other public agencies in work that involves flood prevention and soil conservation, as well as the conservation, development, utilization, and disposal of water. It established the Small Watershed Program through which the NRCS constructs dams and implements other measures in upstream watersheds for a variety of purposes, including flood control.

B1.1.25 The Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.)

In accordance with this Act, certain national rivers and their immediate environments that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition; these rivers and their immediate environments shall be protected for the benefit and enjoyment of present and future generations (16 U.S.C. 1271). The Act both identifies specific river reaches for designation as wild or scenic and provides criteria to classify additional river reaches (16 U.S.C. 1272). The National Wild and Scenic River System was established to protect the environmental values of free-flowing streams from any activities, including water resources projects, that may harm them. The system is jointly administered by the U.S. Forest Service, the Department of Agriculture, the National Park Service, and the U.S. Department of the Interior.

B1.1.26 The Wilderness Act (16 U.S.C. 1131 et seq.)

This Act established a National Wilderness Preservation System composed of federally owned areas designated by Congress as "wilderness areas." These are to be managed in a manner that will leave them unimpaired for future use and enjoyment as wilderness and will protect them and preserve their wilderness character. With certain exceptions, the Act prohibits motorized equipment, structures, installations, roads, commercial enterprises, aircraft landings, and mechanical transport. The Act permits mining on valid claims, access to private lands, fire control, insect and disease control, grazing, water-resource structures (upon the approval of the President), and visitor use (16 U.S.C. 1133). Except as otherwise provided in this Act, each agency administering any designated wilderness area shall be responsible for preserving the wilderness character of the area.

B1.1.27 EPA Regulations

10 CFR Part 40, Appendix A, implements EPA regulations at 40 CFR Part 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings. Dual regulation of groundwater at ISL facilities will continue until such a time that NRC can defer to the EPA UIC Program. See EPA requirements for Class III injection wells found in 40 CFR Part 146.

B2 EXECUTIVE ORDERS

B2.1 Executive Order 11514—Protection and Enhancement of Environmental Quality (as Amended)

This Order directs federal agencies to continuously monitor and control their activities to protect and enhance the quality of the environment. It also requires procedures to ensure that federal plans and programs with potential environmental impacts are presented to the public in a timely and understandable way and that the views of interested parties are obtained.

B2.2 Executive Order 11988—Floodplain Management

According to this Order, federal agencies must establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered before any action is undertaken in a floodplain and that floodplain impacts should be avoided to the extent practicable.

B2.3 Executive Order 11990—Protection of Wetlands (May 24, 1977)

This Order states that each federal agency shall provide leadership; take action to minimize the destruction, loss, or degradation of wetlands; and preserve and enhance the natural and beneficial values of wetlands. Agencies must follow these guidelines when (1) acquiring, managing, and disposing of federal lands and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; or (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

B2.4 Executive Order 12898—Environmental Justice

This Order directs federal agencies to achieve environmental justice by identifying and addressing, as appropriate, programs, policies, and activities that have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations in the United States, its territories, and possessions. The Order creates an Interagency Working Group on Environmental Justice and directs each federal agency to develop strategies (within certain time limits) that identify and address environmental justice concerns. The Order further states that each federal agency must collect, maintain, and analyze information on the race, national origin, income level, and other readily accessible and appropriate information for areas surrounding facilities or sites that are expected to substantially affect the environment, human health, or economy of surrounding populations. This information is required when such facilities or sites become the subject of a substantial federal environmental administrative or judicial action, and these federal agencies must make such information publicly available.

B2.5 Executive Order 13007—Indian Sacred Sites

Federal agencies, to the extent permitted by law and consistent with agency missions, are required by this Order to avoid adverse effects to sacred sites and to provide access to those sites to American Indians for religious practices. The Executive Order directs agencies to plan projects that protect and allow access to sacred sites in a way that is compatible with the projects.

B2.6 Executive Order 13084—Consultation and Coordination With Indian Tribal Governments (May 14, 1998)

This Order recognizes that the United States continues to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, trust resources, and Indian tribal treaty and other rights. Accordingly, the Order establishes regular and meaningful consultation and collaboration with Indian tribal governments to develop regulatory practices on federal matters that significantly or uniquely affect these communities, reduces the imposition of unfunded mandates upon Indian tribal governments, and streamlines the application process for and increases the availability of waivers to Indian tribal governments.

B2.7 Executive Order 13175—Consultation and Coordination With Indian Tribal Governments

This Order further directs federal agencies to have regular and meaningful consultation and collaboration with American Indian tribal governments in developing federal policies that have tribal implications, to strengthen United States government-to-government relationships with tribes, and to reduce the imposition of unfunded mandates on tribal governments.

B2.8 Executive Order 13186—Responsibilities of Federal Agencies to Protect Migratory Birds (January 10, 2001)

This Order recognizes that migratory birds are of great ecological and economic value to this country and to other countries and that they contribute to biological diversity and bring tremendous enjoyment to millions of Americans who study, watch, feed, or hunt these birds throughout the United States and other countries. Each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations has two years to develop and implement a Memorandum of Understanding with the U.S. Fish and Wildlife Service to promote the conservation of migratory bird populations. Further, each agency shall ensure that environmental analyses of federal actions that National Environmental Policy Act or other established environmental review processes require must evaluate the effects of actions and agency plans on migratory birds, emphasizing species of concern.

B2.9 Executive Order 13195—Trails for America in the 21st Century (January 18, 2001)

This Order directs federal agencies to protect, connect, promote, and assist development of trails of all types throughout the United States to the extent permitted by law and where practicable and in cooperation with tribes, states, local governments, and interested citizen groups.

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APPENDIX C

SUMMARY OF CONVENTIONAL URANIUM MILLING TECHNOLOGIES

C. SUMMARY OF CONVENTIONAL URANIUM MILLING TECHNOLOGIES

C1.1 Conventional Mills

Uranium milling techniques have evolved over the years, but the basic requirements are similar to those described in NUREG–0706 (NRC, 1980, Appendix B). Although located in an Agreement State and not regulated by the U.S. Nuclear Regulatory Commission (NRC), recent licensing actions related to conventional mill sites in Utah (White Mesa near Blanding and Shootaring Canyon near Ticaboo) can also provide some updated information [Denison Mines (USA) Corporation, 2007; Plateau Resources, Ltd., 2006]. These facilities have a maximum capacity of about 900–1,800 metric tons [1,000–2,000 short tons] of ore per day. Many of the chemical processes are similar to those used to process ISL solutions; unlike ISL uranium processing, however, additional steps are necessary to prepare the solid uranium ore for recovery and manage solid waste disposal.

In traditional conventional milling operations, the uranium ore is mined from a deposit by surface or underground mining techniques and transported to the mill site for processing (Figure C1.1–1). Depending on economic conditions and license requirements, a conventional mill may also process alternate materials such as contaminated soils for their uranium content [Denison Mines (USA) Corporation, 2007]. The conventional uranium milling process involves several basic steps (Figure C1.1–2).

C1.1.1 Ore Handling and Preparation

This stage of the milling process includes ore blending to ensure uniform physical and chemical characteristics, crushing and grinding, and possibly drying or roasting to improve ore handling and solubility properties.

Ore is trucked to the processing facility. The incoming ore is weighed and analyzed for moisture and uranium content. The ore may be stockpiled to manage the feed into the circuit. Ore is initially screened through a large mesh grizzly and transported by conveyer belt into the grinding stage, usually by discharge into a semiautogenous grinding mill. Water is added to the ore to produce a slurry containing approximately 70 percent solids. The slurry is then pumped through screens into large surge tanks to maintain feed into the leach circuit. Oversize material is recycled back into the semiautogenous grinding mill, and undersize material flows to a storage sump.

C1.1.2 Mill Concentration

This stage of the milling processing includes physical (e.g., washing) or chemical techniques to leach uranium from the slurry, followed by further uranium concentration using techniques such as ion exchange or solvent recovery.

The leaching circuit dissolves uranium minerals from sandstone grains. A two-stage leaching circuit is typically used (Plateau Resources, Ltd., 2006). The ore slurry is pumped from the surge tanks to the first-stage leach circuit where the ore is mixed and agitated with a sulfuric acid or alkaline leach solution, and an oxidant and passed through a series of leach tanks in

APPENDIX D

CULTURAL AND HISTORICAL RESOURCE MANAGEMENT PROCESSES

D. CULTURAL AND HISTORICAL RESOURCE MANAGEMENT PROCESSES

D1.1 CULTURAL RESOURCES

Cultural resources are historic properties that include archaeological sites and historical-period structures and features protected under the NHPA of 1966, as amended (16 U.S.C. 470). Cultural resources further include traditional cultural properties that significantly define community practices and beliefs that are important to maintaining community identity. According to Section 106 of the NHPA, federal agencies must account for effects to historic properties that may result from the agencies' undertakings. 36 CFR Part 800 defines the process by which federal agencies comply with the NHPA, as amended. The National Register of Historic Places (NRHP) is a register of historic buildings, objects, sites, and districts as well as archaeological resources. Archaeological resources consist of prehistoric and historical-period sites that contain evidence of past human lifeways and adaptations. Traditional cultural properties, cultural landscapes, ethnographic landscapes, rural historic landscapes, and historic mining landscapes can also be evaluated for listing in the NRHP.

The federal government established the NRHP and devised the way historic properties are eligible and can be nominated to be listed in the NRHP; this process preserves significant historic properties. The listing of a historic property in the NRHP ensures that a property is protected under provisions of the NHPA. In addition, properties deemed potentially eligible for inclusion in the NRHP are given this same protection.

In the context of a federal undertaking, the significance of a cultural resource is judged according to NRHP eligibility criteria. These criteria are defined in Title 36, Part 60, of the Code of Federal Regulations (36 CFR Part 60), which states that

> "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and;
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in pre-history or history."

In addition to these four criteria, there is a general stipulation that the property be 50 or more years old (for exceptions, see 36 CFR 60.4, Criteria Considerations a–g). The importance of this historic information is measured by its relevance to identified research questions that can be addressed through the analysis of particular types (National Park Service, 1991). In addition to research potential, both Native American and Euroamerican cultural resources may possess

APPENDIX E

HAZARDOUS CHEMICALS

E. HAZARDOUS CHEMICALS

E1.1 Accident Analysis for Ammonia

In uranium *in-situ* leach (ISL) facilities ammonia is used for pH adjustment during the precipitation of uranium as an insoluble uranyl peroxide compound. Large capacity outdoor tanks are typically employed for storage of ammonia at ISL facilities. The ammonia is piped from the tank to the main plant for use in the processing circuit. Mackin, et al. (2001) identifies an ammonia leak in the plant as a significant hazard. If a leak were to occur, the resultant fumes are estimated to be far in excess of the immediately dangerous to life and health value of 300 ppm for ammonia, and the plant ventilation system is not able to sufficiently dilute the concentration to safer levels.

In addition, the spray of liquid ammonia under pressure emanating at the pipe rupture point could also pose an additional hazard to the skin and eyes of any personnel in the immediate vicinity of the pipe break. Further, if at the time of the spill, plant personnel are in an inaccessible location such as on an elevated catwalk, there could be a delay in exiting the spill location. Finally, ammonia can react vigorously with water as well as with sulfuric acid and hydrochloric acid, two strong acids used in ISL uranium recovery.

Other potential hazards associated with ammonia include a major leak in the outdoor storage tank and associated piping and accidental contact with process wastes, sulfuric or hydrochloric acid, or water.

To minimize the risk of an accidental release, ammonia system design and operating procedures should be consistent with American National Standards Institute, Safety Requirements for the Storage and Handling of Anhydrous Ammonia (American National Standards Institute, 1989) or any future revision or update thereof. Following are examples of recommendations that provide safe handling of ammonia consistent with this pamphlet.

- Ammonia system supply piping should include an excess flow valve that closes automatically if flow rate exceeds a specific value. The valve should be located as close to the storage tank as possible

- All nonrefrigerated ammonia piping should conform to the applicable sections of the American National Standards Institute/American Society of Material Evaluation standard code for pressure piping

- Positive pressure, self-contained, full face respirators should be readily available in the immediate vicinity of ammonia piping and process operations

Prudent design would also ensure that ammonia piping is placed so as to minimize impact from vehicles or other objects that might cause ruptures.

E1.2 Accident Analysis for Sodium Hydroxide

At uranium ISL facilities, sodium hydroxide (NaOH) is used for pH control in the radium removal process from the barren lixiviant bleed stream using a conventional barium/radium sulfate co-precipitation process. Sodium hydroxide is typically stored as a 50-percent solution in 208-L [55-gal] drums, and is pumped to the bleed neutralization and precipitation tanks.

Sodium hydroxide is a corrosive irritant to the skin, eyes, and mucous membranes. It can cause burns and deep ulceration. Mists, vapors, and dusts containing sodium hydroxide from an accidental release can cause small burns, and contact with the eyes rapidly causes severe damage. Inhalation of the dust or mist from an accidental release can cause damage to the upper respiratory tract and to lung tissue. Sodium hydroxide ingestion causes serious damage to the mucous membranes or other tissues contacted. (Lewis, 1993).

As noted in NUREG/CR–6733 (Mackin, et al. 2001), sodium hydroxide is not volatile. A spill of 50-percent sodium hydroxide solution in a uranium ISL facility will not pose a significant inhalation hazard to workers. The immediately dangerous to life and health concentration for dust and mists of sodium hydroxide is 10 mg/m^3. This limit applies to sodium hydroxide as an airborne contaminant such as a dust or mist. Since uranium ISL facilities typically do not employ sodium hydroxide in solid form, dust is not a concern. However, mists and sprays from leaks in drums and piping systems need to be avoided, as these could cause harm through contact with the skin or through inhalation.

Other hazards associated with sodium hydroxide include a major leak in the outdoor storage tank and associated piping and accidental contact with sulfuric acid, hydrochloric acid, or water.

Standards such as Process Safety Management or Risk Management Program should be employed to reduce risk of accidents to acceptable levels.

E1.3 Accident Analysis for Sulfuric Acid

Sulfuric acid (H_2SO_4) is extremely irritating, corrosive, and toxic to tissue, resulting in rapid destruction of the tissue and causing severe burns (Lewis, 1993). In uranium ISL facilities, sulfuric acid is used to split the uranyl carbonate complex from rich eluate into carbon dioxide gas and uranyl ions in preparation for their precipitation. The sulfuric acid is usually stored in a tank located outdoors and in some cases may be piped to a much smaller day tank in the main plant for use in the processing circuit. The day tank is normally bermed for spill containment. The risk analysis performed in Mackin, et al. (2001) identifies a spill of 93 percent sulfuric acid in the plant not to be a significant inhalation hazard to workers as long as the plant ventilation system is functioning to provide adequate dilution air. However, the formation of mists and sprays, such as from a leak in the piping system, should be avoided, as these could cause harm through contact with the skin or through inhalation.

Other hazards associated with sulfuric acid include a major leak in the outdoor storage tank and associated piping and accidental contact with ammonia, sodium carbonate, sodium hydroxide and water, all of which are present at uranium ISL facilities. Suitable pre-cautions should therefore be taken to ensure that leaks and accidental contact with these chemicals are prevented. At some facilities, the sulfuric acid day tank is situated close to other eluate processing tanks, such that a simultaneous leak in more than one tank system could cause a vigorous reaction between the acid and the water in the eluate solutions. ISL facility design should ensure that this situation is avoided. It is recommended that uranium ISL facility operators follow industry best practices and design and operating practices published in accepted codes and standards that govern sulfuric acid systems and include this in the license application.

E1.4 Accident Analysis for Hydrochloric Acid

Hydrochloric acid is a corrosive irritant to the skin, eyes, and mucous membranes. A concentration of 35 ppm causes irritation of the throat after short exposure (Lewis, 1993). In uranium ISL facilities, hydrochloric acid (HCl) is used for pH control during radium removal from the barren lixiviant bleed stream via a conventional barium/radium sulfate co-precipitation process. The hydrochloric acid is usually stored in a tank located outdoors and is piped to the main plant for use in the processing circuit.

The risk analysis performed in NUREG/CR–6733 (Mackin, et al. 2001) indicates a spill of 30 percent hydrochloric acid in the plant is a significant inhalation hazard to workers, especially if the heating, ventilation, and air conditioning system is not functioning properly. In such a case, any person entering or already present within the facility would have a very short time to exit before injury. The formation of mists and sprays, such as from a leak in the piping system, should be avoided, as these could cause harm through contact with the skin or through inhalation.

Other hazards associated with hydrochloric acid include a major leak in the outdoor storage tank and associated piping and accidental contact with sodium hydroxide, ammonia, water, sodium carbonate, and sulfuric acid. Precautions should therefore be taken to ensure that accidental contact of hydrochloric acid with these chemicals is prevented. Standards such as Process Safety Management or Risk Management Program should be explained in the license application and employed to reduce risk of accidents to acceptable levels.

E1.5 Accident Analysis for Oxygen

In uranium ISL facilities, oxygen (O_2) is added to the barren lixiviant prior to the injection of the lixiviant into the ground. The oxygen may be fed into the barren lixiviant header via a common connection or via multiple connections to each individual injection well pipe. As joints are susceptible to leaks, the common header system is inherently safer. Solenoids that automatically shut off the oxygen supply in case of power failure (normally closed solenoids) may be employed at some locations. Most well header houses are also equipped with an exhaust ventilation system. The normally closed solenoids and the exhaust ventilation reduce the risk of oxygen leaks in the lixiviant injection piping and buildup in the header house.

Fire and explosion are the main hazards associated with the storage and use of oxygen. Materials that are flammable in air burn more vigorously in oxygen. If ignited, combustibles such as oil and grease will burn with nearly explosive violence in oxygen. All oil, grease, and other combustible material must be removed from piping systems and containers before putting them into oxygen service. Cleaning Equipment for Oxygen Service (Compressed Gas Association, Inc., 1996a), CGA G4–1, and the Handbook of Compressed Gases, Chapter 11 (Compressed Gas Association, Inc., 2000) describe cleaning methods used by manufacturers of oxygen equipment. To the extent possible, sources of ignition should be eliminated. Sudden opening of valves can result in ignition, and is to be avoided. ASTM G–88, Standard Guide for Designing Systems for Oxygen Service (ASTM International, 1997) discusses safety measures, including providing system isolation and barriers. Liquid oxygen piping systems must include pressure relief devices to prevent the buildup of excessive pressure due to vaporization when liquid is trapped between valves in piping. CGA G–4.4, Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems (Compressed Gas Association, Inc., 1993a) provides a detailed discussion on the design and installation of gaseous oxygen piping systems. Requirements for both underground and above-ground piping, as well as material specifications, velocity restrictions, location and specifications for valves, and the design and specification of metering stations and filters are included in this publication.

Oxygen can be shipped as a gas, at pressures of 13,887 kPa (2,000 psig) or above, or as a cryogenic liquid at pressures below 1,480 kPa (200 psig) and temperatures below −147 °C [−232 °F]. Ordinary carbon steels and most alloy steels lose their ductility at the temperature of liquid oxygen and are considered unsuitable for use. Austenitic stainless steels such as Types 304 and 316, nickel-chrome alloys, nickel, Monel 400, copper brasses, bronzes, and aluminum alloys are more suitable for use in liquid oxygen service. To effectively isolate them from fires and accidents in other systems, the oxygen storage facilities should be located a safe distance away from other storage tanks and process facilities. Standards to ensure safety with oxygen systems at user sites are detailed in National Fire Prevention Association publications such as NFPA–50, Standard for bulk Oxygen Systems at Consumer Sites (National Fire Prevention Association, 1996).

Oxygen presents a substantial fire and explosion hazard. Accordingly, uranium ISL facility licensees should comply with accepted industry standards for handling this material. General pre-cautions for safe handling of gaseous oxygen are contained in CGA–4, Oxygen (Compressed Gas Association, Inc., 1996b). A thorough discussion of necessary pre-cautions to be used for liquid oxygen can be found in CGA P–12, Safe Handling of Cryogenic Liquids (Compressed Gas Association, Inc., 1993b) and in the Handbook of Compressed Gases, in Chapter 2 (Compressed Gas Association, 2000).

E1.6 Accident Analysis for Hydrogen Peroxide

In the uranium ISL process, a hydrogen peroxide (H_2O_2) solution (typically of 50-percent strength) is added to an acidified uranium-rich solution to form an insoluble uranyl peroxide precipitate, which is then typically fed to a thickener for further processing into yellowcake. The 50-percent hydrogen peroxide solution is normally stored in a large capacity outdoor tank and is piped to the main plant for use in the precipitation process.

Hydrogen peroxide is a strong oxidizer and a reactive, easily decomposable compound. Its hazardous decomposition products include oxygen and hydrogen gas, heat, and steam. Decomposition can be caused by mechanical shock, light, ignition sources, excess heat, combustible materials, incompatible materials, strong oxidants, rust, dust, and pH > 4.0. Incompatible materials include alkalies, oxidizable materials, finely divided metals (e.g., magnesium, iron), alcohols, and permanganates. Although many mixtures of hydrogen peroxide and organic materials do not explode upon contact, the resultant combinations can be detonable either upon catching fire or from impact. In addition, when sealed in strong containers, even a gradual decomposition of hydrogen peroxide can cause excessive pressure to build up which may then cause the container to burst explosively (Lewis, 1993).

Solutions, vapors, and mists of hydrogen peroxide are irritating to body tissue. The eyes are particularly sensitive to this material, and a 50-percent solution will cause blistering of the skin. Inhalation of the vapors can burn the respiratory tract.

The risk analysis performed in NUREG/CR–6733 (Mackin, et al. 2001) indicates that a piping system leak in the process building can potentially result in localized vapor concentrations in excess of the immediately dangerous to life and health value of 75 ppm within minutes. A leak in a confined space such as a piping trench can potentially generate lethal vapor concentrations at an even faster rate.

E1.7 Accident Analysis for Carbon Dioxide

Carbon dioxide (CO_2) is added to the lixiviant at uranium ISL facilities either upstream or downstream of the ion exchange resin vessels to maintain the carbon dioxide concentration in the lixiviant. The carbon dioxide is typically delivered by truck and is stored on site under pressure in a tank in liquid form. The carbon dioxide is allowed to evaporate and the gas is then transported by pipe to the process flow stream where it is introduced into the lixiviant piping under pressure.

The primary hazard associated with carbon dioxide is leakage in a confined space, because it will displace oxygen and could lead to asphyxiation. Carbon dioxide concentrations of 10 percent or more can produce unconsciousness or death. The American Conference of Governmental Industrial Hygienists (1995) recommended that the time-weighted average for carbon dioxide is 5,000 ppm [9,000 mg/m^3], and the short-term exposure limit is 30,000 ppm [54,000 mg/m^3]. Since gaseous carbon dioxide is one and one-half times heavier than air, it can accumulate in low or confined areas. Appropriate warning signs should be posted outside such areas. When entering low or confined areas where high concentrations of carbon dioxide gas may be present, a self-contained breathing apparatus should be used. Floor level positive ventilation systems with carbon dioxide monitoring at low points are recommended in both satellite and central processing plants.

Carbon dioxide is typically stored outdoors onsite in insulated, mechanically refrigerated tanks. The carbon dioxide is maintained at low temperatures and under pressure in these tanks. Insulated carbon dioxide bulk storage systems must be designed to safely contain the required pressure and to meet applicable federal, state, and local regulations. Further information regarding the safe handling and use of carbon dioxide can be found in the following publications of the Compressed Gas Association: Handbook of Compressed Gases (2000); CGA–6, Carbon Dioxide (1997); CGA G–6.1, Standard for Low Pressure Carbon Dioxide Systems at Consumer Sites (1995); and CGA G–6.5, Standard for Small Stationary Low Pressure Carbon Dioxide Systems (1992).

The primary problems associated with carbon dioxide piping are ruptures from elevated pressure or from the loss of piping ductility at low temperature. Rapid depressurization will cause the liquid to autorefrigerate. If temperatures are allowed to decrease to −78.5 °C [−109.3 °F], dry ice will form in the lines. In addition, the rapid discharge of liquid carbon dioxide through a line that is not grounded can result in a buildup of static electricity which may be dangerous to operating personnel. Safe operation of carbon dioxide piping and systems is discussed in some detail in Mackin, et al. (2001).

E1.8 Accident Analysis for Sodium Carbonate and Sodium Chloride

Sodium carbonate (Na_2CO_3) and sodium chloride ($NaCl$) are used at ISL facilities for regeneration of the ion exchange resin. The loaded resin is typically contacted with a solution containing sodium chloride and sodium carbonate (soda ash) in a sequence that regenerates the resin by removing the uranyl dicarbonate ions from the resin and converting them to uranyl tricarbonate.

A concentrated solution of sodium carbonate is typically prepared in a commercially available saturator by passing warm water through a bed of soda ash. The saturated solution is stored in an indoor tank. A saturated solution of sodium chloride is similarly prepared using a commercially available brine generator, and is also stored in indoor tanks. Using a multistage elution circuit, the eluate solution containing the sodium chloride and sodium carbonate is used to contact the resin.

Both sodium chloride and sodium carbonate can be skin and eye irritants. Sodium carbonate is also moderately toxic by inhalation. In addition, sodium carbonate will react vigorously with sulfuric acid (Lewis, 1993) and with hydrochloric acid, typically present at uranium ISL facilities.

As indicated in NUREG/CR–6733 (Mackin, et al., 2001), sodium carbonate is not volatile, and a spill of saturated sodium carbonate solution in a uranium ISL facility will not pose a significant inhalation hazard to workers. Since several tons of sodium carbonate salt will be used as feed in the saturator, pre-cautions should be taken to ensure that inhalation of the dust is avoided. The formation of a sodium carbonate solution mist from a piping system leak should also be avoided as an inhalation hazard. Finally, pre-cautions should be taken to prevent accidental contact of sodium carbonate salt or solution with sulfuric or hydrochloric acid.

E1.9 Accident Analysis for Hydrogen Sulfide and Sodium Sulfide

In the uranium ISL process, hydrogen sulfide (H_2S) is used to immobilize heavy metals during groundwater restoration.

Fire and leakage in a confined space are the two main hazards associated with hydrogen sulfide. Because it is a flammable gas normally transported and stored in liquid form, the amount of flammable material is much greater per unit volume, making it a dangerous fire hazard when exposed to heat, flame, or oxidizers (Lewis, 1993). Hydrogen sulfide is a poison and a severe irritant to the eyes and mucous membranes. The immediately dangerous to life and health limit is 100 ppm [National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards (National Institute for Occupational Safety and Health, 2005)]. For maximum safety, indoor storage should be avoided and indoor areas should have positive ventilation with at least six volumes of air change per hour—Handbook of Compressed Gases (Compressed Gas Association, 2000).

Hydrogen sulfide is added to injection well headers. Header houses should therefore be equipped with adequate ventilation. To prevent injection during abnormal or unsafe process conditions, safety interlocks should be included in the design of instrumentation and control systems. In addition, the design should include adequate pre-cautions to ensure personnel safety when entering a confined space such as a piping trench carrying a hydrogen sulfide line.

Hydrogen sulfide storage sites should be located far away from other storage tanks, oxidizing materials, acids, and process facilities so that they are effectively isolated from fire and accidents.

Detailed information on the pre-cautions required for the safe handling of hydrogen sulfide and for the procedures and equipment for its use may be found in CGA G–12, Hydrogen Sulfide (Compressed Gas Association, 1996c) as well as in the Handbook of Compressed Gases (Compressed Gas Association, 2000). Standards such as Process Safety Management or Risk Management Program should be employed to drive down risk of accidents to acceptable levels. Sodium sulfide (Na_2S) may be used instead of hydrogen sulfide for the *in-situ* precipitation of heavy metals during groundwater restoration operations. Sodium sulfide is corrosive and will cause severe eye and skin burns. Under certain conditions, sodium sulfide can react violently with water to liberate hydrogen sulfide and free alkali (Lewis, 1993). Contact with heat, flame, or other sources of ignition should be avoided as sodium sulfide can be flammable. Materials to avoid include strong oxidizing agents, strong acids, and most common metals.

E2. References

American Conference of Governmental Industrial Hygienists. "1995–1996 Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (SEIs)." Cincinnati, Ohio: American Conference of Government Industrial Hygienists. 1995.

American National Standards Institute. "Safety Requirements for the Storage and Handling of Anhydrous Ammonia." Pamphlet K-61.1 New York City, New York: American National Standards Institute. 1989.

ASTM International. "Standard Guide for Designing Systems for Oxygen Service." ASTM G–88. West Conshohocken, Pennsylvania: ASTM International. 1997.

Compressed Gas Association, Inc. *Handbook of Compressed Gases*. Norwell, Massachusetts: Kluwer Academic Publisher. 2000.

Compressed Gas Association, Inc. *Carbon Dioxide. 5th Edition*. CGA–6. Norwell, Massachusetts: Kluwer Academic Publisher. 1997.

Compressed Gas Association, Inc. *Cleaning Equipment for Oxygen Service*. CGA G–4.1. Norwell, Massachusetts: Kluwer Academic Publishers. 1996a.

Compressed Gas Association, Inc. *Oxygen*. CGA–4. Norwell, Massachusetts: Kluwer Academic Publishers. 1996b.

Compressed Gas Association, Inc. *Hydrogen Sulfide*. CGA G–12. Norwell, Massachusetts: Kluwer Academic Publishers. 1996c.

Compressed Gas Association, Inc. *Standard for Low Pressure Carbon Dioxide Systems at Consumer Sites*. CGA G–6.1. Norwell, Massachusetts: Kluwer Academic Publishers. 1995.

Compressed Gas Association, Inc. *Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems*. G–4.4. Norwell, Massachusetts: Kluwer Academic Publishers. 1993a.

Compressed Gas Association, Inc. *Safe Handling of Cryogenic Liquids*. CGA P–12. Norwell, Massachusetts: Kluwer Academic Publishers. 1993b.

Compressed Gases Association, Inc. *Standard for Small Stationary Low Pressure Carbon Dioxide Systems*. G–6.5. Norwell, Massachusetts: Kluwer Academic Publishers. 1992.

Lewis, Sr., R.J. *Hazardous Chemicals Desk Reference. 3rd Edition*. New York City, New York: Van Nostrand Reinhold. 1993.

Mackin, P.C., D. Daruwalla, J. Winterle, M. Smith, and D.A. Pickett. NUREG/CR–6733, "A Baseline Risk-Informed Performance-Based Approach for *In-Situ* Leach Uranium Extraction Licensees." Washington, DC: NRC. September 2001.

National Fire Prevention Association. “Standard for Bulk Oxygen Systems at Consumer Sites.” NFPA–50. Quincy, Massachusetts: National Fire Prevention Association. 1996.

National Institute for Occupational Safety and Health. “Pocket Guide to Chemical Hazards.” Atlanta, Georgia: National Institute for Occupational Safety and Health. 2005.

APPENDIX F

DESCRIPTION OF PROCESSES FOR REVIEW OF CUMULATIVE EFFECTS

F. DESCRIPTION OF PROCESSES FOR REVIEW OF CUMULATIVE EFFECTS

F1 GENERAL DESCRIPTION OF THE COUNCIL ON ENVIRONMENTAL QUALITY 11-STEP PROCESS

An example for analyzing potential cumulative effects process can be based on applying the Council on Environmental Quality's (CEQ) 11-step process to the 12 identified resource areas (CEQ, 1997):

- Step 1: Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals. This step is based on identifying typical incremental impacts associated with the construction, operation, aquifer restoration, and decommissioning phases associated with the ISL project.

- Step 2: Establish the geographic scope for the analysis. The scope for the four identified cumulative effects issues and related resource areas consists of the local and regional areas around the proposed ISL project. The specific spatial boundaries are place based and vary with each resource area.

- Step 3: Establish the timeframe for the analysis. The selected timeframe is typically from the initiation of area energy development projects (e.g., 1960s) to the future point in time when the proposed ISL project will have extracted the useable uranium.

- Step 4: Identify other actions affecting the resources, ecosystems, and human communities of concern. As noted in the earlier definition, other actions include past, present, and reasonably foreseeable future actions (RFFAs) that have, or would be expected to have, impacts on the four identified resource areas. Identifying past actions will typically involve reviewing local and regional energy and industrial development projects and various land use activities and changes (e.g., from agricultural usage to residential usage). Present actions may include current planning and license applications related to ISL projects, other energy and industrial development projects, and/or activities leading to land use changes. The RFFAs, which may include the continued operation or expansion of past and present actions, can be defined as

  > Actions identified by analysis of formal plans and proposals by public and private entities that have primary (direct) or secondary (indirect) impacts on the four resource areas. RFFAs also include potential actions that are beyond mere speculation when incorporated in plans or documents by credible private or public entities. RFFAs may also include events forecasted by trends, probable occurrences, policies, regulations, or other credible data that may have bearing on the four resource areas.

- Each identified RFFA should be defined by its anticipated time period of occurrence, probability of occurrence, and geographical location relative to the proposed ISL facility.

- Step 5: Define the pertinent resource areas identified during scoping in terms of how they will respond to change and ability to withstand stresses. In this case, scoping refer

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NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

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10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This Draft Generic Environmental Impact Statement (Draft GEIS) was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 and NRC regulations for implementing NEPA found at Title 10, "Energy," of the U.S. Code of Federal Regulations (CFR) Part 51 (10 CFR Part 51). This Draft GEIS evaluates on a programmatic basis, the potential environmental impacts associated with the construction, operation, ground water restoration, and decommissioning of uranium milling facilities employing the in-situ leach (ISL) process.

In the ISL process, a leaching agent, such as oxygen with sodium bicarbonate, is added to native ground water for injection through wells into the subsurface ore body to dissolve the uranium. The leach solution, containing the dissolved uranium, is pumped back to the surface and sent to the processing plant, where ion exchange is used to separate the uranium from the solution. The underground leaching of the uranium also frees other metals and minerals from the host rock. Operators of ISL facilities are required to restore the ground water affected by the leaching operations. The milling process concentrates the recovered uranium into the product known as "yellowcake" (U3O8). This yellowcake is then shipped to uranium conversion facilities for further processing in the overall uranium fuel cycle.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

Uranium Recovery
In-Situ Leach Process
Uranium
Environmental Impact Statement

13. AVAILABILITY STATEMENT

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