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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 G

## Final Report


Office of Federal and State Materials and
Environmental Management Programs

Wyoming Department of Environmental Quality
Land Quality Division

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

## Chapters 5 through 12 and Appendices A through G

## Final Report

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**Land Quality Division**

# ABSTRACT

The Atomic Energy Act of 1954 and the Uranium Mill Tailings Radiation Control Act of 1978 authorize the U.S. Nuclear Regulatory Commission (NRC) to issue licenses for the possession and use of source material and byproduct material. These statutes require NRC to license facilities that meet NRC regulatory requirements that were developed to protect public health and safety from radiological hazards. *In-situ* leach (ISL) uranium recovery facilities must meet NRC regulatory requirements in order to obtain a source material license to operate.

Under NRC's environmental protection regulations in the Code of Federal Regulations, Title 10, Part 51, which implement the National Environmental Policy Act (NEPA), issuance of a license to possess and use source material for uranium milling requires an environmental impact statement (EIS) or a supplement to an EIS. NRC has prepared a generic environmental impact statement (GEIS) to help fulfill this requirement. The GEIS assesses the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISL uranium recovery facility in four specified regions in the western United States. The intent of the GEIS is to determine which impacts would be essentially the same for all ISL facilities and which ones would result in varying levels of impacts for different facilities, thus requiring further site-specific information to determine the potential impacts. As such, the GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISL facilities, as well as for applications to amend or renew existing ISL licenses.

NRC developed this 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 preparation of the GEIS. NRC's licensing experience 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.

Based on discussions between uranium recovery companies and the NRC staff, future 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.

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# EXECUTIVE SUMMARY

## BACKGROUND

The Atomic Energy Act of 1954 and the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) authorize the U.S. Nuclear Regulatory Commission (NRC) to issue licenses for the possession and use of source material and byproduct material. The statutes require NRC to license facilities that meet NRC regulatory requirements that were developed to protect public health and safety from radiological hazards. *In-situ* leach (ISL) uranium recovery facilities must meet NRC regulatory requirements in order to obtain this license to operate.

NRC designed the licensing process to assure the safe operation of ISL facilities. In addition to information for a safety evaluation review, license applicants must submit an environmental report as part of their license application. Under the NRC's environmental protection regulations in the Code of Federal Regulations, Title 10, Part 51 (10 CFR Part 51), which implement the National Environmental Policy Act (NEPA), issuance of a license to possess and use source material for uranium milling requires an environmental impact statement (EIS) or a supplement to an EIS.

> **<u>Generic Environmental Impact Statement (GEIS)</u>**
>
> A GEIS is an environmental impact statement that assesses the scope of the environmental effects that would be associated with an action (such as issuing a license for an ISL facility) at numerous sites. The Commission directed the NRC staff to prepare the GEIS to cover as many of the potential uranium recovery sites as possible.
>
> **<u>Supplemental Environmental Impact Statement (SEIS)</u>**
>
> A supplemental EIS updates or supplements an existing EIS (such as the GEIS). The Commission directed the NRC staff to issue site-specific supplements to the GEIS for each new license application.

NRC prepared the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) to help fulfill this requirement. The GEIS was prepared to assess the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISL facility in four specified geographic areas. The intent of the GEIS is to determine which impacts would be essentially the same for all ISL facilities and which ones would result in varying levels of impacts for different facilities, thus requiring further site-specific information to determine the potential impacts. As such, the GEIS provides a starting point for NRC's NEPA analyses on site-specific license applications for new ISL facilities, as well as for applications to amend or renew existing ISL licenses.

## PURPOSE AND NEED

Commercial uranium recovery companies have approached NRC with plans to submit a number of license applications for new uranium recovery facilities and for the restart or expansion of existing facilities in the next several years. The large majority of these potential applications would involve use of the ISL process. The companies have indicated that these new, restarted, and expanded ISL facilities would be located in Wyoming, South Dakota, Nebraska, and New Mexico.

NRC is the regulatory authority responsible for issuing a source material license for an ISL facility in those four states. 10 CFR Part 51 regulations require evaluating the environmental impacts of the ISL facility as part of the licensing process. Recognizing that the technology for ISL uranium milling is relatively standardized, that the applications may be submitted over a relatively short period of time, and that the potential ISL facilities would be located in relatively discrete regions in the western United States, NRC decided to prepare a GEIS to avoid unnecessary duplicative efforts and to identify environmental issues of concern to focus on in site-specific environmental reviews. In this way, NRC could increase the efficiency and consistency in its site-specific environmental review of license applications for ISL facilities and so provide an option for applicants to use and licensees to continue to use the ISL process for uranium recovery.

## 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 grant an application to obtain, renew, or amend a source material license for an ISL facility.

Under NRC's environmental protection regulations at 10 CFR 51.20(b)(8), issuing a license to possess and use source material to a uranium milling facility is identified as a major federal action that requires the preparation of an EIS or a supplement to an EIS. NRC will prepare a SEIS for new ISL facility license applications. NRC will prepare an EA, SEIS or EIS for applications to amend or renew an existing ISL facility license.

**The Proposed Federal Action**

To grant applications to obtain, renew, or amend source material licenses for an ISL facility.

**Purpose for the Proposed Federal Action**

To provide an option for an applicant to use or a licensee to continue to use ISL technology for uranium recovery

The environmental review requirements for a material license are in 10 CFR Part 51. NRC's public health and safety requirements for ISL facilities are found in 10 CFR Parts 20 and 40. Parts 20, 40, and 51 require applicants to provide NRC with sufficient information to evaluate the impacts to public health and safety and the environment during the life-cycle of the ISL facility. NRC then prepares safety and environmental reviews that are used by NRC officials to decide whether to grant the source material license.

In reviewing an ISL license application, NRC will use the GEIS as starting point for its site-specific environmental reviews. NRC will evaluate site-specific data and information to determine whether the applicant's proposed activities and the site characteristics are consistent with those evaluated in the GEIS. NRC will then determine which sections of the GEIS can be incorporated by reference and which impact conclusions can be adopted in the site-specific environmental review, and whether additional data or analysis is needed to determine the environmental impacts to a specific resource area. Additionally, the GEIS provides guidance in the evaluation for certain impact analyses (e.g., cumulative impacts, environmental justice) for which the GEIS did not make impact conclusions. No decision on whether to license an ISL facility will be made based on the GEIS alone. The licensing decision will be based, in part, on a site-specific environmental analysis that makes use of the GEIS.

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 the ISL process, a leaching agent, such as oxygen with sodium carbonate, is added to native groundwater and injected through wells into the subsurface ore body to mobilize the uranium. The leach solution containing the mobilized uranium 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 resultant product, a mixture of uranium oxides also known as "yellowcake," is placed in 55-gallon drums prior to shipment offsite for further processing.

A range of alternatives was evaluated for inclusion in the GEIS. As defined in the GEIS, the proposed federal action is NRC's determination to grant an application to obtain, renew, or amend a source material license for an ISL facility. Under the no-action alternative, NRC would deny the applicant's or licensee's request. As a result, the new license applicant may choose to resubmit the application to use an alternate uranium recovery method or decide to obtain the yellowcake from other sources. A licensee whose renewal application is denied would have to commence shutting down operations in a timely manner. Denials of license amendments would require the licensee to continue operating under its previously approved license conditions.

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 (conventional milling and heap leaching) are viable alternative technologies.

Inasmuch as the suitability and practicality of using alternative milling methodologies depends on site-specific conditions, a generic discussion of alternative milling methodologies is not appropriate. Accordingly, this 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.

## ANALYTICAL APPROACH

The GEIS serves to increase efficiency and eliminate repetitive discussions in NRC's environmental review process by identifying and evaluating environmental impacts that are generic and common to ISL uranium recovery facilities. Information from the GEIS can be summarized and incorporated by reference into the subsequent site-specific environmental review documents. The GEIS also identifies resource areas that need site-specific information to more fully determine the environmental impact to particular resource areas. The site-specific environmental impact analysis also will include any new or significant information necessary to evaluate the ISL facility license application.

For the GEIS, NRC identified the potential environmental impacts associated with the ISL process and the resource areas that could be affected. The general methodology for doing so was to (1) describe the ISL process activity or activities that could affect the resource, (2) identify the resource(s) that can be affected, (3) evaluate past licensing actions and associated environmental review documents and other available information, (4) assess the nature and magnitude of the potential environmental impacts to the resource(s), (5) characterize the significance of the potential impacts, and (6) identify site conditions and mitigation measures that may affect the significance. For some types of impacts analyses (e.g., cumulative impacts, environmental justice evaluations), NRC recognized the difficulty in making determinations in the GEIS, given the location-specific nature of these analyses. For these categories, NRC collected information and conducted initial evaluations, which are documented in the GEIS. The purpose of this information gathering and initial evaluation is intended to provide background data and guidance for the site-specific analyses for these types of impact evaluations.

NRC developed this GEIS based on its experience in licensing and regulating ISL facilities gained during the past 30 years. In the 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 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 previously identified 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 GEIS, these regions are

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

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

Chapter 2 of the 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 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 in NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs," issued 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 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 resources
- Visual and scenic resources
- Socioeconomic
- Public and occupational health

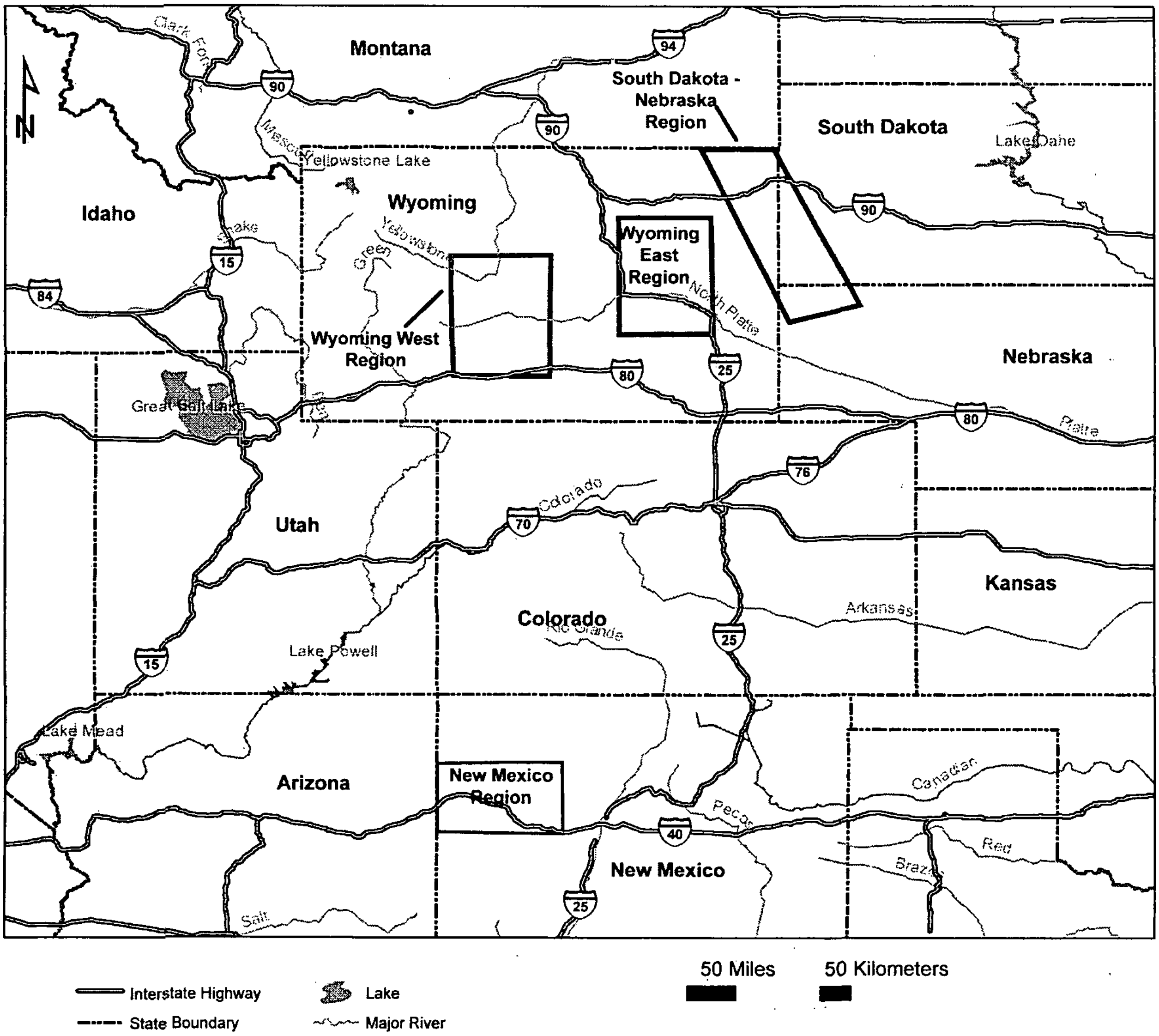



**Figure ES–1. Location of Four Geographic Regions Used as a Framework for the Analyses Presented in This GEIS**

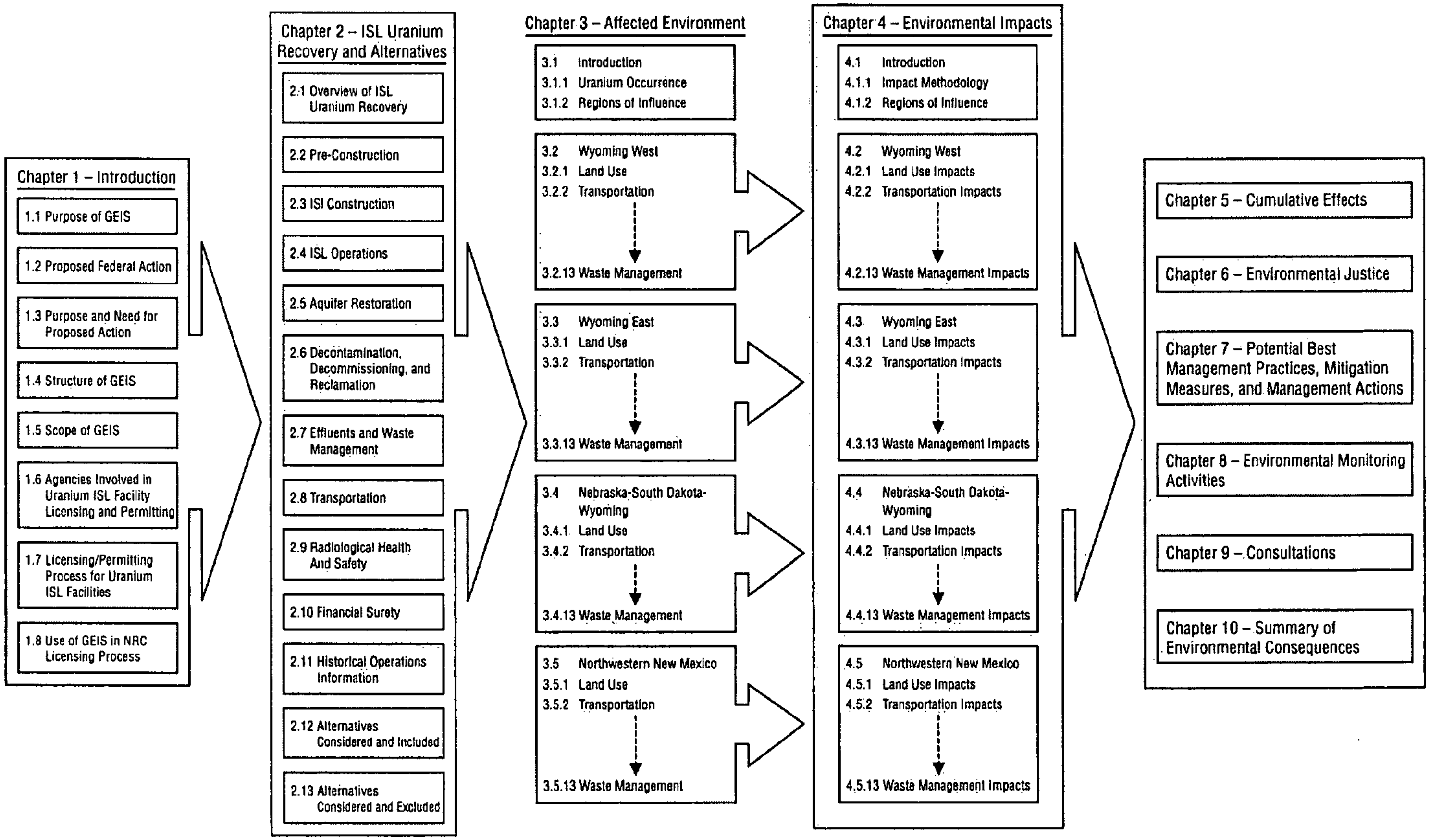



**Figure ES–2. Structure of This GEIS**

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 GEIS. These include 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 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 in the event ISL license applications are submitted.

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

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

## SIGNIFICANCE LEVELS

In the 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 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

Chapter 4 of the 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 next.

### 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 on 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 boundaries. 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 similar to, or less than, those 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 the 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 15 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 activities, liquid effluent 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.

**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, and 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 operate 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 of fluids, 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, recontour, 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.

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 groundwater 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. Impacts from the 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 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 and NRC's approval process—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 MODERATE, 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 and 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 and netting 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 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 and netting would limit impacts. Contamination of soils could 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, and alternative sites would reduce overall impacts—SMALL.

DECOMMISSIONING—During decommissioning and reclamation, there would be a temporary disturbance to land (e.g., excavated soils, buried piping, removal of structures). However, revegetation and recontouring 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 are reestablished—SMALL to MODERATE, depending on site-specific conditions.

**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 thus the 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 recontouring, 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 assist in reducing impacts—SMALL 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 LARGE—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 recontoured. 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 to LARGE.

**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 are 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, nonradiological air quality impacts would be SMALL. A Prevention of

Significant Deterioration Class I area exists in only one of the four regions (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.

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 nonradiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas, nonradiological air quality impacts would be SMALL. A Prevention of Significant Deterioration 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, those during operations. For NAAQS attainment areas, nonradiological air quality impacts would be SMALL. Where a Prevention of Significant Deterioration 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. 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, would be short-term, and would be 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, nonradiological air quality impacts would be SMALL. However, where a Prevention of Significant Deterioration 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, and 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 the 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. Generally, 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 is typically of short duration. Also, noise usually is not discernable to offsite receptors at distances of more than 300 m [1,000 ft.] Generally, 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 those 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, aquifer restoration 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]. Generally, 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]. Generally, the uranium districts are located more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.

**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 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 State Environmental Departments), and Native American Tribes (the 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, 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 those 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, 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 U.S. Bureau of Land Management. 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 Mount 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 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 Mount Taylor. As previously discussed, a Prevention of Significant Deterioration Class I area (Wind Cave National Park) is located in the Nebraska-South Dakota-Wyoming Uranium Milling Region. Prevention of Significant Deterioration Class I areas require more stringent air quality standards that can affect visual impacts. 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 these sites are in sparsely populated areas and there is 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 these sites are in sparsely populated areas and there is 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, and 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—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 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 conditions (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 those 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/recontouring the ground surface. Employment levels and use of local contractor support during decommissioning would be similar to those required for construction. Employment would be temporary, however, as decommissioning activities are short 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 the 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.) Nonradiological 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 nonradiological 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 during aquifer restoration overlap with similar activities during operations (e.g., operation of well fields, waste water treatment and disposal). The resultant impacts on public and occupational health and safety would be bound by operational impacts. The reduction of some operational activities (e.g., yellowcake production and drying, remote ion exchange) will limit 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, how ensuring the safety of workers and the public would be maintained, and how applicable safety regulations would be 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 radium 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 the safety of workers and the public and compliance with applicable safety regulations. 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 |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| FONSI | Finding of No Significant Impact |
| GEIS | Generic Environmental Impact Statement |
| ISL | *In-situ* Leach |
| 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 | 1.8 °C + 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." This chapter describes past, present, and reasonably foreseeable future actions (RFFAs) in the uranium milling regions and evaluates which resource areas would be potentially impacted by both *in-situ* leaching (ISL) facilities and the types of RFFAs identified in the regions. Due to the complex and site-specific nature of a cumulative impact assessment, this chapter provides useful information for understanding the potential for cumulative impacts when licensing future ISL facilities in the milling regions, but does not make conclusions regarding cumulative impacts that could be applied to specific sites.

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 that can be used to identify impact contributions from various actions, as well as the resource sustainability (Committee on Hardrock Mining on Federal Lands, 1999).

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 identify 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), supplemental 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 describe the affected environment, and Steps 8–11 to determine 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 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 history and also the 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, 2009). A total of 62 sites are included, with the sites subdivided into three types (ISL facilities, conventional uranium milling, and heap leach facilities). A total of nine ISl research and development sites are listed. Additionally, several other ISL research and development sites were associated with basic information gathering on the ISL process for a particular site that was later used to support approval for a license for commercial production.

Twenty-four of the sites involve conventional milling. Many of these sites are either in active decommissioning or have already been decommissioned. The U.S. Department of Energy (DOE) is the long-term custodian for the decommissioned sites under a general license issued by NRC. It should be noted that in the table, under the Wyoming West Uranium Milling Region, there are two entries for the Sweetwater site name. One entry is for an existing conventional uranium mill site, while the other lists both a potential conventional mine and a potential ISL facility.

In addition, there are abandoned convention uranium mining sites from the past that exist in the four uranium milling regions. For example, from 1944 to 1986, nearly 4 million tons of uranium ore was extracted in New Mexico under lease agreements with the Navajo National (EPA, 2008). This has resulted in over 500 abandoned uranium mines and associated environmental contamination in that area alone (EPA, 2008). Evaluating the potential impacts from past mining activities on new ISL proposals is a site-specific analysis that, if applicable to a proposed site, would be evaluated by applicants during site characterization and by the NRC staff when a site-specific licensing review is conducted.

A total of 31 past, present, 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). Out of these 31 ISL sites, 21 sites are in the Wyoming East Uranium Milling Region, 9 sites are in the Wyoming West Uranium Milling Region, and 1 site is in the Nebraska-South Dakota-Wyoming Uranium Milling Region. Five additional ISL sites are or potentially may be located in the Nebraska-South Dakota-Wyoming Uranium Milling Region, and one research and development site and one licensed ISL site are in the Northwestern New Mexico Uranium Milling Region. The table also shows four potential conventional milling sites (three in the Northwestern New Mexico Uranium Milling Region and the Sweetwater site in the Wyoming West Uranium Milling Region) and one potential heap leach site (in the Northwestern New Mexico Uranium Milling Region).

To reflect present actions and RFFAs related to uranium recovery in the four uranium milling regions analyzed in the GEIS, certain of the sites are identified as "potential sites" under Status

| Table 5.2-1. Past, Existing, and Potential Uranium Recovery Sites in Wyoming, South Dakota, Nebraska, and New Mexico* | | | | |
|---|---|---|---|---|
| **Site Name** | **Company/Owner** | **Type††** | **County, State** | **Status‡** |
| **Wyoming West Uranium Milling Region** | | | | |
| Sky | Strathmore Minerals Corp. | ISL | Fremont, WY | Potential site |
| Jab & Antelope | Uranium One | ISL[2,3] | Fremont, WY | Potential site license application under review by the U.S. Nuclear Regulatory Commission (NRC) |
| Lucky Mc | Pathfinder Mines Corp. | Conv. | Fremont, WY | Decommissioning |
| Split Rock | Western Nuclear, Inc. | Conv. | Fremont, WY | Decommissioning |
| Bison Basin | Ogle Petroleum | ISL[3] | Fremont, WY | License terminated |
| Riverton | U.S. Department of Energy (DOE) | Conv. | Fremont, WY | UMTRCA Title I processing site |
| Gas Hills | Power Resources Inc. | ISL[2] | Natrona & Fremont, WY | Licensed—on standby |
| Gas Hills | Strathmore Minerals Corp. | Conv. | Natrona & Fremont, WY | Potential site |
| Gas Hills | Umetco Minerals Corp. | Conv. | Natrona & Fremont, WY | Decommissioning |
| ANC | American Nuclear Corp. | Conv. | Natrona, WY | Decommissioning |
| Nine Mile Lake | Rocky Mountain Energy Co. | ISL[1] | Natrona, WY | License terminated |
| Lost Soldier | UR-Energy Corp. | ISL | Sweetwater, WY | Potential site |
| Sweetwater | Wildhorse Energy | ISL & Conv. | Sweetwater, WY | Potential site |
| West Alkali Creek | Wildhorse Energy | ISL | Sweetwater, WY | Potential site |
| Lost Creek | UR-Energy Corp. | ISL[3] | Sweetwater, WY | Potential site—license application under review by NRC |
| Sweetwater | Kennecott Uranium Co. | Conv. | Sweetwater, WY | Licensed—on standby |
| **Wyoming East Uranium Milling Region** | | | | |
| Reno Creek 2 | International Uranium Corp. | ISL[3] | Campbell, WY | Not licensed—applicant withdraws |
| Ruby Ranch | Conoco | ISL[1] | Campbell, WY | Not licensed—applicant withdraws |
| Ruby Ranch | Power Resources Inc. | ISL | Campbell, WY | Potential site |
| Reno Creek | Strathmore Minerals Corp. | ISL | Campbell, WY | Potential site |
| Nichols Ranch & Hank | Uranerz Energy Corp. | ISL[2,3] | Campbell & Johnson, WY | Potential site—license application under review by NRC |

| Table 5.2-1. Past, Existing, and Potential Uranium Recovery Sites in Wyoming, South Dakota, Nebraska, and New Mexico* (continued) | | | | |
|---|---|---|---|---|
| **Site Name** | **Company/Owner** | **Type††** | **County, State** | **Status‡** |
| **Wyoming East Uranium Milling Region (continued)** | | | | |
| Moore Ranch | Uranium One | ISL[3] | Campbell, WY | Potential site—license application under review by NRC |
| North Butte & Ruth | Power Resources Inc. | ISL[2,3] | Campbell, WY | Licensed—on standby |
| Reno Creek 1 | Rocky Mountain Energy Co. | ISL[1] | Campbell, WY | License terminated |
| Collins Draw | Cleveland Cliffs Iron Co. | ISL[1] | Campbell, WY | License terminated |
| Shirley Basin South | DOE | Conv. | Carbon, WY | UMTRCA Title II disposal site |
| Peterson Ranch | Arizona Public Service Co. Malapai Resources | ISL[1] | Converse, WY | Not pursued |
| Ludeman | Uranium One | ISL | Converse, WY | Potential site |
| Highland 1 | Exxon Minerals | ISL[3] | Converse, WY | Licensed but not pursued |
| Reynolds Ranch | Power Resources Inc. | ISL[2] | Converse, WY | Licensed but not operational |
| Highland 2 | Everest Minerals | ISL[3] | Converse, WY | Licensed—later combined with Smith Ranch facility license |
| Smith Ranch - Highland | Power Resources Inc. | ISL[3] | Converse, WY | Operating |
| Bear Creek | Bear Creek Uranium Co. | Conv. | Converse, WY | Decommissioning |
| Highlands | Exxon Mobil Corp. | Conv. | Converse, WY | Decommissioning |
| Leuenberger | Teton Exploration Drilling | ISL[1,3] | Converse, WY | License terminated |
| South Powder River Basin | Kerr-McGee | ISL[1] | Converse, WY | License terminated with approval of Smith Ranch license |
| Spook | Department of Energy | Conv. | Converse, WY | UMTRCA Title I disposal site |
| Allemand-Ross | Uranium One | ISL | Johnson, WY | Potential site |
| Irigaray/ Christensen Ranch | Cogema Malapai Resources | ISL[2,3] | Johnson, WY | Licensed for operations |
| Willow Creek | J&P Corp. Western Nuclear | ISL[1] | Johnson, WY | License terminated with approval of Irigaray license |
| Shirley Basin | Pathfinder Mines Corp. | Conv. | Natrona, WY | Decommissioning |

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

| Site Name | Company/Owner | Type†† | County, State | Status‡ |
|---|---|---|---|---|
| **Wyoming East Uranium Milling Region (continued)** | | | | |
| North Platte | Uranium Resources | ISL[1] | Platte, WY | License terminated |
| **Nebraska-South Dakota-Wyoming Uranium Milling Region** | | | | |
| Marsland | Cameco (Crow Butte Resources) | ISL[2] | Dawes, NE | Potential site |
| Three Crow | Cameco (Crow Butte Resources) | ISL[2] | Dawes, NE | Potential site |
| North Trend | Cameco (Crow Butte Resources) | ISL[2] | Dawes, NE | Potential site—license application under review by NRC |
| Crow Butte | Cameco (Crow Butte Resources) | ISL[3] | Dawes, NE | Operating |
| Dewey Burdock | Powertech Uranium Corp. | ISL[3] | Fall River, SD | Potential site—license application submitted to NRC |
| Edgemont | DOE | Conv. | Fall River, SD | UMTRCA Title II disposal site |
| Dewey Terrace | Powertech Uranium Corp. | ISL[2] | Niobrara, WY | Potential site |
| **Northwestern New Mexico Uranium Milling Region** | | | | |
| Grants Ridge | Uranium Energy Corp. | Heap Leach | Cibola, NM | Potential site |
| Homestake | Homestake Mining Co. | Conv. | Cibola, NM | Decommissioning |
| Bluewater | DOE | Conv. | Cibola, NM | UMTRCA Title II disposal site |
| L-Bar | DOE | Conv. | Cibola, NM | UMTRCA Title II disposal site |
| Marquez | Neutron Energy | Conv. | McKinley, NM | Potential site |
| Mt. Taylor | Rio Grande Resources | Conv. | McKinley, NM | Potential site |
| Roca Honda | Strathmore Minerals Corp. | Conv. | McKinley, NM | Potential site |
| Crownpoint | Hydro Resources, Inc. | ISL[3] | McKinley, NM | Licensed but not operational |
| Ambrosia Lake | Rio Algom | Conv. | McKinley, NM | Decommissioning |
| Churchrock | United Nuclear Corp. | Conv. | McKinley, NM | Decommissioning |
| Section 9 | Mobil Corp. | ISL[1] | McKinley, NM | License terminated |
| Ambrosia Lake | DOE | Conv. | McKinley, NM | UMTRCA Title I disposal site |

| Table 5.2-1. Past, Existing, and Potential Uranium Recovery Sites in Wyoming, South Dakota, Nebraska, and New Mexico* (continued) | | | | |
|---|---|---|---|---|
| Site Name | Company/Owner | Type†† | County, State | Status‡ |
| Northwestern New Mexico Uranium Milling Region (continued) | | | | |
| Shiprock | DOE | Conv. | San Juan, NM | UMTRCA Title I disposal site |

*Information on potential future uranium recovery applications is based on indication from industry summarized in NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 3/11/2009" <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public.pdf> (07 April 2009).
†Type:
1 = Research and Development/Pilot
2 = Satellite
3 = Commercial scale
Conv. = Conventional uranium mill
‡Status: Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I and Title II sites are uranium mill processing or tailings sites that have been decommissioned. The U.S. Department of Energy is the long-term custodian of these sites.

column, consistent with either license applications received by NRC or formal letters of intent to submit license applications sent to NRC by the identified company/owner (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 U.S. Environmental Protection Agency (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 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 four 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 RFFAs, 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.

| 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) |
| October 24, 2008 | South Gillette Area Coal Lease Applications. Draft EIS, Proposal to Lease Four Tracts of Federal Coal Reserves, Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, Wyoming Power River Basin, Campbell County, WY |

| 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) |

| 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** |
| 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) |
| 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) |
| 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) |

| 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** |
| 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) |

For the Wyoming East Uranium Milling Region, Table 5.2-3 includes four 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 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.

| 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<br>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<br>• Sinks Canyon and Boysen State Park and Reservoir (Fremont)<br>• Endess K. Wilkins State Park and Independence Rock State Historical Site (Natrona)<br>• Seminoe SP & Reservoir (Carbon) | <br>LU, WR, E<br>LU, E, HC<br>LU, WR, E |
| National Forest/Grasslands<br>• Shoshone National Forest (Fremont) | <br>LU, WR, E, HC, VS |
| National Wildlife Areas<br>• Pathfinder National Wildlife Refuge (Natrona/Carbon)<br>• Seedskadee National Wildlife Refuge (Sweetwater) | <br>LU, E, HC, VS<br>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, Sheridan, 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, Campbell) | GS, WR, E, AQ |
| 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 |
| • Coal bed natural gas/methane development (Campbell, Carbon, Converse, Fremont, Johnson, Sweetwater, Sheridan) | LU, GS, WR. E. AQ, N. HC, VS, S |
| 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 |
| • Sand and gravel | |

**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*** | |
| Fort Robinson—Nebraska | LU, HC |
| 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

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 obtained from <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 5.3-2. 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 Ranch | Rio Tinto Energy America | Campbell Co. | Surface | 40,000,376 |
| Black Thunder | Thunder Basin Coal | Campbell Co. | Surface | 92,517,728 |
| North Antelope/ Rochelle | Powder River Coal | Campbell Co. Converse Co. | Surface | 88,527,969 |
| Antelope | Rio Tinto Energy America | Campbell Co. Converse Co. | Surface | 33,984,178 |
| 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 |
| *Wyoming Mining Association. "Wyoming Coal Data." 2008. <http://www.wma-minelife.com/coal/coalfrm/coaldat.htm> (16 November 2008). | | | | |

| 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 |

| 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†** |
| ***Traditional Land Uses (continued)*** | |
| 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 |
| 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, Sheridan, 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, Campbell) | GS, WR, E, AQ |
| Coal leasing (Campbell, Converse) | LU, S |

| 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†** |
| ***Mineral Extraction/Energy Development (continued)*** | |
| 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 |
| • Coal Bed natural gas/methane development (Campbell, Carbon, Converse, Fremont, Johnson, Sweetwater, Sheridan) | LU, GS, WR, E, AQ, N, HC, VS, S |
| 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<br>• Bentonite (Weston, Johnson, Natrona)<br>• Sand and Gravel<br>• Scoria | LU, T, GS, WR, E, AQ, N, HC, VS, S, WM |
| ***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 obtained from the following Wyoming website at <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

**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<br>• 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 |

| 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†** |
| ***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, 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)<br>• Thunder Basin National Grasslands (Weston, Campbell, Converse) | LU, WR, E, HC, VS |
| National Parks/Monuments (Wyoming)<br>• Devils Tower, Wyoming (Weston) | LU, WR, E, HC, VS |
| State Parks (South Dakota)<br>• Custer State Park (Custer)<br>• Angostura State Recreation Area (Fall River) | LU, WR, E<br>LU, WR, E |
| National Forest/Grasslands (South Dakota)<br>• Black Hills National Forest (Fall River, Custer, Pennington, Lawrence)<br>• Buffalo Gap National Grassland (Fall River, Custer, Pennington) | LU, WR, E, HC, VS<br>LU, WR, E, HC, VS |
| National Parks/Monuments (South Dakota)<br>• Mt. Rushmore National Memorial (western Pennington)<br>• Jewel Cave National Monument (Custer)<br>• Wind Cave National Park (Custer) | LU, WR, E, HC, VS<br>LU, WR, E, HC, VS<br>LU, WR, E, HC, VS |
| State Parks/Recreation Areas (Nebraska)<br>• Chadron SP (Dawes); within the Nebraska National Forest<br>• Ft. Robinson SP (Sioux, Dawes)<br>• Box Butte Reservoir State Recreation Area (Dawes) | LU, WR, E, HC, VS<br>LU, WR, E, HC, VS<br>LU, WR, E, HC, VS |

| 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†** |
| ***Government Lands and Land Management (continued)*** | |
| 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 |
| 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 |

| 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†** |
| ***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.

reflective of both past and continuing actions; further, the majority of the actions are expected to continue into the future.

### 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, 2009). In addition, each region includes a number of

| 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 |
| ***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 |

**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† |
|---|---|
| ***Government Lands and Land Management (continued)*** | |
| 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<br>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) | |
| 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 |
| 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 |

| 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†** |
| ***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

individual and programmatic present and RFFAs as reflected by recent EISs (Tables 5.2-2 through 5.2-6).

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 F 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 F, a Level 1 analysis is based on consideration of the four scoping steps (Steps 1–4) 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 F), 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.

EPA. "Health and Environmental Impacts of Uranium Contamination in the Navajo Nation: Five Year Plan; as Requested by the House Committee on Oversight and Government Reform." 2008. <http://www.epa.gov/region09/superfund/Navajo-nation/pdf/NN-5-Year-Plan-12.pdf> (25 February 2009).

NRC. "Expected Uranium Recovery Facility Applications / Restarts / Expansions: Updated 04/24/2009." 2009. <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public.pdf> (28 April 2009).

# 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." In drafting the policy statement, 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 addresses environmental justice in environmental impact statements (EISs) and, as appropriate, in supplemental EISs (NRC, 2004; 2003, Appendix C). As discussed in Section 1.8, NRC will use the GEIS to prepare a supplemental EIS for the issuance of a new ISL license. Additionally, NRC may use the GEIS to prepare a site-specific environmental assessment or EIS for applications to renew or amend existing ISL licenses. 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.

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 to consider when evaluating 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 appropriate for the potential impact area. Because ISL facilities may employ both local and outside workers {i.e., workers willing to commute more than 48 km [30 mi] (Section 3.2.10.4)}, 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 ensures consideration of an adequate 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).

**<u>Components of an Environmental Justice Analysis (CEQ, 1997; NRC, 2004)</u>**

*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 potential effects on both 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.

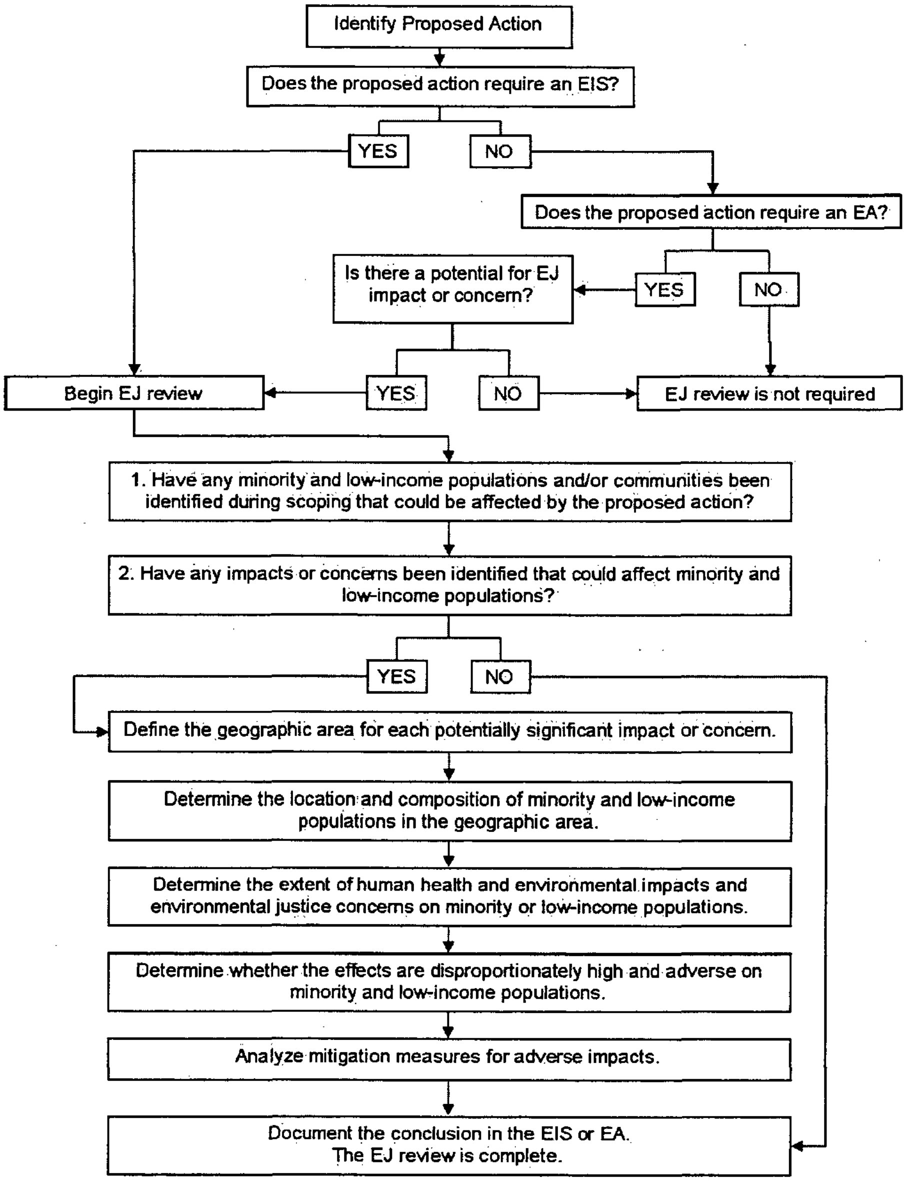



**Figure 6.1-1. Environmental Justice Process Flow Chart**

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 census block group percentage of minority populations and economically stressed households in the area for assessment to the state and county percentages. As general guidance, NRC (2003, Appendix C) notes that differences greater than 20 percentage points may be considered significant and would merit further analysis. Additionally, based on U.S., county, or state date, 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 minority 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). For this GEIS, 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 they 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, 2009).

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 to one of these communities would be about 24 km [15 mi] to the southeast of Arapahoe at Sand Draw.

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 nearest location of past, present, or future uranium milling activity in the 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,

**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).

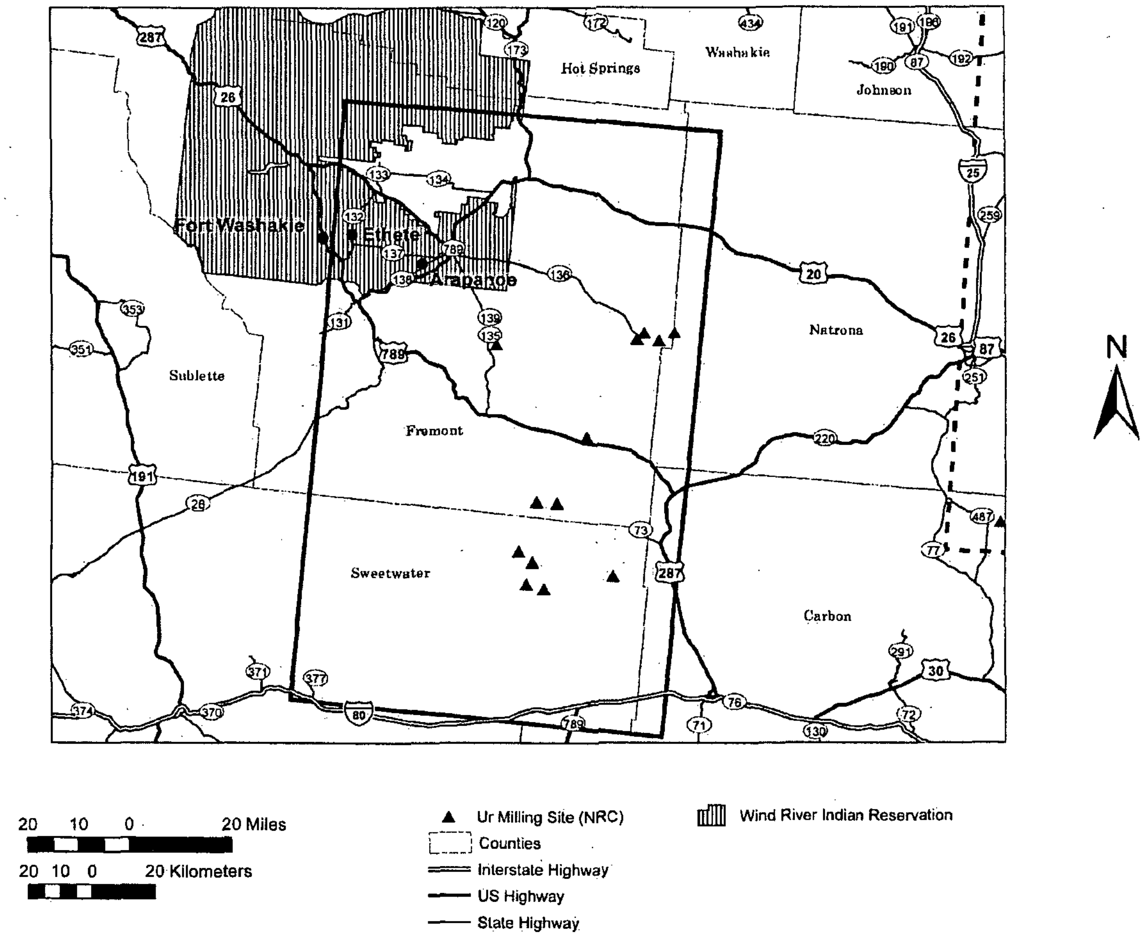



**Figure 6.1-2. Affected Minority and Low-Income Population for the Wyoming West Uranium Milling Region**

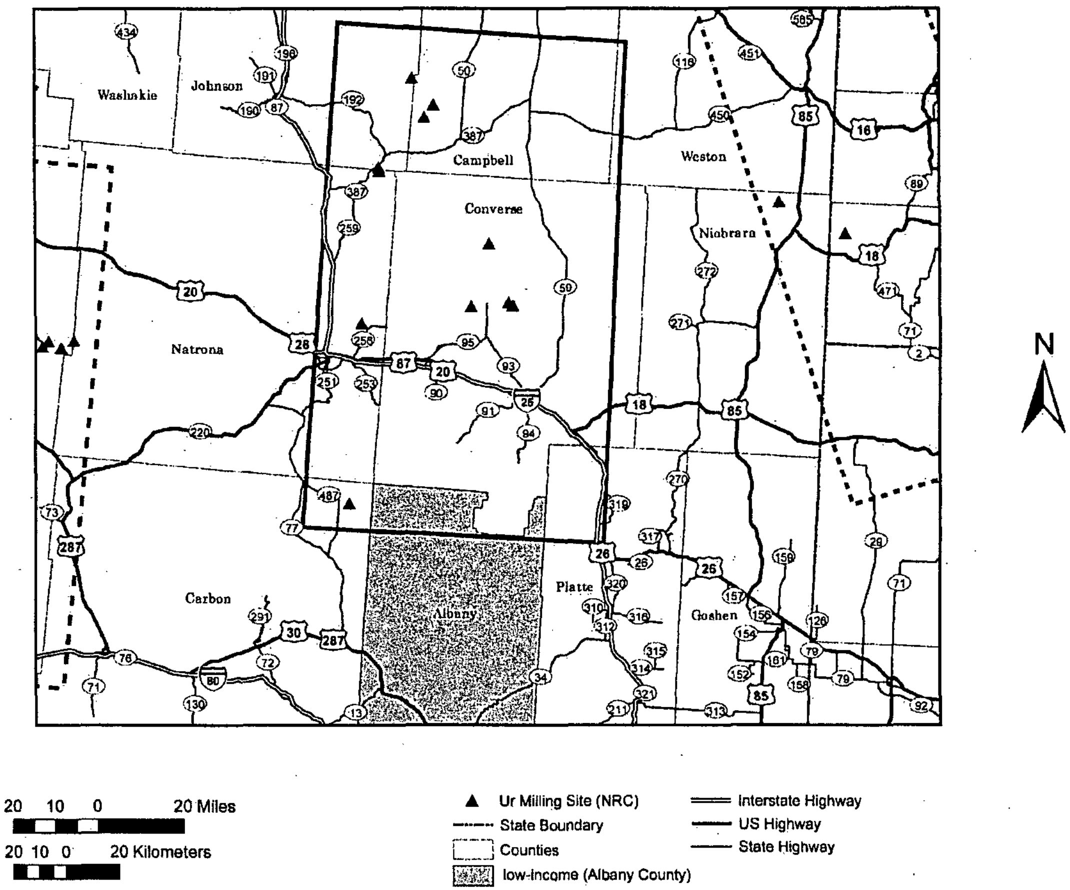



**Figure 6.1-3. Affected Minority and Low-Income Population for the Wyoming East Uranium Milling Region (No Minority Populations Were Identified)**

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

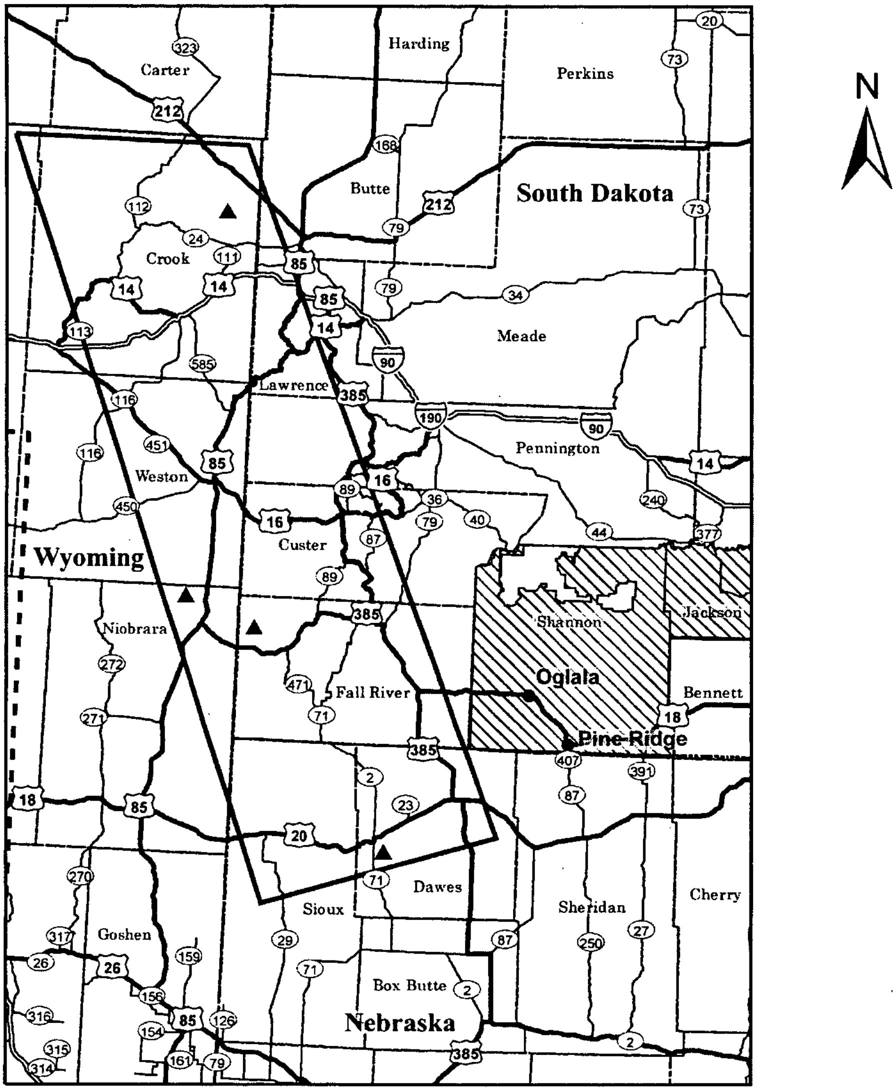
The Navajo Nation represents the largest tribal area and is located approximately 1.6 km [1 mi] from the closest potential ISL facility and 74 km [46 mi] from the farthest known potential ISL facility. A portion of the Navajo Nation lies within McKinley County in the northwestern portion of the Northwestern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

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.




▲ Ur Milling Site (NRC)
State Boundary
Counties
Interstate Highway
US Highway
State Highway

**Federal Lands**

Pine Ridge Indian Reservation

10 5 0 10 Miles

10 5 0 10 Kilometers

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

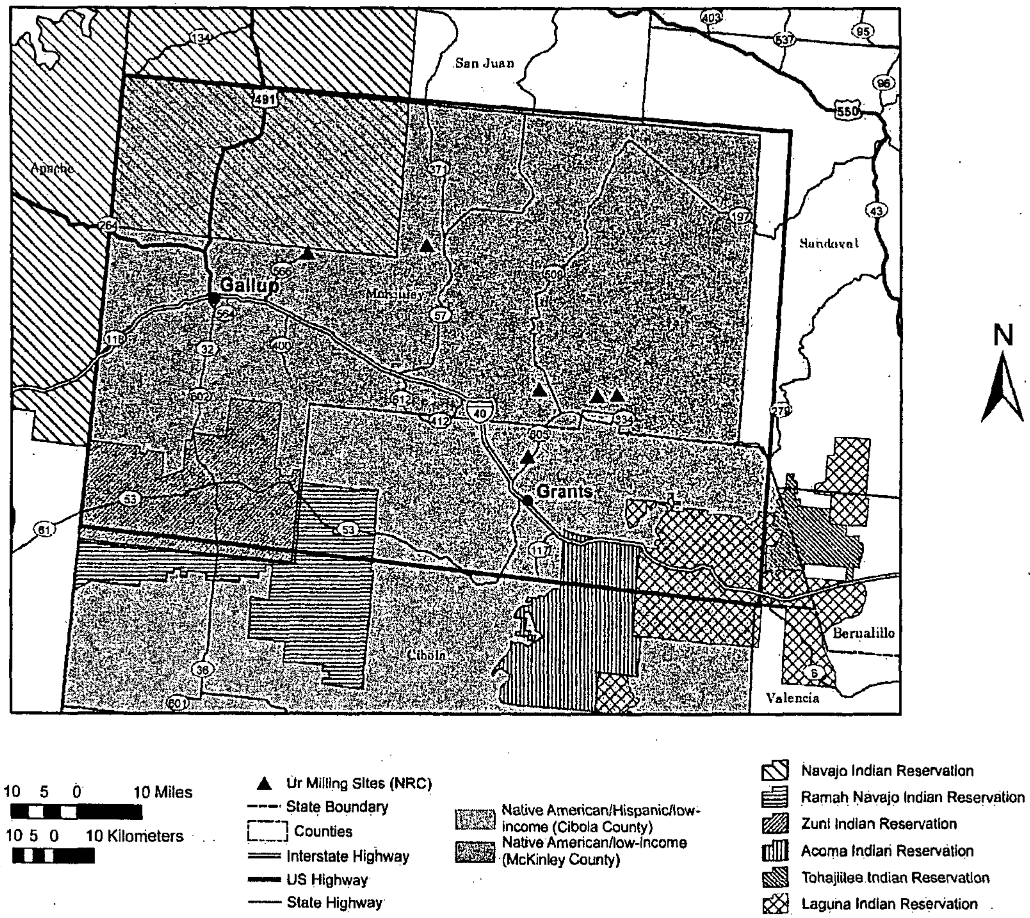



**Figure 6.1-5. Affected Minority and Low-Income Populations for the Northwestern New Mexico Uranium Milling Region**

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 a 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 that 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 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. 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 socioeconomics 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.

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 in 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 in the area of the 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.

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 Mount Taylor Traditional Cultural Property listing on June 14, 2008 (Los Angeles Times, 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 in 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 nonsubsistence 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 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 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 exist 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 notes 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.

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# 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. As part of this oversight, the NRC staff evaluates violations of specific license commitments to determine their impact on safety and the environment. Depending on significance, NRC may levy a written notice of violation and, in certain circumstances, a civil penalty such as a fine. In no case will licensees who cannot achieve and maintain adequate levels of safety be permitted to continue to conduct NRC-licensed activities. Specific aspects of inspection and enforcement of the terms and conditions of an NRC license for an ISL facility can only be addressed at the site-specific levels, and each enforcement action is dependent on the circumstances of the case. In addition, licensees will be subject to requirements and inspections associated with other necessary permits issued by other state and federal agencies for an ISL facility (see Sections 1.6 and 1.7).

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; WDEQ, 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.<br>• Conduct historic and cultural resource surveys prior to land disturbance.<br>• Conduct ecological resource surveys prior to land disturbance.<br>• Reclaim lands disturbed during the construction process.<br>• Decontaminate and decommission facilities.<br>• Reclaim lands disturbed by surface facilities no longer needed.<br>• Plug and abandon wells. |
| Transportation | • Use dedicated tanker trucks for transporting uranium-loaded and barren resins from satellite facilities.<br>• Use accepted industry codes and standards for handling and transporting hazardous chemicals.<br>• Maintain shipping records (bill of lading) to identify nature and quantity of shipped materials.<br>• Conduct surveys of truck exterior and cab prior to each shipment of yellowcake or resin.<br>• Establish an emergency response plan for yellowcake spill and other potential transportation accidents.<br>• Implement safe driving and emergency response training for personnel and truck drivers.<br>• Use check-in/check-out or global positioning satellite technology to track shipments.<br>• 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.<br>• Retain sediment within the disturbed areas by using silt fencing, retention ponds, and hay bales.<br>• 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).<br>• Fill pipeline and cable trenches with excavated rock and soil soon after completion and regrade to surrounding topography.<br>• Reestablish temporary or permanent native vegetation as soon as possible after disturbance.<br>• Construct roads to minimize erosion (e.g., surface 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).<br>• Implement a spill prevention and cleanup plan to minimize soil contamination.<br>• 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.<br>• 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.<br>• Minimize physical changes to drainage channels by building bridges or culverts where roadways would intersect areas of intermittent water flow.<br>• 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.<br>• 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.<br>• Maintain natural contours as much as possible, stabilize slopes, and avoid unnecessary off-road vehicle travel to minimize erosion.<br>• Train employees in the handling, storage, distribution, and use of hazardous materials.<br>• Conduct fueling operations and store hazardous materials and other chemicals in bermed areas with proper set back distances from water bodies.<br>• Provide rapid response cleanup and remediation capability, techniques, procedures, and training for potential spills.<br>• Prepare and implement a Storm Water Pollution Prevention Plan consistent with state and federal standards for construction activities.<br>• Implement a spill prevention and cleanup plan to minimize soil contamination.<br>• 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.<br>• Implement measures to minimize water use during operations.<br>• Minimize surface disturbance, which will minimize changes in surface-water flow and subsequent infiltration.<br>• Implement a spill prevention and cleanup plan to minimize soil contamination.<br>• Provide rapid response cleanup and remediation capability, techniques, procedures, and training for potential spills.<br>• Monitor to detect and define unanticipated surface spills, releases, or similar events that may infiltrate into the groundwater system.<br>• Manage water balance to ensure hydraulic flow into production zone.<br>• Monitoring well pressures to detect leaks.<br>• 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.<br>• Manage pumping and injection to control and recover excursions.<br>• 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.<br>• Use dust suppression measures to minimize wind and other erosion and aid recovery on disturbed areas.<br>• Conduct pre-construction surveys to evaluate important ecological resources and habitats and to determine the reclamation potential of sites.<br>• Implement measures to relocate or avoid sensitive species.<br>• Minimize groundbreaking or land-clearing activities during the critical nesting period for migratory birds.<br>• Collect data to plan to restore disturbed areas and minimize impacts to sensitive habitats before ground-disturbing activities.<br>• Phase construction to the extent practicable.<br>• Limit grading activities to the phase immediately under construction, and limit ground disturbance to areas necessary for project-related construction activities.<br>• Revegetate with appropriate native species to minimize potential for invasive species.<br>• Use weed control as necessary. |
| Air quality | • Reduce fugitive dust emissions using standard dust control measures (e.g., water application, speed limits).<br>• Reduce maximum fugitive dust by coordinating dust-producing activities.<br>• Use fossil-fuel vehicles that meet applicable emission standards.<br>• Reclaim or re-vegetate disturbed areas.<br>• Reduce diesel particulate matter emissions using measures such as particle traps and other technological or operational methods.<br>• Ensure that diesel-powered construction equipment is properly tuned and maintained.<br>• Use ultra-low sulfur diesel fuel.<br>• Use newer, cleaner equipment.<br>• Avoid leaving equipment unnecessarily idling or operating. |
| Noise | • Avoid construction activities at night.<br>• Use sound controls on operating equipment and facilities.<br>• Use personal hearing protection for workers in high noise areas. |
| Historic and cultural resources | • Consult with appropriate state and tribal historic preservation officers.<br>• Ensure that onsite employees complete cultural resource sensitivity and protection training to reduce the potential for intentional or accidental harm to sites or artifacts.<br>• Conduct pre-construction surveys to ensure that work would not affect important archaeological resources.<br>• 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. |

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

| Environmental Resource | Potential Best Management Practices and Management Actions |
|---|---|
| Visual and Scenic | • Use exterior lighting only where needed to accomplish facility tasks.<br>• Limit the height of exterior lighting units.<br>• Use shielded or directional lighting to limit lighting only to areas where it is needed. |
| Socioeconomics | • Purchase materials from local vendors as appropriate.<br>• Hire local employees and contractors. |
| Occupational and public health and safety | • Use ventilation to keep radon levels as low as is reasonably achievable.<br>• Use vacuum dryers, bag filters, and vapor filtration to reduce particulate emissions during yellowcake drying.<br>• Use high-efficiency particulate air filters or similar controls for particulates.<br>• Use personal monitoring devices and respirators as appropriate.<br>• Design task procedures to reduce potential accidents.<br>• 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.<br>• Use decontamination techniques that reduce waste generation.<br>• Institute preventive maintenance and inventory management programs to minimize waste from breakdowns and overstocking.<br>• Recycle nonradioactive materials where appropriate.<br>• Encourage the reuse of materials and use of recycled materials.<br>• Avoid using hazardous materials when possible.<br>• Develop a spill prevention plan for petroleum products and other hazardous materials.<br>• Ensure that equipment is available to respond to spills, and identify the location of such equipment.<br>• Inspect and replace worn or damaged components.<br>• 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.<br>• Incorporate high-performance and sustainable building criteria into the design and construction of nonnuclear facilities. |

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# 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 licensees 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 direct radiation measurements are made and surface waters, groundwater, sediments, soils, and the air are sampled for radionuclides. Licensees must document the sampling and monitoring results and maintain records for a specified period of time. In addition, under 10 CFR 40.65, licensees 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, licensees 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 Direct Radiation Monitoring

Direct radiation or gamma monitoring is needed to establish a baseline external radiation level before ISL operations begin, and thereafter to determine if there has been an increase in external radiation exposure from ISL facility operations. Devices to measure direct radiation levels typically are co-located with air sampling stations, but also need to be located to measure the potential direct radiation exposure to the public (NRC, 1980).

### 8.2.3 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).

### 8.2.4 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.

### 8.2.5 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.

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).

### 8.2.6 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; however, the areal extent of environmental monitoring can go beyond the well field, as needed, based on site-specific conditions. As discussed in NUREG–1569 (NRC, 2003a, Section 2.2.3), the applicant is required, as part of site characterization, to survey and report locations of all privately owned wells within 3.3 km [2 mi] of the permit area and their current uses and production rates to assess potential impacts on these wells due to the ISL operations. Required environmental monitoring programs (NRC, 1980) include routine monitoring of all downgradient public wells that could be used for drinking water, livestock watering, or crop irrigation.

## 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 discussed in Section 8.2 (e.g., sampling of surface water, sediments, soils). 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. 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 Well Field 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 variability, should be collected and analyzed for each listed constituent (NRC, 1997, 1998, 2003).

**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.

### 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 at least every 2 weeks during well field operations to verify that ISL solutions are contained within the operating well field. 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, the operator takes samples every 2 weeks from the 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 into the well field until aquifer cleanup is complete or provide an increase in surety amount agreeable to NRC that would cover the expected full cost of correcting or cleaning up the excursion (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.

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# 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 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 (Endangered Species Act, Section 7), and tribal consultations with appropriate Native American communities. The U.S. Nuclear Regulatory Commission (NRC) consultation process stresses 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 (EIS).

**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 effect 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 does not include Section 106 consultations. The site specific environmental reviews would identify the area of potential effect and list 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 U.S. Fish and Wildlife Service, 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 evaluate 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. Consultation would be initiated with the U.S. Fish and Wildlife Service 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 U.S. Fish and Wildlife Service 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. 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. As discussed in Section 1.8, NRC will use the GEIS to prepare a supplemental EIS for new license applications and a site-specific environmental assessment or EIS for applications to renew or amend existing ISL licenses. As part of the environmental review for new applications, NRC may conduct a scoping process, consistent with its regulations at 10 CFR 51.26(d), 51.28, and 51.29. During the scoping and information gathering process for a site-specific environmental review, the NRC staff typically contacts appropriate state and local agencies for initial, informal discussion about the proposed action and potential impacts. Additionally, NRC will publish the draft supplemental EIS for public comment in accordance with 10 CFR 51.73 and 51.117. Part of the NRC state consultations would include informing affected state governments when these opportunities for involvement are initiated for specific licensing actions. The NRC staff will address state comments received on the draft supplemental EIS prior to making a final licensing decision. For site-specific reviews of license renewal or amendment requests that result in the preparation of an environmental assessment, NRC would submit a copy of the draft environmental assessment 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. NRC would consult with affected tribal governments to consider topics of concern regarding specific ISL proposals, including potentially affected places of cultural significance, land disturbance, health, and groundwater use and restoration. NRC has developed a strategy for outreach to Native American tribes to facilitate an open dialogue with tribes on topics of mutual interest regarding future uranium recovery licensing actions. This strategy is available on the NRC website (NRC, 2000). As discussed in Section 1.8, NRC will use the GEIS to prepare a supplemental EIS for new license applications and a site-specific environmental assessment or EIS for applications to renew or amend existing ISL licenses. As part of the environmental review for new applications, NRC may conduct a scoping process, consistent with its regulations at 10 CFR 51.26(d), 51.28, and 51.29. Additionally, NRC will publish the draft supplemental EIS for public comment in accordance with 10 CFR 51.73 and 51.117. Part of the NRC tribal consultations would include informing affected tribal governments when these opportunities for involvement are initiated for specific licensing actions. The NRC staff will address public comments received on the draft supplemental EIS prior to making a final licensing decision. For site-specific review of license renewal or amendment requests that result in the preparation of an environmental assessment, NRC would submit a copy of the draft environmental assessment 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. Department of the Interior, 2008). These consultations for site-specific environmental reviews would take into account topics identified by NRC and the tribal agencies (e.g., Navajo Nation Environmental Protection Agency).

**Reference**

U.S. Department of the Interior. "Health and Environmental Impacts of Uranium Contamination in the Navajo Nation: Five-Year Plan." Washington, DC: U.S. Department of the Interior, Bureau of Indian Affairs. 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 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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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. 15 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 are likely—SMALL.<br><br>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.<br><br>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.<br><br>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 wetlands. Temporary changes to spring and stream flows from grading and changes in topography and natural drainage patterns could be mitigated through best management practices, 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.<br><br>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. Because the aquifers containing uranium ore-bodies would have a weak, if any, connection to local surface water features, such as streams and springs, the impacts of excess net groundwater extraction from local surface water bodies would be SMALL to MODERATE, depending on site-specific characteristics.<br><br>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.<br><br>DECOMMISSIONING—Impacts 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 surface waters—SMALL. |

| 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.<br><br>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. Impacts associated with 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.<br><br>AQUIFER RESTORATION—Potential impacts include 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 used at the facility. Groundwater Consumptive use during aquifer restoration could be greater than during ISL operation, if groundwater sweep is implemented during aquifer restoration in which pumped water is not recirculated. 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 MODERATE, depending on site-specific conditions.<br><br>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 and 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.<br><br>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, would limit impacts. Temporary contamination or alteration of soils would be from operational leaks and spills and possiblly 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 timing stipulations would reduce overall impacts—SMALL.<br><br>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, and netting 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 timing stipulations would reduce overall impacts—SMALL.<br><br>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 are 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.<br><br>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.<br><br>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.<br><br>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 could occur in addition to potential habitat loss. 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 assist in identifying potential impacts—SMALL to LARGE—depending on site-specific habitat and presence of threatened or endangered species.<br><br>OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats could occur, in addition to potential habitat loss. 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 LARGE—depending on site-specific habitat and presence of threatened or endangered species.<br><br>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.<br><br>DECOMMISSIONING—Impacts resulting from individual takes could 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 are 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.<br><br>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 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 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.<br><br>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.<br><br>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 be 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 effect on wildlife habitat and their reproductive success in the 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 levels. Wildlife generally avoid construction noise areas. The two uranium districts within the Wyoming West Uranium Milling Region are generally more than 16 km [10 mi] from the closest community—SMALL to MODERATE.<br><br>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 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 be 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 generally more than 16 km [10 mi] from the closest community—SMALL.<br><br>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 that 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 two uranium districts within the Wyoming West Uranium Milling Region are generally more than 16 km [10 mi] from the closest community—SMALL to MODERATE.<br><br>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 be 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 generally more than 16 km [10 mi] from the closest community—SMALL. |

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

| 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) 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 occur during the site-specific licensing application and review process. Consultations 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 process. 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.<br><br>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.<br><br>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.<br><br>DECOMMISSIONING—Because less land disturbance occurs during the decommissioning phase, and because decommissioning and reclamation activities would focuse 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)**

| Topic/ Resource | GEIS Section | Impact Findings |
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| 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 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 16 km [10 mi] from the closest VRM Class II area, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL.<br><br>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 16 km [10 mi] from the closest VRM Class II area, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL.<br><br>AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as, or less than, during operations—SMALL.<br><br>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 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) | | |
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| 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.<br><br>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 after 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 Jeffrey City and Bairoil.<br><br>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 after 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.<br><br>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 Jeffrey City and Bairoil. |

| Table 10-1. Summary of Impacts for the Wyoming West Uranium Milling Region (continued) | | |
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| **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 would be of short duration and are readily dispersed into the atmosphere—SMALL.<br><br>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 which 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.) Nonradiological 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 nonradiological 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.<br><br>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 reduction 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.<br><br>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 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.<br><br>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 low—SMALL.<br><br>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 low—SMALL.<br><br>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 to NRC review. This plan would detail 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 comply with applicable safety regulations. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be small—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.<br><br>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.<br><br>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.<br><br>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) | | |
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| **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.<br><br>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.<br><br>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.<br><br>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 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued) | | |
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| **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. 15 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.<br><br>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.<br><br>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.<br><br>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) | | |
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| 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. The average annual surface runoff is similar to or slightly less than that in the Wyoming West Uranium Milling Region. As a result, runoff-related impacts will be similar. 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 wetlands. Temporary changes to spring and stream flows from grading, changes in topography, and natural drainage patterns would be mitigated through best management practices, and 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 be SMALL, temporary, and localized to a few feet around boreholes—SMALL, depending on site-specific characteristics<br><br>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. Because the aquifers containing uranium ore-bodies would have a weak, if any, connection to local surface water features, such as streams and springs, the impacts of excess net groundwater extraction from local surface water bodies would be SMALL.<br><br>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.<br><br>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. |

| Table 10-2. Summary of Impacts for the Wyoming East Uranium Milling Region (continued) | | |
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| 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.<br><br>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 not be returned to the aquifer (e.g., process bleed). The 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 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. Impacts associated with 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.<br><br>AQUIFER RESTORATION—Potential impacts include 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. Groundwater consumptive use during aquifer restoration could be greater than during ISL operation, if groundwater sweep is implemented during aquifer restoration in which pumped water is not recirculated. 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 MODERATE, depending on site-specific conditions.<br><br>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 and 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 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.<br><br>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, and netting 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, would limit the magnitude of overall impacts to terrestrial ecology. Mitigation measures such as perimeter fencing, netting, alternative sites, and timing stipulations would reduce overall impacts—SMALL.<br><br>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, and netting 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 timing stipulations would reduce overall impacts—SMALL.<br><br>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 are 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.<br><br>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.<br><br>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.<br><br>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) | | |
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| **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 could occur, in addition to potential habitat loss. 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 assist in identifying potential impacts—SMALL to LARGE—depending on site-specific habitat and presence of threatened or endangered species.<br><br>OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur, in addition to potential habitat loss. 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.<br><br>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.<br><br>DECOMMISSIONING—Impacts resulting from individual takes could 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 10-2. 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 are 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.<br><br>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 condition, or mitigation measures to reduce impacts—SMALL.<br><br>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.<br><br>DECOMMISSIONING—Fugitive dust and combustion (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 be 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 the 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, generally 16 km [10 mi] from the closest communities—SMALL to MODERATE.<br><br>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 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 be 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, generally 16 km [10 mi] from the closest communities—SMALL to MODERATE.<br><br>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; 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, generally 16 km [10 mi] from the closest communities—SMALL to MODERATE.<br><br>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 be 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, generally 16 km [10 mi] from the closest communities—SMALL to MODERATE. |

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 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 process. 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.<br><br>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.<br><br>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.<br><br>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. |

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

| 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 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 visible from more than about 1 km [0.6 mi]. The uranium districts in the region are located more than 8 km [5 mi] from the closest VRM Class II area, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV—SMALL.<br><br>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 three uranium districts in the region are located more than 8 km [5 mi] from the closest VRM Class II area, and the visual impacts associated with ISL construction would be expected to be consistent with the predominant VRM Class III and IV—SMALL.<br><br>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.<br><br>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 would be 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 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 10-2. 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.<br><br>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 after 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.<br><br>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 after 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.<br><br>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 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.<br><br>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 which 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.) Nonradiological 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 nonradiological 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.<br><br>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 reduction 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.<br><br>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 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.<br><br>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 low—SMALL.<br><br>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 low—SMALL.<br><br>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 to comply with 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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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. 15 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.<br><br>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.<br><br>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.<br><br>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 the same or lower surface runoff (areal flow) than the Wyoming West Uranium Milling Region, and for that reason, runoff-related impacts will be similar or lower. 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 wetlands. Temporary changes to spring and stream flows from grading and changes in topography and natural drainage patterns could be mitigated through best management practices, 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.<br><br>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 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. Because the aquifers containing uranium ore-bodies would have a weak, if any, connection to local surface water features, such as streams and springs, the impacts of excess net groundwater extraction from local surface water bodies would be SMALL —SMALL to MODERATE depending on site-specific characteristics.<br><br>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.<br><br>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 mitigated by use of best management practices—SMALL.<br><br>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). The amount of water lost could 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. Impacts associated with 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—SMALL to LARGE, depending on site-specific conditions.<br><br>AQUIFER RESTORATION—Potential impacts include 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. Groundwater Consumptive use during aquifer restoration could be greater than during ISL operation, if groundwater sweep is implemented during aquifer restoration in which pumped water is not recirculated. 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 MODERATE depending on site-specific conditions.<br><br>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 and 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 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 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.<br><br>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 and netting 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 timing stipulations would reduce overall impacts—SMALL.<br><br>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, and netting 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 timing stipulations would reduce overall impacts—SMALL.<br><br>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 are reestablished—SMALL. |

| Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued) | | |
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| **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.<br><br>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.<br><br>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.<br><br>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 could occur in addition to potential habitat loss. 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 assist in identifying potential impacts—SMALL to LARGE—depending on site-specific habitat and presence of threatened or endangered species.<br><br>OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats would occur in addition to potential habitat loss. 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—depending on site-specific habitat and presence of threatened or endangered species.<br><br>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.<br><br>DECOMMISSIONING—Impacts resulting from individual takes could 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 recontoured. 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 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued) | | |
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| **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 are 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.<br><br>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 reduce particulate emissions from operations and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program ensures 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 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.<br><br>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.<br><br>DECOMMISSIONING—Fugitive dust and combustion (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) | | |
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| **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 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 be 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 the 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 levels. Wildlife generally avoid construction noise areas. 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 to MODERATE.<br><br>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 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 be 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 generally more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.<br><br>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; however, relative increases to existing traffic levels from commuting may be more significant for lightly traveled rural roads through smaller communities. There are additional sensitive areas that should be considered within this region, but because of decreasing noise levels with distance, aquifer restoration 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 generally more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.<br><br>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 be 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 occur during the site-specific licensing application and review process. Consultations 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 process. 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.<br><br>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.<br><br>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.<br><br>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. |

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 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 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 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 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.<br><br>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.<br><br>AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as, or less than, during operations—SMALL.<br><br>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 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 these 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 10-3. 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 small relative size and temporary nature 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.<br><br>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 after 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 smaller communities such as Oglala, Pine Ridge, and Sioux City.<br><br>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 after 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.<br><br>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.<br><br>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.) Nonradiological 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 nonradiological 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.<br><br>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 reduction 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.<br><br>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 would comply with applicable safety regulations—SMALL. |

| Table 10-3. Summary of Impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region (continued) | | |
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| **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.<br><br>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 low—SMALL.<br><br>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 low—SMALL.<br><br>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, to ensure safety of workers and the public and to comply with applicable safety regulations would be complied with. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be small—SMALL. |

| Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region | | |
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| **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 the 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.<br><br>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.<br><br>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.<br><br>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) | | |
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| 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.<br><br>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.<br><br>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.<br><br>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) | | |
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| **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. 15 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 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.<br><br>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.<br><br>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.<br><br>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 |
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| 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 wetlands. Temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated through best management practices, 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.<br><br>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. Because the aquifers containing uranium ore-bodies would have a weak, if any, connection to local surface water features, such as streams and springs, the impacts of excess net groundwater extraction from local surface water bodies would be SMALL.<br><br>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.<br><br>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. |

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

| Topic/ Resource | GEIS Section | Impact Findings |
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| 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.<br><br>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 be small 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 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 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. Impacts associated with 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 New Mexico—SMALL to LARGE, depending on site-specific conditions.<br><br>AQUIFER RESTORATION—Potential impacts include 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. Groundwater Consumptive use during aquifer restoration could be greater than during ISL operation, if groundwater sweep is implemented during aquifer restoration in which pumped water is not recirculated. 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 MODEDERATE, depending on site-specific conditions.<br><br>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) | | |
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| **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 and 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. Temporary displacement of animal species would be possible. Critical wintering habitats vital for the 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 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 affected.<br><br>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 and netting 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 timing stipulations would reduce overall impacts—SMALL.<br><br>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 and netting 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, and alternative sites, and timing stipulations would reduce overall impacts—SMALL.<br><br>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 recontouring would restore habitat altered during construction and operations. Wildlife would be temporarily displaced, but are anticipated to return after decommissioning and reclamation are completed and vegetation and habitat are reestablished—SMALL to MODERATE. |

| Table 10-4. Summary of Impacts for the Northwestern New Mexico Uranium Milling Region (continued) | | |
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| **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 best management practices—SMALL.<br><br>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.<br><br>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.<br><br>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) | | |
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| **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 could occur in addition to potential habitat loss. 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 LARGE—depending on site-specific habitat and presence of threatened or endangered species.<br><br>OPERATION—Impacts could result from individual takes due to conflicts with operations. Small fragmentation of habitats could occur in addition to potential habitat loss. 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.<br><br>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.<br><br>DECOMMISSIONING—Impacts resulting from individual takes could 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 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 recontouring, habitat would be reestablished and impacts would, therefore, be limited—SMALL to LARGE. |

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 are 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.<br><br>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 reduce particulate emissions from operations and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program ensures 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.<br><br>AQUIFER RESTORATION—Because the same 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.<br><br>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 be 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 the 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 levels. Wildlife generally avoid construction noise areas. The uranium districts within the Northwestern New Mexico Uranium Milling Region are generally more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.<br><br>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 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 be 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 generally more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.<br><br>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 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 uranium districts within the Northwestern New Mexico Uranium Milling Region are generally more than 300 m [1,000 ft] from the closest community—SMALL to MODERATE.<br><br>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 be 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 generally 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 Mount 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 (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 TSPs also occurs during the site-specific licensing application and review process. Consultations to determine whether significant cultural resources would be avoided or mitigated occurs during consulting with the State Historic Preservation Office, other governmental agencies, and Native American Tribes, including Tribal Historic Preservation Offices (THPOs) as part of 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.<br><br>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.<br><br>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.<br><br>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. |

**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 Mount 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 Mount 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 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 Mount Taylor. 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 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.<br><br>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 ISL facilities in the region are located more than 8 km [5 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.<br><br>AQUIFER RESTORATION—Because aquifer restoration activities use the same infrastructure, potential visual impacts would be the same as, or less than, during operations—SMALL.<br><br>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 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 these 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, however, 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 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 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.<br><br>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 after 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.<br><br>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 after 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.<br><br>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 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 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 |
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| 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.<br><br>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.) Nonradiological 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 nonradiological 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.<br><br>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 reduction 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.<br><br>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 comply with 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.<br><br>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 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 low—SMALL.<br><br>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 low—SMALL.<br><br>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 to ensure safety of workers and the public and to comply with applicable safety regulations would be complied with. Overall, volumes of decommissioning radioactive, chemical, and solid wastes would be small—SMALL. |

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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 protection under the Safe Drinking Water Act for an aquifer, or a portion of an aquifer, that meets the criteria for an underground source of drinking water, has been waived by the EPA based on applicable underground injection control regulations at 40 CFR 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

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 exempted 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 the full definition at 10 CFR Part 40.4. *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 there 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 typically 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 is discharged 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 percent of the Earth's crust.

**Flare**—The undetected spread of recovery solutions between the well field and monitoring wells of the production zone. Flare is also a proportionality 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 of 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**—A leachate solution composed of native groundwater and chemicals (such as sodium carbonate/bicarbonate, ammonia, or sulfuric acid) added by the ISL facility operator. In the ISL process, the lixiviant is pumped underground for the purpose of mobilizing (dissolving) uranium from a uranium ore body.

**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)$_{2-3}$(Al, Si)$_4$O$_{10}$(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.

**Redox**—A term commonly used to refer to the oxidation-reduction potential of a chemical system.

**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 each constituent in the affected groundwater to its NRC-approved baseline concentration or to an alternate standard approved by NRC.

**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, or any combination thereof, in any physical or chemical form or ores which contain by weight one-twentieth of one percent (0.05%) or more of: uranium, thorium, or any combination thereof. Source material does not include special nuclear material.

**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**—The product of the uranium extraction (milling) process that is mixture of uranium oxides that can vary in proportion and in color from yellow to orange to dark green (blackish) depending at which temperature the material was dried.

# 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/uranium-recovery/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.

Ground Water Protection Requirements and Guidance: 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).

Restoration Goal: 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 is to evaluate in a GEIS the potential impacts of 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 nonradiological 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 nonradiological (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 MINING OR 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 MINING OR MILLING PAST OR PRESENT

A number of commenters addressed conventional uranium mining and milling topics. These topics included (1) the GEIS on conventional milling (NRC,1980), (2) the legacy of past conventional mining or 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 mining and milling will not be addressed in the GEIS. The legacy of past conventional uranium mining and 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 MINING OR 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 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | | | | | | | | |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | | | | | |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

## 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 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 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Geoffrey Fettus and Christopher E. Paine, Natural Resources Defense Council | X | X | X | X | X | X | | | X | X | X | X | X | X | | | X | X | X | X | X | X | X | X |
| 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 | | | | | | | | | | | | | |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tami Rund | | | | | | X | | | | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | | |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mel Langdon | X | | X | | | | | | | | | | | | | | | | | | | X | | |
| 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 |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Perry H. Rahn | | | | | | X | | | | | X | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | | | | | | | | |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nancy Seewald | | | X | | | | | | | | | | | | | | | | | | | | | |
| 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 |
| Casper, Wyoming Scoping Meeting | | | | | | | | | | | | | | | | | | | | | | | | |

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | |
| Bill Kunerth | | | | | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | | | | | | | |
| Jerry Slim, Eastern Navajo Allottee Association | X | | | | | | | | | | | X | | | | | | | | | | | | X |
| Mel Stairs, Independent Miner | | | | | | | | | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| Steve Cabaniss | | | | | | X | | | | | | | | | | | | | | | | | X | |
| Paul Frye, Navajo Nation Attorney General's Office | X | | | X | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| George Byers, Neutron Energy Inc. | | | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | | | | | | | | | | | | |
| Michael Daly, McKinley County Water Board | | | | | | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 International | 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)**

| | | | |
|---|---|---|---|
| Rocco Peter | 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

# B1 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 Act 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 areas 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. These regulations implement the Uranium Mill Tailings Radiation Control Act (UMTRCA) and require protection and restoration of groundwater. 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.

# APPENDIX C

# SUMMARY OF CONVENTIONAL URANIUM MILLING TECHNOLOGIES

# C1 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]. Conventional mills 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. However, unlike ISL uranium processing, additional steps are necessary to prepare the solid uranium ore for recovery and to 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

The ore handling and preparation stages 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

The mill concentration 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

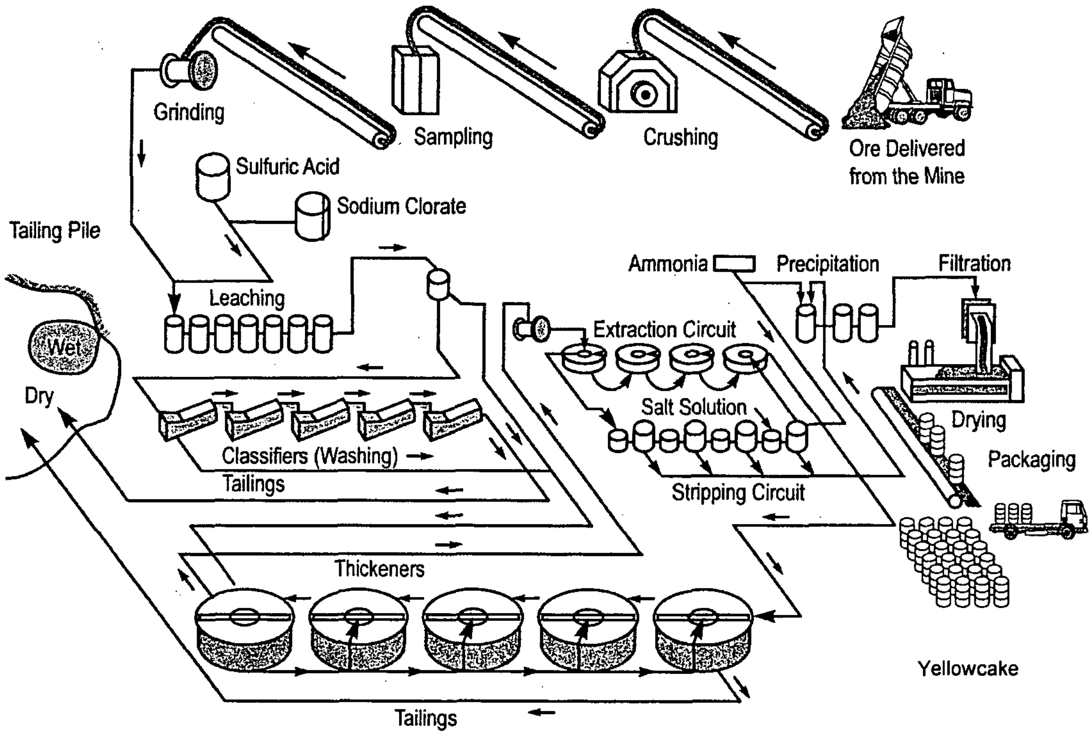


**Figure C1.1–1. Schematic of a Conventional Uranium Milling Operation (Energy Information Administration, 1995)**

series. Following the first-stage leach, the slurry is transferred to the decant thickener. The decanted liquid from the thickener is enriched in dissolved uranium and is pumped to the solvent recovery unit for further concentration. The solids from the thickener are pumped to a series of tanks for a second leaching stage and further uranium recovery using sulfuric acid with an oxidant. Each tank in the second stage is agitated to keep the sand grains in suspension. The output from the second leach stage is a slurry of solids and sulfuric acid solution with dissolved uranium.

The slurry is transferred to the first of a series of countercurrent decantation tanks for washing and thickening. This countercurrent flow of liquid and solids washes the residual dissolved uranium compounds from the solids. The uranium-rich acid solution decanted from the countercurrent decantation is transferred to a clarifier, filtered, and pumped to the solvent recovery circuit. Settled and filtered solids are recycled to the second stage leach circuit for additional uranium recovery.

The purpose of the solvent recovery circuit is to concentrate and purify uranium. First, the uranium acid solution is mixed with an organic solvent that is preferentially selective for uranium. The organic solvent and acid solution are then allowed to settle and separate. After going through a series of mixing and settling tanks, almost all of the uranium is removed from the acid solution.

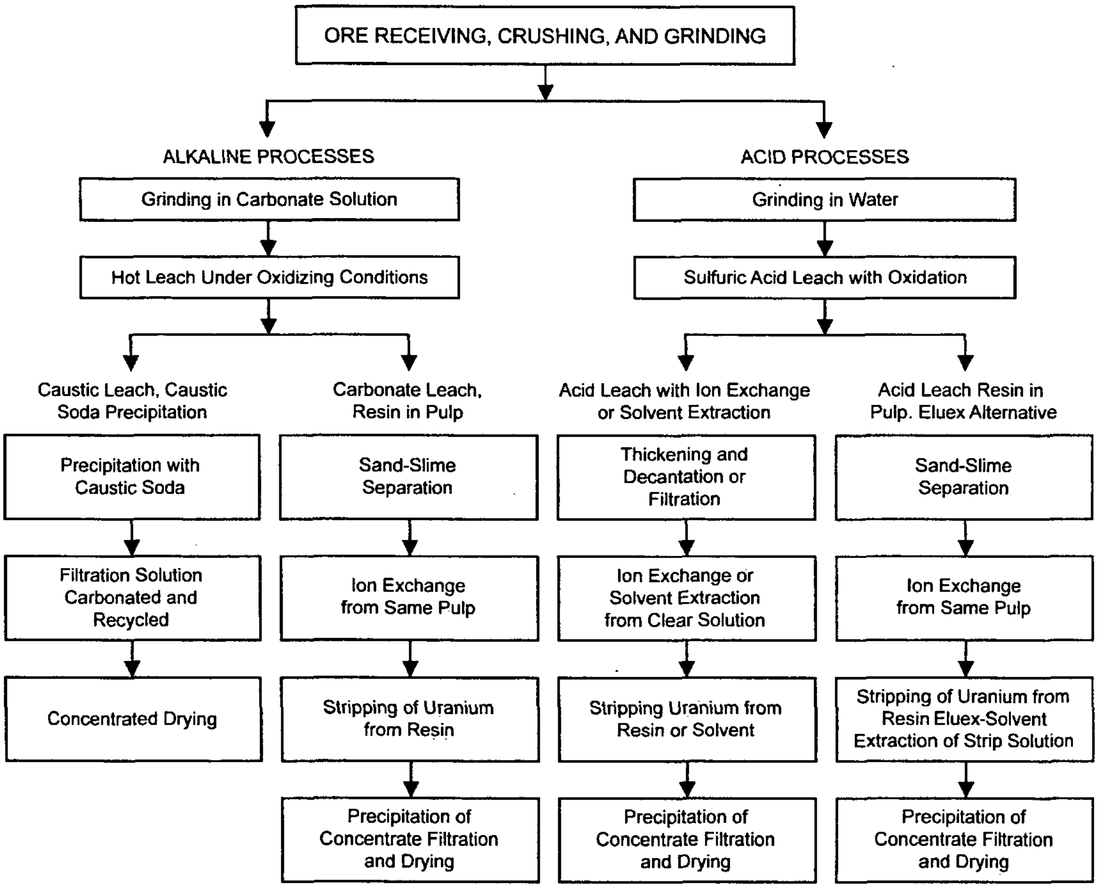


**Figure C1.1.–2. Flow Diagram of the Conventional Uranium Milling Process (Energy Information Administration, 1995)**

The uranium-rich organic solvent is washed with acidified water and stripped of its uranium content by mixing it in a series of mixer/settling tanks with an aqueous solution such as ammonium sulfate or sodium chloride [Denison Mines (USA) Corporation, 2007; Plateau Resources, Ltd., 2006]. After stripping, the now barren organic solvent is recycled back into the solvent recovery circuit. The uranium-rich (pregnant) solution then goes to the final stage for purification, precipitation, drying, and packaging.

## C1.1.3 Product Recovery

Product recovery is the final step in the milling process, where the product is recovered from solution by filtration, purification, and chemical precipitation, followed by drying and packaging of the yellowcake for shipment. This stage is similar to the ISL processing. The uranium-rich solution from the solvent recovery circuit and stripping process is treated chemically to induce uranium precipitation. The precipitated yellowcake is allowed to settle and thicken before filtration and drying. The precipitate is then washed, dried, and packaged as described in Section 2.4.

### C1.1.4 Tailings Management

Conventional milling techniques recover about 90 percent of the uranium content of the feed ore. Unlike ISL milling, each stage of the conventional milling process produces solid, liquid, and gaseous waste streams that require disposal. These wastes can be either radioactive or nonradioactive, depending on the specific process controls used for a facility. Typically, these waste streams are transferred to tailings piles and tailings ponds for disposal (Figure C1.1–3). Tailings represent the bulk of the wastes originating from the uranium mill, and with the exception of the recovered uranium and process losses, account for practically all of the ore solids and the process additives, including water (NRC, 1980, Appendix B). When discharged from the operating mill, the tailings will consist of a mixture of solids and solutions that vary in chemical and physical compositions, depending on the nature of the ore and the process used. The typical components of tailings include tailings sand, fine solids (called slimes), liquids composed of chemical solutions and dissolved ore solids, and water.

As part of the uranium mill licensing process, NRC reviews the design and construction details associated with the applicant or licensee-proposed tailings retention system to ensure safe disposal of tailings. The design review can include features such as geotechnical stability, surface water hydrology and erosion protection, groundwater protection (liners and monitoring), and radiation protection (radon caps) (NRC, 2003). Surety estimates for aquifer restoration, decommissioning, and reclamation activities are conducted similarly to those described in Section 2.10 of the Generic Environmental Impact Statement (GEIS), although the scope of the effort will vary depending on the size of the conventional milling facility and the presence or absence of contamination at the end of operations.

## C2 HEAP LEACH METHOD

Like conventional milling operations, the heap leaching process is a way of extracting uranium from uranium ore. Ore is either mined at the location or trucked into the site. The uranium ore

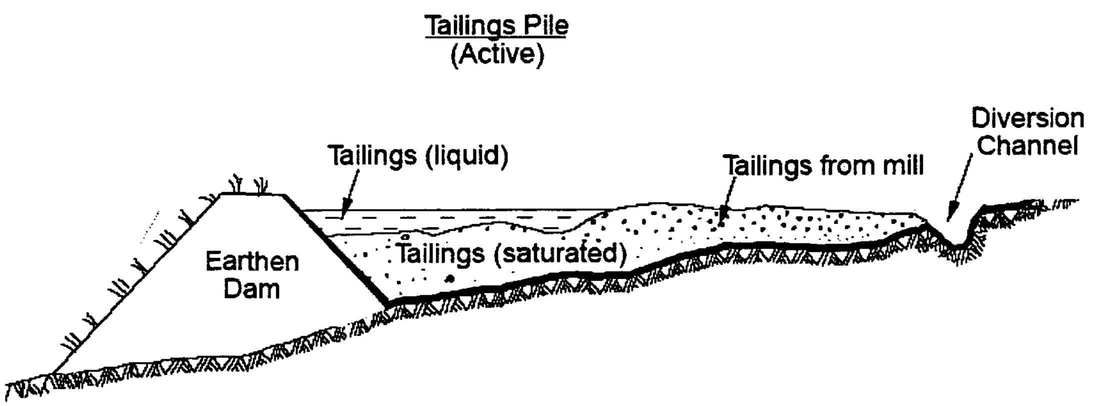


**Figure C1.1–3. Schematic Cross Section of an Active Tailings Pile and Tailings Pond (Energy Information Administration, 1995)**

is sized and stacked on a graded site in a series of lifts using heavy equipment. Leaching solutions (typically sulfuric acid) are applied to the top of the pile and percolate through the ore pile, dissolving uranium as they move. The uranium-rich solutions are collected at the bottom of the ore pile, typically by a series of perforated plastic pipes buried in a gravel layer underneath the pile. Heap leach technology has largely been developed for gold and copper mining, but many of the same features are relevant to uranium recovery.

The heap leach site is typically lined with a clay liner or geomembrane to prevent ore constituents (uranium plus other metals) from infiltrating the groundwater (Figure C2.1–1). The operator determines the type and size of the leach pad based in part on the economics of producing the uranium ore, the nature of the ore, geotechnical stability issues, site topography, and reclamation costs (Chadwick, 2007). Brief descriptions of types of leach pads follow:

- Conventional or flat pads are relatively flat, either graded smooth or terrain contoured on gentle alluvial fans. Ore is generally stacked in thin lifts, on the order of 5–10 m [16–33 ft] thick.

- Dump leach pads are similar to flat pads or can include slightly more rugged terrain. The term “dump” usually means that the ore is stacked in much thicker lifts, perhaps as much as 50 m [164 ft].

- Valley fills are used in rugged and steep topography. These heap leach pads are designed to fill in natural valleys using either a buttress dam at the bottom of the valley or a leveling fill within the valley. These can be very large pads, depending on the local topography and the size of the ore deposit.

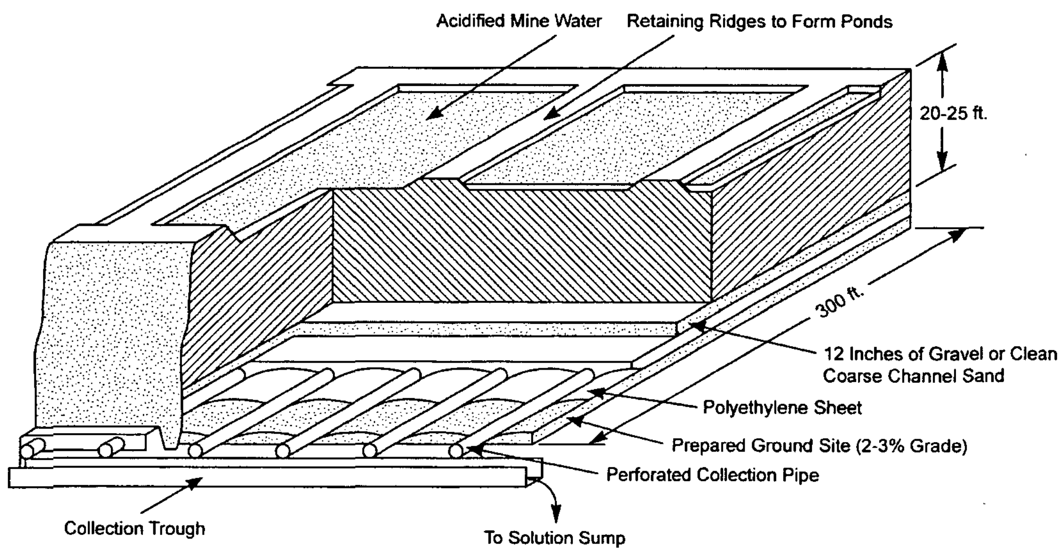


**Figure C2.1–1. Schematic Diagram of Typical Heap Leach Pile (NRC, 1980)
[1 ft = 0.3048 m; 1 in = 0.39 cm]**

- On/off pads are hybrid heap leach systems. A relatively flat pad is built using a robust liner and overliner system. Then, a single lift of ore from 4 m to 10 m [13 to 33 ft] thick is loaded and leached. At the end of the leach cycle the spent ore is removed for disposal, fresh ore is restacked on the pad, and the cycle is repeated.

The top of the heap leach pile is typically graded and divided into sections to induce leach solution ponding. A pile is abandoned when the uranium recovery no longer justifies the expense of pumping leaching solution through it or when a specified low limit of solution grade is reached. Collected enriched solutions can be processed at the leaching site by ion exchange or solvent recovery and precipitated by chemical processing. The final precipitated slurry product is then trucked to a processing facility.

Heap leaching is usually used to treat low-grade ores or when the ore body is small and situated far from the milling facilities. Haulage costs dictate the choice of heap leaching at sites far from the milling plant because the shipment of a high-grade pregnant solution or a crude bulk precipitate from a point near the mine site is cheaper than hauling low grade ore to the mill (NRC, 1980; Beahm, 2007). In cases where the heap leach pile is located reasonably near a mill, acid solutions from the mill circuit are commonly used for the heap leach operation, with the enriched solutions returned to the mill circuit for processing. Heap leaching for uranium recovery was used on an experimental basis in the United States in the 1970s and 1980s, but the process is not in use at a commercial scale today (EPA, 2007).

Tailings from a heap leach process are handled in the same manner as tailings from a conventional uranium mill process (see Section C1.1.4). This includes the design and construction of a tailings retention system to address issues such as geotechnical stability, surface water hydrology and erosion protection, groundwater protection, and radiation protection. Surety estimates for aquifer restoration, decommissioning, and reclamation activities are conducted similarly to those described in GEIS Section 2.10, although the scope of the effort will vary depending on the size of the heap leach facility and the presence or absence of contamination at the end of operations.

## C3 PREVIOUS ENVIRONMENTAL REVIEWS OF CONVENTIONAL MILLING AND HEAP LEACH TECHNOLOGIES

NRC, its predecessor agency (the Atomic Energy Commission), and Agreement States have licensed both conventional uranium milling and uranium heap leach operations (White, 1984). Additionally, a number of these facilities have ceased operations and have been or are in the process of being decommissioned. In support of its licensing decisions regarding facility operation and decommissioning, NRC has conducted safety and environmental reviews. Under the Agreement State program, NRC also has a concurrence role in an Agreement State's approval ensuring that the final decommissioning and reclamation of a licensed conventional mill or heap leach tailings site complies with all applicable standards. Finally, because reclaimed conventional mill and heap leach tailings sites are eventually transferred for long-term control to either the federal government (presently the U.S. Department of Energy) or to the state in which the sites are located (at the option of the state), NRC reviews and accepts a long-term surveillance plan for each tailings site prior to placing the site under a general license at 10 CFR 40.28.

References to a sample of review documents prepared by NRC, Agreement States, and the U.S. Department of Energy are provided in Table C3-1. These documents provide discussion of the types of environmental impacts associated with conventional milling and heap leach methods. Additional information concerning environmental impacts associated with conventional milling can be obtained using the information in Table 5.2-1.

**Table C3-1. References to Previous Discussions of Environmental Impacts Associated with Conventional Uranium Milling and/or Uranium Heap Leach Technologies**

| Title | Reference | Notes |
|---|---|---|
| Final Generic Environmental Impact Statement on Uranium Milling Project M-25 | NRC, 1980 | Addresses environmental impacts of the conventional milling process in support of a rulemaking to 10 CFR Part 40 |
| Final Environmental Statement Related to Operation of Shootaring Canyon Uranium Project, Plateau Resources, Ltd. | NRC, 1979a | EIS prepared in support of a licensing decision for a new conventional uranium mill |
| Final Environmental Statement Related to Operation of White Mesa Uranium Project, Energy Fuels Nuclear, Inc. | NRC, 1979b | EIS prepared in support of a licensing decision for a new conventional uranium mill |
| Draft Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico | NRC, 1994 | Draft EIS prepared in support of a licensing decision for a new ISL facility; it includes a discussion of conventional mining and milling as a reasonable alternative |
| Final Environmental Statement Related to the Operation of the Teton Uranium ISL Project | NRC, 1983 | EIS prepared in support of a licensing decision for a new ISL facility; it includes a discussion of conventional mining and milling and of heap leach methods as reasonable alternatives |
| Draft Long-Term Surveillance Plan for the Maybell West, Colorado, UMTRCA Title II Site | Malhotra, 2007 | Draft DOE plans for long-term care of a former heap leach site; it includes discussion of long-term site monitoring |
| Completion Review Report for the Maybell Site Located in Moffat County, Colorado | Vranka, 2007 | Final Agreement State report on the reclamation of a former heap leach site |

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NRC. NUREG–1508, "Draft Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico." Washington, DC: NRC. October 1994.

NRC. NUREG–0925, "Final Environmental Statement Related to the Operation of the Teton Uranium ISL Project." Washington, DC: NRC. August 1983.

NRC. NUREG– 0706, "Final Generic Environmental Impact Statement on Uranium Milling Project M-25." Washington, DC: NRC. September 1980.

NRC. NUREG–0583, "Final Environmental Statement Related to Operation of Shootaring Canyon Uranium Project, Plateau Resources, Ltd. Washington, DC: NRC. July 1979a.

NRC. NUREG–0556, "Final Environmental Statement Related to Operation of White Mesa Uranium Project, Energy Fuels Nuclear, Inc." Washington, DC: NRC. May 1979b.

Plateau Resources, Ltd. "Environmental Report for Shootaring Canyon Uranium Processing Facility." Rev. 1. Riverton, Wyoming: Plateau Resources, Ltd. 2006.

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# APPENDIX D

# CULTURAL AND HISTORICAL RESOURCE MANAGEMENT PROCESSES

# D1 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 National Historic Preservation Act of 1966 (NHPA), 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;
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> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
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> (b) that are associated with the lives of persons significant in our past; or
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> (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 public and ethnic values. Cultural resources may also have broader public significance, such as serving to educate the public about important aspects of national, state, or local history and pre-history. In this way, the cultural properties are evaluated in terms of the NRHP criteria with a focus on integrity and information potential.

The eligibility of a cultural resource nominated for an NRHP listing may be based upon any of the four criteria. Some criteria are best addressed through archival or architectural research, but criterion (d) is typically documented by archaeological evidence. However, historical-period properties in particular may also be eligible under criteria (a)–(c).

Eligibility for listing in the NRHP under criterion (d) requires that the importance or "significance" of the cultural resources in question be evaluated. There is no formula for making a NRHP eligibility determination that will satisfy every possible cultural resource that needs to be evaluated. NRHP eligibility, therefore, must occur within a theoretical or substantive context referred to as a Historic Context.

## D2 HISTORIC RESOURCES

Historic contexts (or research themes) are the framework within which the federal historic preservation process is structured. A historic context is a body of information about properties organized by its basic elements—theme, place, and time. Together, the historic contexts of a particular geographic area make up the history or pre-history of the area broken down into a series of historically meaningful segments; each segment is a single historic context. Grouped together, the various historic contexts of an area form a comprehensive summary of all aspects of the area's history and pre-history.

A region has an indefinite number of historic contexts or research themes. Because these contexts or themes reflect contemporary theoretical concerns in archaeology, historic contexts are dynamic and constantly need to be evaluated, rethought, and refined. Historic contexts are hierarchical frameworks of general concepts or categories. Topics are developed within each historic context that address specific areas of research. Research questions within topics focus discussion on particular issues and guide the archaeologist or historian with the initial questions they can use to evaluate a cultural resource.

A key determination regarding site significance involves the concept of integrity—the physical condition of a cultural resource. If the physical condition of a site can potentially provide important information about history or pre-history, then it has integrity. If various processes of disturbance—environmental or cultural, intentional or unintentional—have affected the property so that its cultural essence is lost or severely damaged, then the property is said to lack integrity. In general, properties that lack integrity lack the potential to provide important information about pre-history or history and are therefore considered ineligible for listing in the NRHP.

In summary, the protection of archaeological, historical period, and traditional cultural resources and landscapes within and in the vicinity of proposed projects and alternatives must be carefully considered under the statutory requirements of both the National Environmental Protection Act and Section 106 of the NHPA, as amended. A facility's construction, operation, or decommissioning can adversely impact historic properties either directly through construction and maintenance activities or indirectly through increased access to historic properties that could potentially lead to vandalism.

## D2.1 Native American Consultation

Native American groups that have ties to the region or locality in which a project is proposed should be consulted during the early stages of a project. Discussions should be included with any Tribal Historic Preservation Officer or other tribal cultural organization about the presence of traditional cultural properties, traditional use areas, plant and animal procurement areas, springs, shrines, sacred sites, ethnographic landscapes, and other cultural resources of concern that might be present in the project area.

## D2.2 Area of Potential Impacts to Historic and Cultural Resources

The general area of potential impacts to cultural and historic resources encompasses the project area and its alternatives, all its structures and facilities, and related infrastructure developments. That area is wherever direct or indirect impacts adversely affect or have the potential to adversely affect historic and cultural resources, traditional cultural properties, and landscapes that are or have the potential to be listed in the NRHP. Determining effects to historic and cultural resources, traditional cultural properties, and landscapes will coincide with the site-specific review and development of a supplemental EIS, as required.

## D2.3 General Historic Contexts

Developing Historic Contexts is critical in evaluating archaeological resources for listing in the NRHP as part of the National Environmental Policy Act and NHPA Section 106 processes. These overarching themes are the framework on which specific historic contexts will need to be developed for the specific regions and localities in which ISL mining projects are proposed.

For pre-history, the key themes might include the following: Chronology, Subsistence, Subsistence Technology and Methods, Land Use and Settlement Patterns, Community Development and Organization, and Cultural Affiliation and Boundaries are considered to be the major prehistoric and protohistoric themes related to prehistoric cultural resources of the western United States and are applicable to Nebraska. For the Historic period, the key themes include: Farming and Ranching, Mining, Military Presence, Formation of Indian Reservations, Transportation and Communication, Water Control, and Power Generation are considered to be the major historical period themes related to the settlement and development of the western United States.

# D3 HISTORIC AND CULTURAL RESOURCE INVENTORY METHODS

Documentation of historic and cultural resources, traditional cultural properties, and traditional landscapes required for the NEPA and NHPA Section 106 evaluative processes for development of a supplemental environmental assessment/environmental impact statement (EIS) as project-specific localities occurs as ISL milling projects are identified. The inventory methods are discussed on a general level in the following section. The actual documentation process and level of documentation will coincide with the site-specific review and development of a supplemental EIS as required.

## D3.1 Class I Inventory

Class I inventory consists of reviewing existing cultural resources files (existing literature, other documents, maps, files, and photographs) at the relevant federal, tribal, state, and local repositories. Previous cultural resources inventories in the proposed project areas and alternatives that will be incorporated into project-specific cultural resources inventories and evaluations will be described and documented as part of the Class I records search process. The Class I inventory includes the background research needed to develop regional and locally specific historic contexts. The resulting Class I inventory report forms the foundation for later historical and cultural resources field inventories. The inventory evaluates cultural resources for their eligibility for listing in the NRHP and how they are treated before construction begins.

As part of the Class I inventory, an attempt should be made to identify and contact knowledgeable individuals to, insofar as possible, obtain information about the location of historical and cultural resources. This information should include consultation and ethnographic interviews with Native American individuals or groups (THPOs or tribal cultural and historic preservation offices) to document traditional cultural properties, sacred places, and ethnographic and historic landscapes.

## D3.2 Class II Inventory

The Class II inventory consists of a nonintensive cultural resources field inventory. The Class II inventory typically surveys a portion of a project area rather than conducting a complete inventory (see following information on Class III inventory). The sample that is selected is considered to represent the kind and density of resources in the entire project area. Therefore, it predicts the historical and cultural resources that are expected to be found in the entire project area. Resources that are found during the Class II inventory are fully documented to federal, state, and tribal standards, and a technical report describing the inventory results is created.

## D3.3 Class III Inventory

A Class III inventory consists of an intensive on-the-ground cultural resources inventory of the entire project area. All cultural resources that are found are fully recorded and documented to meet federal, state, and tribal inventory requirements. A technical report meeting State Historic Preservation Officer and/or land managing agency reporting standards that describes the results of the cultural resources inventory is created.

# APPENDIX E

# HAZARDOUS CHEMICALS

# E1 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 significant leak were to occur inside the plant, 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 the 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 coprecipitation 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$^3$ [27 oz/yd$^3$]. This limit applies to sodium hydroxide as an airborne contaminant such as a dust or mist. Because 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 precautions 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.

## 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 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 aboveground 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 the oxygen storage facilities 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 (Compressed Gas Association, 2000, Chapter 2).

## 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 alkalis, 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 onsite 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$^3$]. Because 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. Because 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

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# APPENDIX F

# DESCRIPTION OF PROCESSES FOR REVIEW OF CUMULATIVE EFFECTS

# F1 DESCRIPTION OF PROCESSES FOR REVIEW OF CUMULATIVE EFFECTS

## F1.1 General Description of the Council on Environmental Quality 11-Step Process

An analysis of potential cumulative effects processes 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 to both public scoping meetings and impact study team scoping that identifies cumulative effects issues. Steps 1 and 4 are particularly relevant and resulted in the four identified resources areas. Resource capacity and response to change (e.g., groundwater usage) need to be identified for local and regional groundwater resources. The types, locations, and sizes of wetlands near the proposed ISL facility should be described. Federal- and state-listed threatened or endangered species in both local and regional areas must be identified along with fundamental scientific information on the "ecology" of the species, the reasons for the original species listing and any subsequent changes (e.g., from a "threatened" status to an "endangered" status), and the availability of specific recovery plans. For nearby cultural resources, those listed or eligible for listing on the National Register of Historic Places (NRHP) should be identified. State listings should also be included.

- <u>Steps 6 and 7: Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds; define a baseline condition for the resources, ecosystems, and human communities</u>. These two steps can be addressed together for each of the four resource areas of concern—groundwater resources, wetlands, threatened and endangered species, and historic and cultural resources. Historical and current laws, regulations, ordinances, and programs that contain policies related to the specific resource area should be identified. Then, historical reference point and trend information, along with current conditions, should be summarized for the indicators representing the resource areas. Many information sources will need to be reviewed during the characterizations called for in Steps 6 and 7. Further, the institutional information, environmental conditions, and compliance with regulations can serve as the basis to categorize past and present sustainability conditions for the resource areas.

- <u>Step 8: Identify the important cause-and-effect relationships between human activities and specific resource areas</u>. This step can largely be accomplished by relating past, present, and RFFAs to the four pertinent resource areas. These connections can be based on peer-reviewed literature, various governmental studies and reports, and impact-study-related and resource-management-related sources. Such references will aid in the documentation of relationships. As noted previously, Step 8 is also related to Step 4, and combining these steps will help establish the "action boundaries."

- <u>Step 9: Determine the magnitude and significance of cumulative effects</u>. To determine the magnitude of the cumulative effects, incremental impacts of the proposed action on each selected resource area and related impacts from past, present, and RFFAs should be analyzed. Quantitative models might be available for some topics, such as evaluating the impacts of groundwater restoration. For other topics such as cumulative effects on wetlands, impact information might be developed by considering the changes in wetland sizes and their functions. Various functionality indices are available for wetlands, and they could be used to determine the magnitude of the cumulative effects. For both threatened and endangered species and cultural resources, a combination of regulatory criteria and information related to the proposed ISL facility could be used.

  The significance of cumulative effects refers to "NEPA significance" as defined in 40 CFR 1508.27. The criteria in 40 CFR 1508.27 note that the requirements of pertinent laws and regulations need to be considered along with numerical standards and criteria, if they exist. A key issue regarding significance is how the combined cumulative effects influence the resource's stability. An alternative approach could include considering relative magnitudes (or contributions) to cumulative effects. These magnitudes could be divided into major, intermediate, and minor contributions from the proposed and other actions. Finally, note that the "magnitude" feature of Step 9 requires scientific and technical approaches, while the "significance" feature involves both scientific and policy considerations.

- Step 10: Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects. This step can be addressed by identifying generic mitigation measures for many of the actions associated with the analyzed actions. Measures that could be included as a license condition and thus become the responsibility of the ISL licensee are especially important. In addition, various regulatory programs that have facilitated, or are expected to emphasize, generic mitigation measures for numerous actions should also be identified and incorporated, as appropriate.

- Step 11: Monitor the cumulative effects of the selected alternative and adapt management. This step is systematically identified for each selected resource area. The key criteria that could be used to trigger Step 11 are the past, present, and future sustainability conditions for the areas. If the conditions of the resource area are currently sustainable and this is expected to continue into the future, only targeted additional monitoring beyond that which is currently being done might be considered. For resource areas that are currently considered to be not sustainable or marginally sustainable, specific collaborative monitoring with pertinent governmental agencies may be recommended.

## F2 WYOMING INTERNET INFORMATION SOURCES

The following list of websites contains information on environmental conditions in the state of Wyoming, and/or information on past, present, and reasonably foreseeable future actions within the state. (These websites generally provide information at the state level, and the reviewer may consider them as a starting point for a more region-specific analysis.)

- U.S. Forest Service—National Forests—<http://www.fs.fed.us/r2/mbr/>. This website includes information on national forests, their history, management plans, projects, and NEPA compliance documents such as environmental assessments and environmental impact statements (EISs).

- U.S. Bureau of Land Management—Wyoming—<http://www.blm.gov/wy/st/en/info>. This website includes resource management plans, land usage information on BLM lands, and various recent and current NEPA compliance documents such as environmental assessments and EISs.

- Uranium-related website—<http://www.wise-uranium.org>. This website includes both general and specific information on uranium recovery projects.

- Coal-mine-related website—<http://www.rootsweb.com/~wymining/1898coalmines.html>. This website includes historical and current information on coal mining in Wyoming.

- General website—<www.all-llc.com>. This website includes information on coal bed methane projects in Wyoming.

- General website—<http://www.wma-minelife.com/uranium/mining/pits.html>. This Wyoming Mining Association website includes useful information on uranium, coal, and other minerals' mining activities.

The following list of State of Wyoming websites includes information on state agencies listed at <http://wyoming.gov/government.asp>. Some of the websites have limited information, but many (e.g., State Geological Survey) have links to numerous applicable publications.

- Wyoming Department of Agriculture—<http://wyagric.state.wy.us/links.htm>. Links to Rural Development Councils and Conservation Districts.

- Wyoming State Climatologist—<http://www.wrds.uwyo.edu/wrds/wsc/wsc.html>. Link to Wyoming drought monitoring.

- Wyoming Business Council—<http://www.wyomingbusiness.org>. Link to state Energy Program, including the quarterly newsletter, Wyoming Energy Notes, and viability analyses of underground coal gasification in the Powder River Basin and similar documents and link to the Wyoming Oil and Gas Conservation Commission.

- Wyoming Department of Environmental Quality—<http://deq.state.wy.us/>. Links to all divisions, including Water Quality, Air Quality, and Abandoned Mine Lands.

- Wyoming Game and Fish Department—<http://gf.state.wy.us/>. Final 2007 Gray Wolf Management Plan and document on current and future energy uses in Wyoming, also link to Recommendations for Development of Oil and Gas Resources Within Crucial and Important Wildlife Habitats (2004)—A Strategy for Managing Energy Development Consistently with the Federal Land Planning and Management Act Principles of Multiple Use and Sustained Yield.

- Wyoming GIS Coordination Structure—<http://wgiac2.state.wy.us/html/index.asp>. GIS databases and online maps, including coalbed methane map.

- Wyoming State Geological Survey—<http://w.wsgs.uwyo.edu/>. Online publications include pamphlets on coalbeds, earthquakes, and natural gas in Wyoming; Wyoming Mineral Updates (through January 2008) and link to the Industrial Minerals and Uranium Section.

- Office of Homeland Security—<http://wyohomelandsecurity.state.wy.us/>. Includes the 2008 State Mitigation Plan addressing various natural and human-induced disasters. The plan includes many RFFAs applicable to Wyoming and other western states.

- Wyoming Department of Health—<http://wdh.state.wy.us/>. Has environmental health page with links to limited information on such topics as mercury in fish, chemical hazards, etc.

- Oil and Gas Conservation Commission—<http://wogcc.state.wy.us/>. Includes updates of several large projects, as well as geological reports and resources analyses. Home page lists several potential RFFAs.

- Wyoming Board of Outfitters—<http://outfitters.state.wy.us/>. Includes link to 39-page memorandum of understanding between the outfitters and several state and federal agencies.

- State Parks and Cultural Resources—<http://wyospcr.state.wy.us/>. Has links to all state parks, various planning documents, and park visitor statistics.

- Department of Transportation—<http://dot.state.wy.us/>. Information Central icon has information on public meetings, manuals, and other publications.

- Wyoming Travel and Tourism—<http://www.wyomingtourism.org>. Includes interactive map and travel regions.

- Wyoming Water Development Commission—<http://wwdc.state.wy.us/>. Includes legislative reports, history of Wyoming water law, water basin plans for the two Regions, as well as links to water resources data system and water library.

- Wyoming Wildlife and Natural Resource Trust—<http://wwnrt.state.wy.us/>. Funded by interest earned on a permanent account, donations, and legislative appropriation, the purpose of the program is to enhance and conserve wildlife habitat and natural resource values throughout the state.

## F3 NEBRASKA AND SOUTH DAKOTA INFORMATION SOURCES

The following list of websites contains information on environmental conditions in the states of South Dakota and Nebraska, and/or information on past, present, and RFFAs within each state. (These websites generally provide information at the state level, and the reviewer may consider them as a starting point for a more region-specific analysis.)

- U.S. Forest Service—National Forests—<http://www.fs.fed.us/r2/mbr/>. This website includes information on national forests, and their history, management plans, projects, and NEPA compliance documents such as environmental assessments and EISs.

- Bureau of Land Management—South Dakota and Nebraska—<http://www.blm.gov/sd/st/en/info> and <http://www.blm.gov/ne/st/en/info>. These websites include resource management plans, land usage information on BLM lands, and various recent and current NEPA compliance documents such as environmental assessments and EISs.

## F3.1 South Dakota State Agencies

The following list of State of South Dakota websites includes information on agencies listed at http://sd.gov/state_agencies.aspx. Some of the websites have limited information, but many (e.g., State Geological Survey) have links to numerous applicable publications.

- South Dakota Department of Agriculture—<http://www.state.sd.us/doa/>. Includes several divisions such as Resource Conservation and Forestry (links to Conservation Districts, statewide conservation plans, range management, forestry land enhancement, state statutes, etc.) and wildland fire suppression (links to drought protection measures, burning regulations, etc.).

- Department of Environment and Natural Resources—<http://www.state.sd.us/denr/denr.html>. Excellent site with information on 2008 surface water quality, groundwater quality, oil and gas, geology, Superfund Amendments and Reauthorization Act sites, air quality monitoring, Pollution Prevention programs, stormwater management, NPDES permits, water rights, permitting and reporting procedures, etc.

- South Dakota Game, Fish and Parks—<http://www.sdgfp.info/>. Information on state parks, prairie dog management plan, state recreational fishing surveys, and hunting and fishing regulations.

- Department of Health—<http://doh.sd.gov/>. Includes publications on state health statistics and diseases such as hanta virus.

- Department of Public Safety—<http://www.state.sd.us/dps/>. Includes homeland security information, burning ban maps, link to Governor's drought task force, etc.

- Department of Revenue and Regulation—<http://www.state.sd.us/drr2/revenue.html>. Includes information on the Petroleum Release Compensation Fund (cleanup fund).

- Department of Tourism and State Development—<http://www.tsd.sd.gov/>. Includes six divisions—Tourism, History, Arts, Housing, Tribal Relations and the Governor's Office of Economic Development. Has links to State Historic Preservation Office (SHPO) and historic preservation regulations.

- Department of Transportation—<http://www.sddot.com/>. Includes county maps, other maps of aviation facilities and construction areas, information on railroad loading facilities, environmental programs, etc.

- School and Public Lands—<http://www.sdpubliclands.com/>. A brief review indicated letting of a mineral lease for Fall River County and surface land leases for Fall River and Pennington Counties.

- Public Utilities Commission—<http://puc.sd.gov/>. Includes statutes and administrative law.

- South Dakota Geological Survey—<http://www.sdgs.usd.edu/>. Includes interactive state geological map, online databases, link to Black Hills hydrological study, and information on oil and gas wells in Fall River County.

- Cooperative Extension Service—<http://sdces.sdstate.edu/>. Includes agriculture and weather information.

## F3.2 Nebraska State Agencies

The following list of State of Nebraska websites includes information on state agencies listed at <http://www.nebraska.gov/agency_sites.phtml>. Some of the websites have limited information, but many have links to numerous applicable publications.

- Nebraska Department of Agriculture—<http://www.agr.state.ne.us/>. Website has links to an interactive statistics map, as follows: <http://www.nass.usda.gov/Statistics_by_State/Nebraska/SVG/index.asp>

- Nebraska Energy Office—<http://www.neo.ne.gov/>. Homepage has links to wind and solar energy initiatives, the state energy program, Federal Energy Policy Act of 2005, and publications such as the Nebraska Energy Quarterly.

- Nebraska Department of Environmental Quality—<www.deq.state.ne.us/>. This is one of the better state sites. Has links to regulations, maps and data, and publications on a wide variety of topics including Resource Conservation and Recovery Act monitoring, wellhead protection, groundwater program, source water protection, NPDES permits, etc.).

- Nebraska Environmental Trust—<http://www.environmentaltrust.org/>. Established in 1992 to conserve, restore, and enhance the natural environments of Nebraska.

- Nebraska Forest Service—<http://www.nfs.unl.edu/>. Affiliated with University of Nebraska Extension Service; has links to publications such as the land cover inventory of the Niobrara watershed, which includes portions of Dawes, Sioux and Box Butte Counties.

- Nebraska Game and Parks Commission—<http://www.ngpc.state.ne.us/>. Has links to the three state parks in the study area: (1) Box Butte Reservoir SWA—Dawes/Box Butte County, (2) Chadron SP—Dawes County, and (3) Ft. Robinson SP—Sioux County.

- Nebraska Department of Health and Human Services—<http://www.dhhs.ne.gov/>. Environmental health section includes links to section on hazardous wastes related to terrorism and also radioactive substances.

- Nebraska Emergency Management Agency—<http://www.nema.ne.gov/>. Has links to division dealing with radiological emergencies.

- Nebraska Department of Natural Resources—<http://www.dnr.state.ne.us/>. Has links to many water resources news releases and publications, including Report on Hydrologically Connected Ground Water and Surface Water in the Upper Niobrara-White Natural Resources District found at <http://www.dnr.state.ne.us/Publications_Studies/UNWNRD_Report_1004.pdf>. Also at this site is information on groundwater flow models, water policy, soils, and GIS natural resources mapping.

- Nebraska Oil and Gas Conservation Commission—<http://www.nogcc.ne.gov/>. Has links to well data and underground injection information and to related websites in surrounding states.

- Nebraska Department of Roads—<http://www.dor.state.ne.us/>. Has information on wetland mitigation, cultural resources, stormwater management, sediment and erosion control, etc. <http://www.dor.state.ne.us/environment/>.

- Nebraska Travel and Tourism—<http://www.visitnebraska.org/>. Regional maps are online.

- University of Nebraska Institute for Agriculture and Natural Resources—<http://ianrhome.unl.edu/Home>. Has links to Extension Service, agriculture schools, and School of Natural Resources, as well as drought information and other influences on agriculture.

## F4 NEW MEXICO INFORMATION SOURCES

The following list of websites contains information on environmental conditions in the state of New Mexico, and/or information on past, present, and RFFAs within the state. (These websites generally provide information at the state level, and the reviewer may consider them as a starting point for a more region-specific analysis.)

- U.S. Forest Service—National Forests—<http://www.fs.fed.us/r2/mbr/>. This website includes information on national forests, their history, management plans, projects, and NEPA compliance documents such as environmental assessments and EISs.

- Bureau of Land Management—New Mexico—<http://www.blm.gov/nm/st/en/info>. This website includes resource management plans, land usage information on BLM lands, and various recent and current NEPA compliance documents such as environmental assessments and EISs.

The following list of State of New Mexico websites includes information on state agencies listed at <http://newmexico.gov/AtoZ.php>. Some of the websites have limited information, but many have links to numerous applicable publications.

- Department of Agriculture—<http://nmdaweb.nmsu.edu/>. Has links to information on conservation districts, watershed districts, wildlife management (pests), rangeland and grazing programs, and water and natural resources policy.

- Middle Rio Grande Conservancy District—<http://www.mrgcd.com/content.asp?CustComKey=226893&CategoryKey=266245&pn=Page&DomName=mrgcd.com>. Involved in a wide spectrum of water-related issues on the Middle Rio Grande as far south as the Bosque del Apache National Wildlife Refuge in Socorro County.

- Department of Cultural Affairs—<http://www.newmexicoculture.org/>. Has links to prehistoric and historic sites and related issues; also, Historic Preservation Division at <http://www.nmhistoricpreservation.org/>. Includes sites listed on the state and federal historic and cultural registers.

- Demographics: Population Estimates and Projections—<http://www.unm.edu/~bber/demograp2.htm>. Data by county.

- Department of Economic Development—<http://www.edd.state.nm.us/index.html>. Maps of counties, railroads and major roads; also county economic and population statistics.

- Energy, Minerals and Natural Resources Department—<http://www.emnrd.state.nm.us/main/index.htm>. Divisions include mining and minerals, oil conservation, forestry, and state parks. Information on mine reclamation, abandoned mine land programs, timber harvesting requirements, etc.

- Environment Department—<http://www.nmenv.state.nm.us/>. Includes regulations and laws and programs for air quality, pollution prevention, hazardous wastes, drinking water and groundwater quality (the latter includes a section on mining and environmental compliance).

- Department of Game and Fish—<http://www.wildlife.state.nm.us/>. Focuses on hunting and fishing, but also has information on birding and small wildlife.

- Bureau of Geology and Mineral Resources—<http://geoinfo.nmt.edu/>. Includes links to petroleum exploration maps for Catron, Cibola, McKinley, and Socorro Counties; geologic and hydrologic maps; and many energy-related publications (e.g., Geology of the Uranium Region near Grants in Cibola County).

- Department of Health—<http://www.health.state.nm.us/>. Has links to county and tribal health departments/councils.

- Department of Homeland Security and Emergency Management—<http://www.nmdhsem.org/default.asp?CustComKey=270308&CategoryKey=274276&pn=Page&DomName=nmdhsem.org>. Includes emergency preparedness information similar to the Federal Emergency Management Agency.

- Indian Affairs Department—<http://www.iad.state.nm.us/>. Includes state map of tribal lands and links to tribal government sites.

- New Mexico Resource GIS Program—<http://rgis.unm.edu/>. Resource GIS provides access to data, training, and technical support for geographic information users, as well as those who desire to incorporate geographic information into their processes and applications; includes the Earth Data Analysis Center.

- State Land Office—<http://www.nmstatelands.org/Default.aspx>. Includes information about oil and gas, mineral and agriculture leasing programs.

- Tourism Department—<http://www.newmexico.org/index3.php>. Information on all outdoor activities, including birding and wildlife watching areas.

- Department of Transportation—<http://www.nmshtd.state.nm.us/>. Information on construction areas, airports, maps, scenic byways and historic and prehistoric sites along them.

- New Mexico Natural Heritage—<http://nhnm.unm.edu/>. Dedicated to information on rare species and ecosystems; has a user-friendly searchable database for county information on state and federally listed species.

## F5 REFERENCE

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

# APPENDIX G

# PUBLIC COMMENTS ON THE DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT AND NRC RESPONSES

CONTENTS

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## TABLES

## ABBREVIATIONS/ACRONYMS

| | |
|---|---|
| ADAMS | Agencywide Documents Access and Management System |
| ACL | Alternate Concentration Limits |
| ALARA | As Low As Is Reasonably Achievable |
| AEA | Atomic Energy Act |
| BLM | U.S. Bureau of Land Management |
| CBM | Coal Bed Methane |
| CEQ | Council on Environmental Quality |
| DOE | U.S. Department of Energy |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| FONSI | Finding of No Significant Impacts |
| GEIS | Generic Environmental Impact Statement |
| ISL | *In-situ* Leach |
| LFO | Lander Field Office |
| LSA | Low Specific Activity |
| MCL | Maximum Contaminant Level |
| MIT | Mechanical Integrity Testing |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NOI | Notice of Intent |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | U.S. Nuclear Regulatory Commission |
| NRHP | National Register of Historic Places |
| PSD | Prevention of Significant Deterioration |
| RAP | Restoration Action Plan |
| RCRA | Resource Conservation and Recovery Act |
| RFFA | Reasonably Foreseeable Future Actions |
| RIX | Remote Ion Exchange |
| RMP | Resource Management Plan |
| SDWA | Safe Drinking Water Act |
| SERP | Safety and Environmental Review Panel |
| SHPO | State Historic preservation Officer |
| TDS | Total Dissolved Solids |
| TENORM | Technologically Enhanced Naturally Occurring Radioactive Material |
| UCL | Upper Control Limits |
| UIC | Underground Injection Control |
| WDEQ | Wyoming Department of Environmental Quality |

# PUBLIC COMMENTS ON THE DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT AND NRC RESPONSES

## G1 OVERVIEW

On July 28, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff published a notice in the *Federal Register* requesting public review of and comment on the Draft Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) (73 FR 43795) in accordance with Title 10, Parts 51.73, 51.74, and 51.117 of the *U.S. Code of Federal Regulations* (10 CFR 51.73, 51.74, and 51.117). The NRC staff initially established October 7, 2008, as the deadline for submitting public comments on the Draft GEIS. The NRC staff subsequently extended this deadline to November 7, 2008 (73 FR 57687). More than 1,650 comment documents (i.e., letters, facsimiles, and e-mails) were submitted to NRC. In addition, oral comments were received from approximately 158 individuals who spoke at the eight public meetings on the GEIS.

## G2 PUBLIC PARTICIPATION

Public participation is an essential part of the NRC environmental review process. This section discusses the process for public participation during the NRC staff's development of the GEIS.

The NRC conducted an open, public GEIS development process consistent with the requirements of the National Environmental Policy Act of 1969 (NEPA) and the NRC's regulations. The NRC held three public scoping meetings early in the GEIS development process and eight public meetings to receive comments on the draft GEIS. Including extensions, the time period for agencies and the public to provide scoping comments to NRC on the GEIS was 129 days. NRC provided a 103-day public comment period, again including extensions, for agencies and the public to review the draft GEIS and provide comments. The GEIS addresses the nearly 2,200 comments the NRC staff identified from letters, facsimile transmittals, and e-mails received from more than 1,350 individuals and from oral comments given by approximately 158 individuals.

### G2.1 Notice of Intent To Develop the GEIS

The NEPA public scoping process begins with publication of a notice of intent (NOI) in the *Federal Register*. The NRC staff published its NOI regarding preparation of the GEIS on July 24, 2007.

### G2.2 Public Scoping

The NRC public scoping process for the GEIS began on July 24, 2007, with the publication in the Federal Register (72 FR 40344) of the NOI to prepare a GEIS. As part of this process, NRC conducted public scoping meetings to solicit both oral and written comments from interested parties on the scope of the GEIS. In addition to the description in the NOI in the aforementioned *Federal Register* notice, the scoping meetings were also advertised in local newspapers. During these meetings, the NRC staff briefly described the NRC's role and mission and its environmental and safety review processes and discussed how the public could effectively participate in the environmental review process. The remainder of each meeting was reserved for attendees to make oral comments. Table G2.2-1 lists these public scoping meetings.

| Table G2.2-1 Public Scoping Meetings on the GEIS | |
|---|---|
| **Date** | **Location** |
| August 07, 2007 | Casper, Wyoming |
| August 09, 2007 | Albuquerque, New Mexico |
| September 27, 2007 | Gallup, New Mexico |

Scoping is an early and open process designed to achieve the following objectives:

- Determine the range of actions, alternatives, and potential impacts to be considered in the GEIS.
- Identify issues of concern to the general public.
- Identify significant issues for future analysis regarding the proposed action.
- Solicit information from the public and other stakeholders to more clearly focus the analysis on issues of genuine concern.
- Ensure that concerns are identified early and are properly studied.
- Identify alternatives to be examined.
- Eliminate issues not warranting detailed analysis.

## G2.3 Issuance and Availability of the GEIS

On July 28, 2008, in accordance with NRC regulations, the NRC published a Notice of Availability of the draft GEIS in the *Federal Register* (73 FR 43795). In the notice, the NRC staff provided information on how to obtain a copy of the GEIS. Additionally, copies of the draft GEIS were mailed to approximately 100 individuals including federal, tribal, state, and local government officials as well as members of the general public. An electronic version of the document and supporting information was made accessible through the NRC's project-specific website (www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html) and through NRC's Agencywide Documents Access and Management System (ADAMS) database on the NRC's website (http://www.nrc.gov/reading-rm/adams.html).

## G2.4 Public Comment Period

In the publication of the Notice of Availability of the draft GEIS on July 28, 2008 (73 FR 43795), the NRC staff stated that the public comments on the draft GEIS should be submitted by October 7, 2008, and notified the public of the dates, times, and locations for the eight public comment meetings. Members of the public were invited and encouraged to submit related comments using an electronic comment form available on the NRC website and comments were also accepted via e-mail and the regular mail and orally at the public meetings held on the draft GEIS. On October 3, 2008, the NRC staff extended the public comment period to November 7, 2008 (73 FR 57687), in response to public requests for extension received at the public meetings and in submitted comment letters and e-mails. The 103-day period for public comment (i.e., from July 28, 2008 to November 7, 2008) exceeds the minimum 45-day comment period required under NRC regulations. By letter, facsimile, and e-mail, approximately 1,350 individuals submitted nearly 2,200 individual comments on the GEIS.

## G2.5 Public Comment Meetings

To facilitate public input on the draft GEIS, the NRC scheduled a series of public meetings at various locations in the regions where applications for future ISL milling are possible. The meeting locations were based, in part, on the availability of appropriate venues near locations where future ISL milling facilities may be located based on notices of intent received by the NRC from companies expecting to submit future ISL facility license applications. Table G2.5-1 provides the date and locations for each of the eight public comment meetings. The meetings were advertised in local and regional newspapers and in a nationwide press release issued on July 28, 2008 (NRC, 2008). Meeting attendance varied at each location from about 20 to about 150 individuals. A transcriber was present at each public meeting so the comments could be recorded. Full transcripts of each meeting are available on the NRC website. Each transcript is part of the public record of the GEIS, and all transcripts were used to identify individual public comments that are included in comment summaries in this appendix.

**Table G2.5-1. Public Comment Meetings on the Draft GEIS**

| Date | Location |
|---|---|
| August 25, 2008 | Spearfish, South Dakota |
| August 27, 2008 | Chadron, Nebraska |
| August 29, 2008 | Newcastle, Wyoming |
| September 08, 2008 | Gallup, New Mexico |
| September 09, 2008 | Grants, New Mexico |
| September 11, 2008 | Albuquerque, New Mexico |
| September 23, 2008 | Gillette, Wyoming |
| September 25, 2008 | Casper, Wyoming |

## G2.6 References

NRC. "NRC Seeks Public Comment on Generic Environmental Study of *In-Situ* Leach Uranium Recovery Operations." *NRC News*, No. 08-139. 2008. <http://www.nrc.gov/reading-rm/doc-collections/news/2008/08-139.html> (9 February 2009).

# G3 COMMENTS RECEIVED ON THE DRAFT GEIS

As discussed previously, the NRC staff received both oral and written comments on the draft GEIS during the comment period. The NRC staff identified nearly 2,200 comments from reviewing the more than 1,650 letters, facsimiles, and e-mails received; the transcripts of 158 formal commenters at the public meetings; and the transcripts of audience members who provided informal comments and questions to NRC at the public meetings. Informal comments refer to those that were not part of the designated public comment portion of the meeting, but were made at other times during the meeting. Each of these comments has been included in the following comment summaries and addressed in the responses provided.

## G3.1 Comment Review Methods

Each comment was individually identified and responded to using a systematic approach. This approach involved identification of individual comments from the source documents, consolidation of comment information into a database, sorting of all comments by topic, and distribution to and review of all comments by the GEIS authors.

Comment documents included e-mails, comment letters, and meeting transcripts for those comments provided orally at public meetings. A numbering system was used to uniquely identify individual commenters and their unique comments within each comment document. Each e-mail or comment letter received by NRC was given a unique number based on the order in which the documents were received. E-mailed comment letters were automatically assigned numbers by the e-mail system when they were received, whereas letters received by facsimile or regular mail were manually assigned a unique consecutive number beginning with the letters HC (for "hard copy") to avoid duplication of numbers with e-mailed comment letters. Because the majority of these letters was sent by individuals, the comment document number also uniquely identifies the commenter, but commenters who submitted multiple comment letters or spoke at multiple meetings have multiple identification numbers (one for each document that contains their comments). For e-mails and letters signed by multiple individuals, a unique group number was assigned to allow identification of all the individuals associated with that letter's comments, but the unique letter identification number was still used to associate the comments with the source document.

Meeting transcripts required a modified identification approach where each meeting transcript was assigned a two-letter identification code associated with the meeting location. Meeting location identification codes used are listed in Table G3.1-1.

For all comment documents (i.e., e-mails, facsimiles, letters, transcripts), staff reviewed each individual comment document and identified, marked, and consecutively numbered individual unique comments in each document. Comment numbers follow a two-part numbering system separated by a hyphen. The part of the comment number to the left of the hyphen is either the unique identification number for an e-mail or hard copy letter (e.g., 001 for the first e-mail received; HC001 for the first letter sent by mail), or the meeting location code paired with a two-digit commenter identification number for comments identified from meeting transcripts (e.g., GR01 for the first commenter at the Grants, New Mexico, public meeting, GR02 for the second commenter at that meeting, and so forth). The number to the right of the hyphen is a consecutive unique count number for each comment identified in a specific comment document regardless of type. Tables G3.1-2 and G3.1-3 provide lists of all commenter names and affiliations by identification number and all identification numbers by commenter names, respectively. Table G3.1-4 identifies individuals who are associated with comment letters that were signed by multiple individuals and their unique group name (group name is used to associate multiple individuals to a single comment letter that is assigned a single identification number). These tables can be used by readers to electronically search the report to locate comments submitted by specific individuals or to find individuals associated with comments described in Section G.5.

Additionally, nearly 1,500 form letters were received from members of the public. Because all of these contained the same comment, they were addressed as one comment in the comment response report. These individuals are captured in Table G3.1-5.

| Table G3.1-1. Public Meeting Identification Codes by Location of Meeting | |
|---|---|
| **Meeting Identification Code** | **Public Meeting Location** |
| AL | Albuquerque, New Mexico |
| CA | Casper, Wyoming |
| CH | Chadron, Nebraska |
| GA | Gallup, New Mexico |
| GI | Gillette, Wyoming |
| GR | Grants, New Mexico |
| NE | Newcastle, Wyoming |
| SP | Spearfish, South Dakota |

| Table G3.1-2. Public Commenter Name, Affiliation, and Identification Number | | | |
|---|---|---|---|
| **Last Name** | **First Name** | **Affiliation** | **Commenter ID Number(s)** |
| Anderson | Jim | Wyoming State Senate | CA04 |
| Anderson | Shannon | Powder River Basin Resource Council | 050, CA01, NE06 |
| Arnold | Dave | Public | GR23 |
| Artim | Alvin/Dolores | Public | 1210 |
| Audience | Member | Public | AL03 |
| Ballander | Sunday | Public | NE08 |
| Barrett | Floy | Public | AL13 |
| Becenti | Ernest | McKinley County, New Mexico, Commissioner | GR06 |
| Becenti, Jr. | Ernest | McKinley County Commissioner | GA08 |
| Belcastro | Frank | Public | 002 |
| Belitz | Jennifer | Public | 1015 |
| Belitz | Larry | Public | 047 |
| Belitz | Mark | Public | 042 |
| Bemis | John | New Mexico State Land Office | AL12 |
| Bernard | Larry | Public | GR04 |
| Blewer | Mac | Deputy Director, Audubon Wyoming | 1319 |
| Bloomer | Jerry | Public | 038 |
| Bolina | Manual | Village of Milan, New Mexico, Mayor pro tempore | GR13 |
| Boomer | John | Public | GR22 |
| Bottomly | Lewis | Public | 1097 |
| Boekatz | Malcom | Safety Council for Pueblo of Zuni | AL15 |
| Boyce | Aaron | Public | AL33 |
| Brechtel | Bob | Wyoming House of Representatives | CA05 |
| Brewer | Jim | Public | GR21 |
| Brewer | Sandy | Public | GR24 |
| Brich | Randy | Public | 020 |
| Bromm | Susan | EPA Office of Federal Activities | 1321 |
| Brown | Elouise | Navajo National Dooda Desert Rock Committee | 011, GR34 |
| Brown | Gerald | Public | GR25 |
| Brown | Joan | Franciscan Sister | AL24 |
| Brygider | Brandon R. | Public | HC020, HC006 HC017 |
| Burnett | Barbara | Public | 495 |
| Burns | Joy | Public | GA18 |
| Bush | Richard | U.S. Department of Energy, Office of Legacy Management | 019 |

| Table G3.1-2. Public Commenter Name, Affiliation, and Identification Number (continued) | | | |
|---|---|---|---|
| Last Name | First Name | Affiliation | Commenter ID Number(s) |
| Byers | George | Neutron Energy | GR09 |
| Campos | Rita | Public | GA02 |
| Capitan | Mitchell | Public | GA15 |
| Capitan | Rita | Public | GA14 |
| Capozzelli | J. | Public | 1371, HC015 |
| Carrier | Rene | Public | 963 |
| Carter | Iva | Public | NE11 |
| Cash | John | National Mining Association | SP10 |
| Cecchini | Rose Marie | Diocese of Gallup, New Mexico | GA10 |
| Clarence | Bill | Public | SP01 |
| Clark | Donna | Public | 062 |
| Clark | Matthew | Stewart Brothers Drilling Company | 007 |
| Clema | John | Public | AL07 |
| Clemenson | Rod | Public | SP06 |
| Cohtsa | Bob | Public | CH12 |
| Cook | Thomas K. | Public | CH05 |
| Coolidge | Dan | Board of Commissioners, Campbell County, Wyoming | 029 |
| Copeland | Bob | Public | CH03 |
| Covington | Diana | Public | CH09 |
| Curry | Ron | New Mexico Environmental Department | 032 |
| Darlington | Jim | Public | NE05 |
| Davis | Robin | Public | 1542 |
| Domenici | Pete | U.S. Senator | AL08 |
| Duran | Adela | Attorney, Comeau, Maldegen, Templeman and Indall | AL10 |
| Dwyer | Anabel | Public | 1539 |
| Edwards | Roy | Campbell County, Wyoming, Board of Commissioners | GI08 |
| Eichelberger | Don | Public | 012 |
| Erdaul | Leland | Public | AL26 |
| Etchepare | John | Director, Wyoming Department of Agriculture | HC009 |
| Everard | Terry | Public | 033 |
| Eviard | Terry | Public | GI02 |
| Fassett | Jerry | Public | 1479 |
| Female Voice | | Public | NE10 |
| Fenton | John | Pavillion Area Concerned Citizens | 057 |
| Fletcher | Terry | New Mexico Mining Association | GR30 |
| Foots | Randy | Uranium Resources, Inc. | GR29 |
| Foust | Tom | Citizens for Uranium Resource Education | 024, CA07 |
| Francis | Mary | Public | 1315 |
| Frankel | David | Aligning for Responsible Mining | 829, 1309, CH02, CH07 |
| Gaines | Les | Stewart Brothers Drilling Company | 035 |
| Garcia | William | Public | GA06 |
| Garrett | Richard | Wyoming Outdoor Council | CA03 |
| Garrett | Roberta | Public | 018 |
| Geary | B. | Public | 021, 1313 |
| Gebeau | Art | Public | GR26 |
| Gilbert | Petuuche | Public | GR14 |

| Table G3.1-2. Public Commenter Name, Affiliation, and Identification Number (continued) | | | |
|---|---|---|---|
| Last Name | First Name | Affiliation | Commenter ID Number(s) |
| Goitein | Ernest | Public | 041 |
| Goitein | Ernie | Public | 001 |
| Gomez | Leo | Public | AL22 |
| Gonzales | Star | Cibola Community Economic Development Foundation | GR19 |
| Greenwald | Janet | Citizens for Alternatives to Radioactive Dumping | AL01 |
| Griffin | Marvin/Evelyn | Public | HC016 |
| Griffin | Mike | Uranium One Americas | CH08 |
| Gronwall | Susan | Public | 040 |
| Group A | Group A | Group A | HC010 |
| Group B | Group B | Group B | 003 |
| Group C | Group C | Group C | 1305 |
| Group D | Group D | Group D | 1320 |
| Group E | Group E | Group E | 1312 |
| Group F | Group F | Group F | 1311 |
| Group G | Group G | Group G | 1300 |
| Group H | Group H | Group H | 1314 |
| Group I | Group I | Group I | HC019 |
| Group J | Group J | Group J | CAG01 |
| Hallinan | Tim | Public | GI04 |
| Hansen | Barb | Public | NE02 |
| Harrison | Gerri | Public | GA24 |
| Harshbarger | Jean | Public | NE09 |
| Harshbarger | Robert (Major) | Public | NE04 |
| Hawkins | Mary | Public | SP05 |
| Hawkins | Ross C. | Crook County Land Use Planning and Zoning Commission | HC018 |
| Head | Candace | Blue Water Valley Downstream Alliance | GR01 |
| Head | Jonnie | Public | GR18 |
| Head | Milton | Public | GR08 |
| Heaton | John | New Mexico House of Representatives | AL09 |
| Heffner | Scott | R.M.D. Operations, LLC | 039 |
| Heili | Wayne | Ur Energy | CA02 |
| Hilding | Nancy | Prairie Hills Audubon Society | 1301, 1302 |
| Hill | Kathleen | National Tribal Water Council | 1317 |
| His Horse Is Thunder | Ron | Standing Rock Sioux Tribe | 026 |
| Hollenbeck | Mark | Powertech Uranium Corp. | SP18, NE12 |
| Hood | Edith | Public | GA28 |
| Hood | Tony | Public | GA27 |
| House | Benjamin | Eastern Navajo Allottee Association | AL18, GA11, GR33 |
| House | Donna | Public | AL05 |
| Hyde | Don | Public | GA12 |
| Hyde | Don | Public | HC014 |
| Indall | Joni | Uranium Producers of America | 017 |
| Iron Cloud | Richard | Public | 046 |
| Janssen | Bob | U.S. Bureau of Land Management | 1173 |
| Jantz | Eric | New Mexico Environmental Law Center | 1196, AL14, 1314 |

**Table G3.1-2. Public Commenter Name, Affiliation, and Identification Number (continued)**

| Last Name | First Name | Affiliation | Commenter ID Number(s) |
|---|---|---|---|
| Jatkar | Shrayas | Public | AL27 |
| John, II | Norman | Navajo Nation | GA07 |
| Johnson | James | Public | HC012 |
| Jones | Jim | Public | 0694, GI01 |
| Kelley | Harold | Public | 030 |
| Kenny | Chris | Public | GA26 |
| Kenny | James | Public | 1109 |
| King | Larry | Public | GR31 |
| Klonowski | Joan | Public | GR03 |
| Knudson | Rodney | Public | GI07, SP14 |
| Kosky | Carol | Public | CH04 |
| Kuhn | Alan | Public | GR10 |
| Lanning | Danny | Public | SP07 |
| LaPlaca | Nancy | Energy Consultant, Bardwell Consulting Ltd. | 1323 |
| Laumer | Kerryn | Public | 043 |
| Ledbetter | George | Public | CH01 |
| LeVines | Joni | Public | 014 |
| Lewis | Marvin | Public | 004 |
| Loomis | Marion | Wyoming Mining Association | CA10 |
| Lubner | Tom | Public | GI05 |
| Mahoney | Betsy | Public | HC007 |
| Male Voice | | Public | CH14 |
| Male Voice | | Public | NE07 |
| Martinez | Amadeo | Juan Tafoya Land Grant Corporation | AL28 |
| Martinez | James | Public | GA22 |
| Martinez | Patricia | Juan Tafoya Land Grant Corporation | AL29 |
| Martinez | Sofia | Public | GR16 |
| Mazik | Kim | Public | 1205 |
| McClure | Beverlee | Association of Commerce and Industry | 008 |
| McCoy | David | Citizen Action New Mexico | AL20 |
| McMullen | Penelope | Loretto Community (Sisters and Comembers) | 048 |
| McQuakay | Bruce | Southwest Cultural Preservation Project | AL31 |
| Meech | Walter | Public | GR17 |
| Mertz | Robert | Public | 1259 |
| Meyer | Eric | Public | 1523 |
| Michals | Stan | South Dakota Department of Game, Fish, and Parks | 034 |
| Miller | Cyd | Public | 025 |
| Miller | Neil/Jennifer | Public | 027 |
| Moxley | Mark | Wyoming Dept of Environmental Quality Land Quality Division | CA06 |
| Mull | Nick | Public | SP04 |
| Murrietta | Joe | Mayor of Grants, New Mexico | AL11, GA09, GR07 |
| Nez | Teddy | Public | GA01 |
| Noon | Maria | Executive Director, Citizens Alliance for Responsible Energy | AL21 |
| O'Brien | Mike | Crook County Land Use Planning & Zoning Commission | GI03 |

| Table G3.1-2. Public Commenter Name, Affiliation, and Identification Number (continued) | | | |
|---|---|---|---|
| **Last Name** | **First Name** | **Affiliation** | **Commenter ID Number(s)** |
| Oglesby | Michael | Public | 396 |
| One Feather | Harold | Public | 1388 |
| Osmund | Marshall | Public | SP02 |
| Patrie | Lewis | Western N.C. Physicians for Social Responsibility | 005, 006 |
| Patrie | Lewis | Public | 1606 |
| Paulson | Oscar | Rio Tinto Energy America, Kennecott Uranium Company | 028 |
| Paulson | Oscar | Kennecott Uranium Company-Sweetwater | CA08 |
| Peets | Ava | Public | GR20 |
| Pelizza | Mark | Hydro Resources, Inc. | AL30 |
| Pelton | Brandy | Public | SP17 |
| Perrottee | Marlene | Sister of Mercy, Partnership for Earth Spirituality | AL25 |
| Polk | Harding | Public | GR32 |
| Pourier | Michael | Public | SP09 |
| Prindle | Wayne | Biodiversity Conservation Alliance | CA09 |
| Pynes | Ronny | Public | GA17 |
| Rader | Patricia | Public | GA03 |
| Reilly | Barney | Public | 1045 |
| Richardson | Don | Public | HC002 |
| Ringwelski | Patricia | Public | 037 |
| Robran | John | Public | GA19, GR28 |
| Rodriquez | Susan | Public | AL34 |
| Rogers | Ms. | Public | AL02 |
| Rose | Danialle | CS-PIP, QNHP, ICCDC III, ADS-RT | 045 |
| Savignac | Noel | Noel Savignac Consultants | 010 |
| Shuey | Chris | Southwest Research and Information Center | AL16, GA23, GR12 |
| Sj | Shawn | Public | 345 |
| Slater | Alice | Nuclear Age Peace Foundation | 1322, 1482 |
| Slim | Jerry | Eastern Navajo Allottee Association | AL23 |
| Smith | Christine | Public | GA13 |
| Smith | Lynnea | Public | GA04 |
| Sorrell | Annie | Public | AL19, GA20 |
| Spilsbury | Delaine | Public | 1500 |
| Steele | Don | Public | GA25 |
| Stewart | Joel | Stewart Brothers Drilling Company | 009 |
| Stewart | Phillip | Public | 023 |
| Stewart | Robert | United States Department of the Interior | 015 |
| Sty | Jack/Mary Ann | Public | 013 |
| Swallow | Brian | Public | CH11 |
| Sweeney | Katie | National Mining Association | 036 |
| Taylor | David | Navajo National Department of Justice Office of the Attorney General | 1318 |
| Thayer | Clayton | Public | 022 |
| Thompson | Dana | Public | 1585 |
| Thompson | Phyllis | Public | NE03 |
| Thorne | R.E. | Public | HC008 |
| Thorne | Ray | Public | 049 |
| Todea | Nancy | Public | AL06 |

| Table G3.1-2. Public Commenter Name, Affiliation, and Identification Number (continued) | | | |
|---|---|---|---|
| **Last Name** | **First Name** | **Affiliation** | **Commenter ID Number(s)** |
| Tohe | Robert | Sierra Club | AL17, GA16, GR11 |
| Tope | Jay | Public | GI06, SP03, SP13 |
| Tope | Jay/Wilma | Public | 1601 |
| Tope | Wilma | Public | 1602, SP12 |
| Tsosie | Tracy | Public | GA05 |
| Ulibarri | David | State of New Mexico Senator | GR05 |
| Unknown1 | Unknown1 | Public | SP15 |
| Unknown2 | Unknown2 | Public | SP16 |
| Unknown3 | Unknown3 | Public | SP19 |
| Van Wicklen | Betty | Public | 1142 |
| Velasquez | Juan | Strathmore Minerals (also representing Uranium Producers of New Mexico, Uranium Producers of America, and National Mining Association) | GR15, AL32 |
| Viviano | Pam | Ranchers & Neighbors Protecting Our Water of Crook County | 059, HC005 |
| Wade | Chuck | Public | GA21 |
| Waugh | Scott | Public | 060 |
| Waugh | Scott/Kelly | Public | 016 |
| Wess | Roger | Local County Commissioner | CH13 |
| West | Darla | Public | 031 |
| Whalen | Jeanne | Public | HC013 |
| Whiteface | Charmaine | Coordinator, Defenders of the Black Hills | 061,SP08 |
| White Plume | Debra | Owe Aku | CH06 |
| Williams | Lynda | Public | 1547 |
| Williams | Ron | Public | GR27 |
| Wilson | Jerry | Public | 044 |
| Winter | John | Uranium One | SP11 |
| Wunder | Matthew | New Mexico Department of Game and Fish | HC011 |
| Yellow Hair | Meelo | Public | CH10 |
| Ziegler | Ted | Uranium Resources, Inc. | GR02 |
| | Cindy | Public | NE01 |
| | Morena | Citizens Alliance for Responsible Energy | AL04 |

| Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation | | | |
|---|---|---|---|
| **Commenter ID Number(s)** | **Last Name** | **First Name** | **Affiliation** |
| 001 | Goitein | Ernie | Public |
| 002 | Belcastro | Frank | Public |
| 003 | Group B | Group B | Group B |
| 004 | Lewis | Marvin | Public |
| 005 | Patrie | Lewis | Western N.D. Physicians for Social Responsibility |
| 006 | Patrie | Lewis | Western N.D. Physicians for Social Responsibility |
| 007 | Clark | Matthew | Stewart Brothers Drilling Company |

**Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation (continued)**

| Commenter ID Number(s) | Last Name | First Name | Affiliation |
|---|---|---|---|
| 008 | McClure | Beverlee | Association of Commerce and Industry |
| 009 | Stewart | Joel | Stewart Brothers Drilling Company |
| 010 | Savignac | Noel | Noel Savignac Consultants |
| 011 | Brown | Elouise | Dooda Desert Rock Committee |
| 012 | Eichelberger | Don | Public |
| 013 | Sty | Jack/Mary Ann | Public |
| 014 | LeVines | Joni | Public |
| 015 | Stewart | Robert | United States Department of the Interior |
| 016 | Waugh | Scott/Kelly | Public |
| 017 | Indall | Joni | Uranium Producers of America |
| 018 | Garrett | Roberta | Public |
| 019 | Bush | Richard | U.S. Department of Energy, Office of Legacy Management |
| 020 | Brich | Randy | Public |
| 021 | Geary | B. | Public |
| 022 | Thayer | Clayton | Public |
| 023 | Stewart | Phillip | Public |
| 024 | Foust | Tom | Public |
| 025 | Miller | Cyd | Public |
| 026 | His Horse Is Thunder | Ron | Standing Rock Sioux Tribe |
| 027 | Miller | Neil/Jennifer | Public |
| 028 | Paulson | Oscar | Rio Tinto Energy America, Kennecott Uranium Company |
| 029 | Coolidge | Dan | Board of Commissioners, Campbell County, Wyoming |
| 030 | Kelley | Harold | Public |
| 031 | West | Darla | Public |
| 032 | Curry | Ron | New Mexico Environmental Department |
| 033 | Everard | Terry | Public |
| 034 | Michals | Stan | South Dakota Department of Game, Fish, and Parks |
| 035 | Gaines | Les | Stewart Brothers Drilling Company |
| 036 | Sweeney | Katie | National Mining Association |
| 037 | Ringwelski | Patricia | Public |
| 038 | Bloomer | Jerry | Public |
| 039 | Heffner | Scott | R.M.D. Operations, LLC |
| 040 | Gronwall | Susan | Public |
| 041 | Goitein | Ernest | Public |
| 042 | Belitz | Mark | Public |
| 043 | Laumer | Kerryn | Public |
| 044 | Wilson | Jerry | Public |
| 045 | Rose | Danialle | CS-PIP, QNLHP, ICCDC III, ADS-RT |
| 046 | Iron Cloud | Richard | Public |
| 047 | Belitz | Larry | Public |
| 048 | McMullen | Penelope | Loretto Community (Sisters and Comembers) |
| 049 | Thorne | Ray | Public |
| 050 | Anderson | Shannon | Powder River Basin Resource Council |
| 057 | Fenton | John | Pavillion Area Concerned Citizens |
| 059 | Viviano | Pam | Ranchers & Neighbors Protecting Our Water of Crook County |

**Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation (continued)**

| Commenter ID Number(s) | Last Name | First Name | Affiliation |
|---|---|---|---|
| 060 | Waugh | Scott | Public |
| 061 | Whiteface | Charmaine | Coordinator, Defenders of the Black Hills |
| 062 | Clark | Donna | Public |
| 345 | Sj | Shawn | Public |
| 396 | Oglesby | Michael | Public |
| 495 | Burnett | Barbara | Public |
| 0694 | Jones | Jim | Public |
| 829 | Frankel | David | Public |
| 963 | Carrier | Rene | Public |
| 1015 | Belitz | Jennifer | Public |
| 1045 | Reilly | Barney | Public |
| 1097 | Bottomly | Lewis | Public |
| 1109 | Kenny | James | Public |
| 1142 | Van Wicklen | Betty | Public |
| 1173 | Janssen | Bob | U.S. Bureau of Land Management |
| 1196 | Jantz | Eric | New Mexico Environmental Law Center |
| 1205 | Mazik | Kim | Public |
| 1210 | Artim | Alvin/Dolores | Public |
| 1259 | Mertz | Robert | Public |
| 1300 | Group G | Group G | Group G |
| 1301 | Hilding | Nancy | Prairie Hills Audubon Society |
| 1302 | Hilding | Nancy | Prairie Hills Audubon Society |
| 1305 | Group C | Group C | Group C |
| 1309 | Frankel | David | Aligning for Responsible Mining |
| 1311 | Group F | Group F | Group F |
| 1312 | Group E | Group E | Group E |
| 1313 | Geary | B. | Public |
| 1314 | Group H | Group H | Group H |
| 1315 | Francis | Mary | Public |
| 1317 | Hill | Kathleen | National Tribal Water Council |
| 1318 | Taylor | David | Navajo National Department of Justice Office of the Attorney General |
| 1319 | Blewer | Mac | Deputy Director, Audubon Wyoming |
| 1320 | Group D | Group D | Group D |
| 1321 | Bromm | Susan | EPA Office of Federal Activities |
| 1322 | Slater | Alice | Nuclear Age Peace Foundation |
| 1323 | LaPlaca | Nancy | Energy Consultant, Bardwell Consulting Ltd. |
| 1371 | Capozzelli | J. | Public |
| 1388 | One Feather | Harold | Public |
| 1479 | Fassett | Jerry | Public |
| 1482 | Slater | Alice | Nuclear Age Peace Foundation |
| 1500 | Spilsbury | Delaine | Public |
| 1523 | Meyer | Eric | Public |
| 1539 | Dwyer | Anabel | Public |
| 1542 | Davis | Robin | Public |
| 1547 | Williams | Lynda | Public |
| 1585 | Thompson | Dana | Public |
| 1601 | Tope | Jay/Wilma | Public |

| Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation (continued) | | | |
|---|---|---|---|
| Commenter ID Number(s) | Last Name | First Name | Affiliation |
| 1602 | Tope | Wilma | Public |
| 1606 | Patrie | Lewis | Public |
| AL01 | Greenwald | Janet | Citizens for Alternatives to Radioactive Dumping |
| AL02 | Rogers | Ms. | Public |
| AL03 | Audience | Member | Public |
| AL04 | | Morena | Citizens Alliance for Responsible Energy |
| AL05 | House | Donna | Public |
| AL06 | Todea | Nancy | Public |
| AL07 | Clema | John | Public |
| AL08 | Domenici | Pete | Public |
| AL09 | Heaton | John | New Mexico House of Representatives |
| AL10 | Duran | Adela | Attorney, Comeau, Maldegen, Templeman and Indall |
| AL11 | Murrietta | Joe | Mayor of Grants, New Mexico |
| AL12 | Bemis | John | New Mexico State Land Office |
| AL13 | Barrett | Floy | Public |
| AL14 | Jantz | Eric | Attorney, New Mexico Environmental Law Center |
| AL15 | Bowekatz | Malcom | Safety Council for Pueblo of Zuni |
| AL16 | Shuey | Chris | Southwest Research and Information Center |
| AL17 | Tohe | Robert | Sierra Club |
| AL18 | House | Benjamin | Eastern Navajo Allottee Association |
| AL19 | Sorrell | Annie | Public |
| AL20 | McCoy | David | Citizen Action New Mexico |
| AL21 | Noon | Maria | Executive Director, Citizens Alliance for Responsible Energy |
| AL22 | Gomez | Leo | Public |
| AL23 | Slim | Jerry | Eastern Navajo Allottee Association |
| AL24 | Brown | Joan | Franciscan Sister |
| AL25 | Perrottee | Marlene | Sister of Mercy, Partnership for Earth Spirituality |
| AL26 | Erdaul | Leland | Public |
| AL27 | Jatkar | Shrayas | Public |
| AL28 | Martinez | Amadeo | Juan Tafoya Land Grant Corporation |
| AL29 | Martinez | Patricia | Juan Tafoya Land Grant Corporation |
| AL30 | Pelizza | Mark | Hydro Resources, Inc. |
| AL31 | McQuakay | Bruce | Southwest Cultural Preservation Project |
| AL32 | Velasquez | Juan | Strathmore Minerals Corporation |
| AL33 | Boyce | Aaron | Public |
| AL34 | Rodriquez | Susan | Public |
| CA01 | Anderson | Shannon | Powder River Basin Resource Council |
| CA02 | Heili | Wayne | Ur Energy |
| CA03 | Garrett | Richard | Wyoming Outdoor Council |
| CA04 | Anderson | Jim | Wyoming State Senate |
| CA05 | Brechtel | Bob | Wyoming House of Representatives |
| CA06 | Moxley | Mark | Wyoming Dept of Environmental Quality Land Quality Division |
| CA07 | Foust | Tom | Citizens for Uranium Resource Education |
| CA08 | Paulson | Oscar | Kennecott Uranium Company-Sweetwater |
| CA09 | Prindle | Wayne | Biodiversity Conservation Alliance |
| CA10 | Loomis | Marion | Wyoming Mining Association |

**Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation (continued)**

| Commenter ID Number(s) | Last Name | First Name | Affiliation |
|---|---|---|---|
| CAG01 | Group J | Group J | Group J |
| CH01 | Ledbetter | George | Public |
| CH02 | Frankel | David | Aligning for Responsible Mining; Western Nebraska Resources Council |
| CH03 | Copeland | Bob | Public |
| CH04 | Kosky | Carol | Public |
| CH05 | Cook | Thomas K. | Public |
| CH06 | White Plume | Debra | Owe Aku |
| CH07 | Frankel | David | Aligning for Responsible Mining; Western Nebraska Resources Council |
| CH08 | Griffin | Mike | Uranium One Americas |
| CH09 | Covington | Diana | Public |
| CH10 | Yellow Hair | Meelo | Public |
| CH11 | Swallow | Brian | Public |
| CH12 | Cohtsa | Bob | Public |
| CH13 | Wess | Roger | Local County Commissioner |
| CH14 | Male Voice | | Public |
| GA01 | Nez | Teddy | Public |
| GA02 | Campos | Rita | Public |
| GA03 | Rader | Patricia | Public |
| GA04 | Smith | Lynnea | Public |
| GA05 | Tsosie | Tracy | Public |
| GA06 | Garcia | William | Public |
| GA07 | John, II | Norman | Navajo Nation |
| GA08 | Becenti, Jr. | Ernest | McKinley County Commissioner |
| GA09 | Murrietta | Joe | Mayor of Grants, New Mexico |
| GA10 | Cecchini | Rose Marie | Diocese of Gallup, New Mexico |
| GA11 | House | Benjamin | Eastern Navajo Allottee Association |
| GA12 | Hyde | Don | Public |
| GA13 | Smith | Christine | Public |
| GA14 | Capitan | Rita | Public |
| GA15 | Capitan | Mitchell | Public |
| GA16 | Tohe | Robert | Sierra Club |
| GA17 | Pynes | Ronny | Public |
| GA18 | Burns | Joy | Public |
| GA19 | Robran | John | Public |
| GA20 | Sorrell | Annie | Public |
| GA21 | Wade | Chuck | Public |
| GA22 | Martinez | James | Public |
| GA23 | Shuey | Chris | Southwest Research and Information Center |
| GA24 | Harrison | Gerri | Public |
| GA25 | Steele | Don | Public |
| GA26 | Kenny | Chris | Public |
| GA27 | Hood | Tony | Public |
| GA28 | Hood | Edith | Public |
| GI01 | Jones | Jim | Public |
| GI02 | Eviard | Terry | Public |
| GI03 | O'Brien | Mike | Crook County Land Use Planning & Zoning Commission |

| Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation (continued) | | | |
|---|---|---|---|
| Commenter ID Number(s) | Last Name | First Name | Affiliation |
| GI04 | Hallinan | Tim | Public |
| GI05 | Lubner | Tom | Public |
| GI06 | Tope | Jay | Public |
| GI07 | Knudson | Rod | Public |
| GI08 | Edwards | Roy | Campbell County, Wyoming, Board of Commissioners |
| GR01 | Head | Candace | Blue Water Valley Downstream Alliance |
| GR02 | Ziegler | Ted | Uranium Resources, Inc. |
| GR03 | Klonowski | Joan | Public |
| GR04 | Bernard | Larry | Public |
| GR05 | Ulibarri | David | State of New Mexico Senator |
| GR06 | Becenti | Ernest | McKinley County, New Mexico, Commissioner |
| GR07 | Murrietta | Joe | Grants, New Mexico, Mayor |
| GR08 | Head | Milton | Public |
| GR09 | Byers | George | Neutron Energy |
| GR10 | Kuhn | Alan | Public |
| GR11 | Tohe | Robert | Sierra Club |
| GR12 | Shuey | Chris | Southwest Research and Information Center |
| GR13 | Bolina | Manual | Village of Milan, New Mexico, May pro tem |
| GR14 | Gilbert | Petuuche | Public |
| GR15 | Velasquez | Juan | Strathmore Minerals (also representing Uranium Producers of New Mexico, Uranium Producers of America, and National Mining Association) |
| GR16 | Martinez | Sofia | Public |
| GR17 | Meech | Walter | Public |
| GR18 | Head | Jonnie | Public |
| GR19 | Gonzales | Star | Cibola Community Economic Development Foundation |
| GR20 | Peets | Ava | Public |
| GR21 | Brewer | Jim | Public |
| GR22 | Boomer | John | Public |
| GR23 | Arnold | Dave | Public |
| GR24 | Brewer | Sandy | Public |
| GR25 | Brown | Gerald | Public |
| GR26 | Gebeau | Art | Public |
| GR27 | Williams | Ron | Public |
| GR28 | Robran | John | Public |
| GR29 | Foots | Randy | Uranium Resources, Inc. |
| GR30 | Fletcher | Terry | New Mexico Mining Association |
| GR31 | King | Larry | Public |
| GR32 | Polk | Harding | Public |
| GR33 | House | Benjamin | Eastern Navajo Allottee Association |
| GR34 | Brown | Elouise | Navajo National Dooda Desert Rock Committee |
| HC002 | Richardson | Don | Public |
| HC005 | Viviano | Pam | Ranchers & Neighbors Protecting Our Water of Crook County |
| HC006 | Brygider | Brandon R. | Public |
| HC007 | Mahoney | Betsy | Public |
| HC008 | Thorne | R.E. | Public |
| HC009 | Etchepare | John | Director, Wyoming Department of Agriculture |

**Table G3.1-3. Public Commenter Identification Numbers by Commenter and Affiliation (continued)**

| Commenter ID Number(s) | Last Name | First Name | Affiliation |
|---|---|---|---|
| HC010 | Group A | Group A | Group A |
| HC011 | Wunder | Matthew | New Mexico Department of Game and Fish |
| HC012 | Johnson | James | Public |
| HC013 | Whalen | Jeanne | Public |
| HC014 | Hyde | Don | Public |
| HC015 | Capozzelli | J. | Public |
| HC016 | Griffin | Marvin/Evelyn | Public |
| HC017 | Brygider | Brandon R. | Public |
| HC018 | Hawkins | Ross C. | Crook County Land Use Planning and Zoning Commission |
| HC019 | Group I | Group I | Group I |
| HC020 | Brygider | Brandon | Public |
| NE01 | | Cindy | Public |
| NE02 | Hansen | Barb | Public |
| NE03 | Thompson | Phyllis | Public |
| NE04 | Harshbarger | Robert (Major) | Public |
| NE05 | Darlington | Jim | Public |
| NE06 | Anderson | Shannon | Powder River Basin Resource Council |
| NE07 | Male voice | | Public |
| NE08 | Ballander | Sunday | Public |
| NE09 | Harshbarger | Jean | Public |
| NE10 | Female Voice | | Public |
| NE11 | Carter | Iva | Public |
| NE12 | Hollenbeck | Mark | Powertech Uranium Corp. |
| SP01 | Clarence | Bill | Public |
| SP02 | Osmund | Marshall | Public |
| SP03 | Tope | Jay | Public |
| SP04 | Mull | Nick | Public |
| SP05 | Hawkins | Mary | Public |
| SP06 | Clemenson | Rod | Public |
| SP07 | Lanning | Danny | Public |
| SP08 | Whiteface | Charmaine | Public |
| SP09 | Pourier | Michael | Public |
| SP10 | Cash | John | National Mining Association |
| SP11 | Winter | John | Uranium One |
| SP12 | Tope | Wilma | Public |
| SP13 | Tope | Jay | Public |
| SP14 | Knudson | Rodney | Public |
| SP15 | Unknown1 | Unknown1 | Public |
| SP16 | Unknown2 | Unknown2 | Public |
| SP17 | Pelton | Brandy | Public |
| SP18 | Hollenbeck | Mark | Powertech Uranium Corp. |
| SP19 | Unknown3 | Unknown3 | Public |

**Table G3.1-4. Group Names, Individuals in Group, and Affiliations for Comment Letters Signed by Multiple Individuals or Organizations**

| Group Name (Commenter ID) | Individuals in Group | Affiliation |
|---|---|---|
| Group A (HC010) | Nancy Hilding | Prairie Hills Audubon Society |
| | Wayne Prindle | Biodiversity Conservation Alliance |
| Group B (003) | Shannon Anderson | Powder River Basin Resource Council |
| | Michele Boyd | Physicians for Social Responsibility |
| | Buffalo Bruce | Western Nebraska Resources Council |
| | Geoffrey H. Fettus | Natural Resources Defense Council |
| | Sarah Fields | Uranium Watch |
| | David Frankel | Aligning for Responsible Mining |
| | Alyssa Go | Natural Resources Defense Council |
| | Jennifer Goldman | Public Health & Toxics Campaign |
| | Eric Jantz | New Mexico Environmental Law Center |
| | Paul Robinson | Southwest Research and Information Center |
| | Debbie Sease | Sierra Club |
| | Pam Viviano | Ranchers & Neighbors Protecting Our Water |
| | Charmaine White Face | Defenders of the Black Hills |
| Group C (1305) | Geoffrey H. Fettus | Natural Resources Defense Council |
| | Alyssa Go | Natural Resources Defense Council |
| | Christopher E. Paine | Natural Resources Defense Council |
| Group D (1320) | Gordon Edwards | Great Lakes United Green Energy and Nuclear Free Task Force |
| | Michael J. Keegan | Great Lakes United Green Energy and Nuclear Free Task Force |
| Group E (1312) | Michele Boyd | Physicians for Social Responsibility |
| | Alyssa Go | Natural Resources Defense Council |
| | Dan Heilig | Western Resource Advocates |
| | Nancy Hilding | Prairie Hills Audubon Society |
| | Michael Jensen | Amigos Bravos |
| | Christopher E. Paine | Natural Resources Defense Council |
| | Joanne Spalding | Sierra Club |
| | Wilma Tope | Ranchers & Neighbors Protecting Our Water |
| Group F (1311) | Jeff Parsons | Western Mining Action Project |
| | Travis E. Stills | Energy Mineral Law Center |
| Group G (1300) | Sarah M. Fields | Uranium Watch, Glen Canyon Group/Sierra Club |
| | No Signatory | Greenaction—for Health and Environmental Justice |
| Group H (1314) | Eric Jantz | New Mexico Environmental Law Center |
| | Michael Jensen | Amigos Bravos |
| | Michael Mariotte | Nuclear Information and Resource Service |
| | Lauren Pagel | Earthworks |
| | Ken Hughes | Rio Grande Chapter of the Sierra Club |
| | (No Signatory) | Aligning for Responsible Mining |
| | Janet Greenwald | Citizens for Alternatives to Radioactive Dumping |
| | Joni Arends | Concerned Citizens for Nuclear Safety |
| | Rochelle Becker | Alliance for Nuclear Responsibility |

**Table G3.1-4. Group Names, Individuals in Group, and Affiliations for Comment Letters Signed by Multiple Individuals or Organizations (continued)**

| Group Name (Commenter ID) | Individuals in Group | Affiliation |
|---|---|---|
| Group I (HC019) | Harold J. Burch, Jr. | Crook County Board of Commissioners |
| | J.W. Hadley | Crook County Board of Commissioners |
| | John A. Moline, Jr. | Crook County Board of Commissioners |
| Group J* (CAG01) | Senator Grant Larson | Wyoming State Congress |
| | Representative Tom Lockhart | Wyoming State Congress |

*A representative of this group provided oral comments at the public meeting in Casper, Wyoming.

**Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the Draft GEIS Via E-Mail**

| | | |
|---|---|---|
| Aaron, Jeremy | Anklam, Mary | Ball, Alaine |
| Abbott, Heather | Antonoplos, Barbara | Bannister, Julie |
| Abraham, Eve | Antrim, Craig | Banse, Liz |
| Acevedo, N.K. | Appia, Biff Michael | Banyan, Leafgreen |
| Adams, Holly | Arachy, Chet | Barbee, John |
| Adelsman, Stephen | Arbon, Leilani | Barber, Robin |
| Albano, Louis G. | Arbour, Stephen | Barbour, Sharon |
| Albert, Anthony | Archambault, Steve | Barclay, Elaine |
| Albertus, Jeanne | Archard, Lee | Barfield, John |
| Albright, Matt | Archuleta, Jeff | Barker, Rebecca |
| Alcorn, Margaret | Arconti, Ken | Barker-Dagen, Dorothy |
| Alderson, George/Frances | Ares, Michael | Baron, Dolores |
| Alexander, Cheryl Ann | Arlen, Barbara | Barrett, Sylvia |
| Alexander, Valerian | Arnold, Tina | Barrett, Veronica |
| Allen, Dennis | Arvelo, D. | Barrs, Sarah |
| Allen-Young, Jessie | Atkinson, Ellen | Bartels, John |
| Alley, Virgil | Avery, Thomas | Batchelder, Patti |
| Alvarez, Maria Fernanda R. | Avila, Ron | Bates, April |
| Alzuro, Herman | Babiak, Katherine | Bates, Stephen |
| Amies, Frank | Backus, Margot | Baurer, Allie |
| Andelin, Clark | Bacon, Nicholas | Bean, Dave |
| Anderson, John H. | Baechle, Mary | Beatini, Tom |
| Anderson, Kathleen | Bafik-Vehslage, Michelle | Bechtel, Paul |
| Anderson, Margaret | Baizel, Bruce | Becker, Judith |
| Anderson, Ryan | Baker, Alice | Beckett, Jonathan |
| Anderson, Shannon | Baker, Ruth | Bedinger, Gail |
| Anderson, Sierra | Balah, Nikolai | Bednaz, Noel |
| Andrade, Dean | Balboa, Alex | Beeche, Eric |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Bell, Anthony | Boustany, Patricia | Burris, Laurence |
| Bell, Dee | Bowen, Donald | Burrus, Judiann |
| Bell, Dottie | Bowman, Candy | Burton, Stephen |
| Bender, Donna | Bowman, Kenneth | Burton, Vic |
| Bengtsson, Petra | Bowyer, Sallye | Burwinkel, Mark |
| Bennett, Bruce | Boyd, Roy | Buscher, David |
| Benoit, Ken | Brady, Carol Ann | Busse, Heather |
| Bentley, Thomas | Brakopp, Evelyn | Butler, Donna |
| Berger, Bria | Branch, Peter | Butler, Maria |
| Berkman, Ivan | Brauer, Joel | Butler, Robin |
| Berlingeri, Julio | Brault, Gene | Calhoun, Charles |
| Bernet, Maurita | Braun, Clait E. | Calhoun, Jerry |
| Berry, Kathy | Brecht, Dan | Cali, Angela |
| Bescript, Linda | Brehm, Mary | Cali, Judy |
| Best, Judith | Brennan, Denise | Cambell, Liz |
| Beukeveld, Bernard | Brickell, Julie | Campbell, Caitlin |
| Biedron, Aleksandra | Briffett, Robert | Campbell, Catherine |
| Bierbrauer, Marjorie | Briggs, Jr., William | Campbell, Dudley/Candace |
| Biernot, Marilyn | Brineman, T. Scott | Cantor, David |
| Billharz, David | Brinton, Richard | Caolo, Rosemary |
| Bindrich, Glen | Britton, Marilyn | Capeilleres, Fabien |
| Blair, Mary | Brizzi, Paul | Capotorto, Jeanette |
| Blake, Kelmie | Brookman, Gerald | Carlisle, Elliott Elizabeth |
| Blanchard, Annette | Brooks, Patricia | Carnevale, Robert |
| Blanchford, Phoebe | Brower, Daniel | Carney, Michael |
| Blauwet, Lori | Brown Jr., Jack | Carr, Laurie |
| Blomberg, Goran | Brown, Babette | Carrillo, Teresa |
| Blum, Jacob | Brown, Jan | Carroll, Mark |
| Blumner, Stuart | Brown, MaryGrace | Carter, Helen |
| Bobko, Brian | Brown, Melissa | Carter, Jeff |
| Bodane, Rich | Brown, Tina | Carter, Margaret |
| Bodde, Mary | Brozell, Chris | Casanova, Neus |
| Bodiford, Christalle | Bruan, Linda | Casey, Mary Ellen |
| Bolbol, Deniz | Bruck, Jr., Darrel | Caton, Peter |
| Bond, Pamela | Bruckman, Leonard | Cayford, David |
| Boniske, Kitty | Bryant, Ben | Celebre, Alice Diane |
| Bonney, Patty | Bryant, Karen | Cerise, Barbara |
| Bonvouloir, A. | Bryant, Tamera | Chandler, Rhiannon |
| Boone, Jim | Bub, Frederic | Chandler, Susan |
| Booth, Robert | Bubb, Ken/Donna | Chaney, Trish |
| Borden, Edward | Buer, Cierra | Chang, Patricia |
| Borgeson, Dean | Bullock, Norvell | Chapman, Zoe |
| Bosch, Henry | Burke, Ken | Chen, Frances |
| Boschert, Carol | Burlew, Jessica | Chenoweth, John |
| Bostick, Amy | Burns, P. | Chew, Ron |
| Chiang, Ben | Croft, Denise | DeGrazia, Denise |

| **Table G3.1-5. Name of Individuals Submitting Duplicate Comments *on the GEIS Via E-Mail (continued)*** | | |
|---|---|---|
| Chicano, Dawn | Cronin, Gary | del Carmen Meyer, Maria |
| Chindelevitch, Leonid | Crotty, John | Delgado, Jr., Victor |
| Chiricuzio, Sossity | Crotty, Megan | Dellinger, Allison |
| Chitwood, Melissa | Crummett, Diane | Depauw, Jolie |
| Chorostecki, Gene | Cruz, Karla | DePoalo, Angel |
| Christensen, Gary | Cruz, Stephanie | DeSalvo, Traffy |
| Christian, Steven | Cuff, Kermit | DesMarais, Elisabeth |
| Chu, Mariel | Cullen, Dale | Deweese, Fred |
| Chyz, George | Culver, Hillary | Deza, Nilton |
| Cielukowski, John | Cumberland, Elizabeth | Dhesi, Nritkaar |
| Cimino, Andrea | Cummings, Brian | Dickerson, Mel |
| Clark, Bob | Cummings, Elizabeth | Diegelman, Margaret |
| Clark, Donna | Curia, Peter/Cheri | DiFiore, Maria |
| Clark, Rick | Curran, Anne | Dillard, Gavin |
| Clovis, Chris | Curran, Claire | Dillon, Theresa |
| CoBabe, Terry | Current, Jon | Dils, Reed |
| Cober, M. | Curry, Timothy | DiMarco, Paul |
| Cockerill, Joanne | Curtis, Kevin | Dimbach, B. |
| Cockrell, C. | Custis, Tim | Dimicco, Gloria |
| Coffin, Jen | Cutts, Michael | DiNoto, Dominick J. |
| Cohen, Gloria | Dagen, Daniel | Dion, Patricia |
| Cohen, Gloria | Dahlgren, Shelley | Dishion, Catherine |
| Colantuono, Frank | Dailey, Christa | DiVittorio, Fred |
| Cole, Fransa | Dale, Emily | Dixon, Beverly |
| Cole, Jo Ellen | Danahar, Gema | Doane, Nicole |
| Coleman, Laura | Dane, William | Dodson, Bert |
| Colledge, Jeffrey | Danese, Robert | Doepke, Robert |
| Comsstock, Ginger | Dangerfield, Dorothy Shays | Doerr, Robert M. |
| Comstock, Christian | DAnna, Marie | Dollyhigh, Adrienne |
| Constance, Bianca | Danzinger, Ryan | Domblaser, Bright |
| Cook, Jonathan | Darovic, Elizabeth | Donart, Arthur |
| Cook, Patricia | Darrar, James | Donkor, Wisdom |
| Cooper, John | Davenport, Robert | Donn, Gloria |
| Coopwood, Nathan | David, Phil | Donnell, Bruce |
| Cortijo, Monica | Davies, Jos/Jorge Aldecoa | Donofrio, Deborah |
| Cothern, Kristin | Davies, Lisa | Donston, Kacey |
| Courchaine, Caroline | Davis, Jay | Dooney, Gerard |
| Cozad, Michael | Davis, Rose | Dority, Roark |
| Crabill, Phil | Davis, Shirley | Dorsey, Tom |
| Crafts, William | Day, Jean | Dougherty, Christopher |
| Craig, Peter | Dean, Mary | Dowler, Nelson |
| Crane, Jeff | Dean, Rayline | Dowling, Rex |
| Crane, Michael | DeBernardi, Brenda | Downing, Steve |
| Crawford, Gayle | Decker, Eleanor | Downs, Martha |
| Cremar, Elizabeth | DeFrancesco, Vic | Doyle, Laurance |
| Drake, Max | Faller, Helen | Friedler, Tamara |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Dreyfuss, Martin | Fancher, Keith | Friel, Rachel |
| Dringus, Brandi | Farber, Shaurain | Friend, Deborah |
| Drum, Erika | Farmer, Vanessa | Friesen, Rick |
| d'Souza, Gladwyn | Fecko, Albert | Fritzler, Deb |
| du Bois, Julie | Federbush, Laurel | Frye-Henderson, Allyson |
| Dube, Mona | Fedorka, Thomas | Fryer, Bob |
| Duda, Karen | Fee, Audrey | Fuhman, Freya |
| Duderstadt, Luann | Feichtinger, Dennis | Funk, Ilse |
| Duke, Kathleen | Feinstein, Joe | Fusco, Carol |
| Duke, Kathy | Feldman, Mark | Futrell, Sherrill |
| Dukovich, John | Felten, Heidi | G, Theresa |
| Dulberg, Joan | Femmer, John | Gaede, Marnie |
| Dunham, Wayne | Ferguson, Tom | Gaffney, Randy |
| Dunlap, Anne | Ferhani, Laurie | Gann, Sara |
| Dunn, Jane L. | Ferraro, Lou | Gannon, Ellen |
| Duran, Gonzalo | Finley, Duane | Gardner, Gabriel |
| Durgadas, Ganapathy | Finley, Sandra | Garvey, Jenna |
| Eades, Debra | Fiorini, Mark | Gasparre, Aimee |
| Eagle, Nee | Fischer, Richard | Gasperoni, John |
| East, Lisa | Fisher, Jack | Gassman, Jay |
| Ebelewicz, Sarah | Fishman, Ted | Gebhardt, Andy |
| Eggleston, Beth | Flamini, G.M. | Gedicks, Al |
| Einseln, Hayley | Fleisher, Sharon | Gendvil, Derek |
| Eister-Hargrave, Leah | Flewitt, Claire | Geronimo, Ginger |
| Elkind, Linda | Flowers, Bobbie D. | Gertz, Lola |
| Ellison, Richard | Foerster, Sigrid | Gestring, Bonnie |
| Ellsworth, Linda | Folmsbee, Amy | Gibbons, Patricia |
| Elms, Laurie | Fonfa, Ann | Gibbs, Sheila Joyce |
| Elterman, Ron | Fong, Lindsey | Gibbs-Halm, Deborah |
| Elton, Judith | Forbes, Keith | Gibson, Jody |
| Embry, Judith | Ford, Mary Ann | Gilardi, Gary |
| Engelhardt, Erika | Fordham, Chad | Gillett, Julia Marie |
| Engineer, Fali | Forester, Lynne | Givner, Morris |
| Enright, Elizabeth | Foster, Lorraine | Gleason, Melinda |
| Eriksson, Peter | Fox, Eleanor | Gliva, Stephen |
| Erwin, Jeffrey | Fox, Larry | Glover, Tim |
| Essig, Cnythia | Fox, Liz | Goa, Kirsten |
| Esterby, Susan | Frachtman, Brianna | Goenner, Emily |
| Estrin, Millie | Franchi, Irena | Gold, Warren |
| Etheridge, Kelly | Frank, Sharon | Golriz, Sani |
| Evans, Pam | Frasieur, Forest | Gomes, Sara |
| Eventoff, Franklin | French, Jeanette | Goncalves, Susana |
| Ezust, Paul | Freudenberger, Gene | Gonzales, Patty |
| Fairfield, Mary Eaton | Freudenburg, Jerry | Goodman, Sharon |
| Falcone, William | Frewin, Terry | Gordon, Rashima |
| Gordon, Rick | Hand, Susan | Hochberg, Adrienne |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Gordon, Ronald | Hanes-Troxell, Romona | Hoffman, Donna |
| Gorton, Nancy | Hanna, Helen | Hogan, Tim |
| Gotesky, Stephen | Hannah, Jilian | Holland, Katherine |
| Gould-Martin, Katherine | Hansen, Martha | Holland, Martha |
| Gourley, Flynn | Harelick, Bari | Holmes, Brigid |
| Grady, Harvey | Harlib, Amy | Holtkamp, Catherine |
| Grady, Pat | Harlow, Linda | Homback Sr., Jon |
| Graehling, Judy | Harold, Richard | Home, Alan |
| Graham, Judith | Harper, Gerald | Homsby, Kay |
| Graham, Kimberley | Harrington, Jack | Hood, Byron C. |
| Graham, Lynn | Harris, Bradley | Hoover, Jacki |
| Graham-Gardner, Rosemary | Harris, Melissa | Hope, John |
| Graubner, Gabriel | Harris, Susan | Horn, Dane |
| Gray, Colleen | Harrison, Stuart | Horvath, Carol |
| Gray, Karen | Hartley, Margaret | Hosler, Pam |
| Gray, Robert | Hartman, Eric | Houston, Karin |
| Grazier, Larry D. | Hartsfield, Joyce | Houtakker, Catherine |
| Green | Hasbrouck, Mary Ellen | Hovekamp, Larry |
| Greer, Carolyn | Hastillo, Jim | Hovland, Laura |
| Gregory, Chilton | Havens, Susan | Howard, Alison |
| Grevelle, Diane | Hawk, Carolyn | Howard, Carl |
| Gricevich, Anne | Hawley, Daniel | Howard, Kristin |
| Griffin, Deneen | Hayes, Sally | Howard, Margaret |
| Griffin, Stuart | Hazzan, Dave | Howard, Patricia |
| Griffith, Jennifer | Heagy-Len, Linda | Howard, Sarah |
| Grill, Richard | Heald, Mark | Howenstein, David |
| Grisham, Sarah | Healy, Mary | Howes, Elaine |
| Griwsold, Mary | Hedahl, Bj | Howland, Sara |
| Groshardt, Joanne | Hediger, Nancy | Hudson, H. |
| Gruenwald, Barbara | Heinlein, Philip | Hudson, Jessica |
| Grumbles, Amber | Heinrich, Hans-Peter | Hudson, Patrick |
| Grundmann, Lisa | Heinze, Scott | Hughes, Aileen |
| Guadagno, Brian | Helmers, Joke | Hughes, Patricia |
| Guiliano, Samantha | Helwig, Melissa | Hummell, Steve |
| Gutmann, Vicky | Hernandez-Kosche, Dena | Hunt, Alexandra |
| Haapala, Anssi | Hersey, Lorraine | Huntsberger, Bev |
| Hager, Jon | Herten, Margaret | Hutchins, Kimberly |
| Haines, Kyle | Hess, Marla | Impola, Paul |
| Hale, Bill | Hetrick, Nathan | Ingall, Dan |
| Hallam, Alice | Hettfield, Dalia E. | Inogamova, Zemfira |
| Hamilton, Diccon | Heyde, Christiane | Insley, Claire |
| Hamilton, Gaye | Hicks, Lacey | Ippolito, Emil |
| Hamilton, Mary | Hill, B.C. | Jackson, Weldon H. |
| Hammemeister, Lisa | Hittel, Kenneth | Jacobs, Mark |
| Hammond, Thomas | Hittmeyer, G.J. | Jacobs, Phillip |
| Jaffee, Jeff | Kaye, Joy | Koteles, Patty |

**Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued)**

| | | |
|---|---|---|
| James, Robert | Kazmercyk, Paul | Kovacs, Michael |
| James, Russell | Keating-Secular, Karen | Krakowski, Pamela |
| Jamison, Michele | Keesing, Donald | Kramer, John |
| Jandourek, Alexia | Keith, Colleen | Kranz, Nicholas |
| Janowitz-Price, Beverly | Keller, Drew | Kreiss, Kevin |
| Jaramillo, Nhelson | Kelley, Bryan | Kroll, Kathy |
| Jenkins, Jon | Kelly Barbara | Kromarek, Christina |
| Jennings, John | Kelly, Alice | Kronenberger, Kathy Lou |
| Jensen, Randal | Kelly, Don | Kropovitch, Anthony |
| Jenvey, Lottie | Kemp, Johnie | Krpan, Anita |
| Joesting, Dr. Joan | Kemple, Jason | Kruger, Cynthia |
| Johns, Julia | Kennedy, Joanna | Kubein, Adele |
| Johnson, Ann | Kenney, Paige | Kunkel, Shirley |
| Johnson, Bettemae | Kent, Michael | Kunz, Keith |
| Johnson, Chessa Rae | Keys, Sharon | Kuper, Donna |
| Johnson, Elizabeth | Khalsa, Mha Atma | Kuras, Brendan |
| Johnson, Sarah | Kibby, Larry | Kurtzhall, Teresa |
| Johnson, Vicki | Kieval, Shena | Kuruna, Daniel |
| Johnston, James | Killingbeck, Judy | Kurz, Don |
| Johnston, Leland | Kim, Miho | Kusner, Josie |
| Jones, Gloria | Kimble, Dawn | Kusold, Dorothy |
| Jones, Jane | King, June | Kutos, Stephen |
| Jones, Margaret | King, Paul | Kuznetsky, Richard |
| Jones, Patricia | Kinne, David | LaDeur, Penny |
| Jordan, Meyer | Kinney, Douglas | Lafond, David J. |
| Jordan, Peggy | Kircher, Mark | LaFreniere, C. Louise |
| Jorgenson, Rhodie | Kirkwood, Kaye | LaFreniere, Joanne |
| Josefa, Rose | Kirschbaum, Saran | Laing, John |
| Joseph, Nancy | Kirschner, Samuel/Muriel | Lambert, Gwen |
| Julian, Lucy | Klass, Kristin | Lambert, Susan |
| Jurcewski, Carol | Klein, James | Lampman, Gary |
| Kafol, Bernhard | Klein, Phil | Lancaster, Bryan |
| Kalovsky, Robert | Kleine, Walter | Landa, Hazel |
| Kaminski, John | Klingel, Jon | Landa, Marty |
| Kane, Tom | Klinke, David | Lane, Marcie |
| Kaneko, Masayo | Kluepfel, Rosemary | Lang, Lynn |
| Kansky, Kathleen | Knerr, William | Langlois, Cheri |
| Kaplan, Richard | Knox, Patricia | Lapointe, Kenneth |
| Kaplan, Robert | Koch, Joann | Larue, Alfred |
| Karban, Julian | Koehl, Lisa | LaSchiava, Dona |
| Karlson, Heather | Kolarik, John | Laughtland, Josh |
| Katzenberg, Richard | Koppanyi, Kara | Launay, Catherine |
| Kauffman, George | Korin, Scott | Lawrence, Carol |
| Kaufman Scher, Jonathan | Korman, Scott | Lawrence, Steven |
| Kaufman, Chrissy | Kortsch, Karen | Le Fevre, Dale |
| Lea, Isolt | Mack, Carrie | McCartin, Mike |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| LeBlanc, David J. | Mackay, Donald | McCollom, Leslie |
| Ledesma, Evelyn | MacLean, Anne | McCollom, Scott |
| Lehmann, Janine | MacLeod, Lea | McCormick, Douglas |
| Leibowitz, Emily | MacPhail, Kristyn | McCoy, Evelyn |
| Leikam, Bill | MacPherson, David | McCready, Edwin |
| Leithauser, David | Macy, Arianne | McCurdy, Dassi |
| Lenamon, Judy | Mages, Dan | McDavit, Susan |
| Lenk, Vivienne | Maizel, Josh | McElhill, Betty |
| Lenthart, Buzz/Barb | Maleck, Dorothy | MCGarvey, Greg |
| Leone, Joe | Malecki, Jimmy | McGee, Aaron |
| Lerner, Michelle | Malinauskas, Helen | McGoldrick, Bill |
| Lesperance, Joy | Malmuth, Sonja | McKee, Laura |
| Lewis, Jane | Malone, Edmond | McKelvey, Don |
| Lewis, Red | Malter, Rosalie | McLaughlin, Lea |
| Lewis, Sandra | Manis, Laurie | McLeod, Hazel |
| Lewis, Suzanne | Mannering, Natalie | McManus, Michael |
| Lewis, Verlene | Manning, Marcy | McMullen, Gail |
| Lillien, Irving | Many, Dorothy | McNabb, Tracie |
| Linarez, Karen | Many, Wallace | McNally, Robert |
| Liner, Norma | Maquire, Joel | McNamara, Andrew |
| Linger, Robert | Margie, Jr., Walter | McNeill, Douglas |
| Linn, Stephanie | Margolis, Greg | McNeill, Norma |
| Linzer, J. Naom | Markovic, Robert | McRae, Susan |
| Lischalk, Beki | Marshall, Rebecca | McWilliams, Corinne |
| Little, Erika | Martin, Brad | Meares, Rhese |
| Livingston, James | Martin, Larry | Meek, Judith |
| Lloyd, Randall | Martin, Melanie | Meighen-Wise, Sara |
| Lofton, Clyde | Martin, Melodie | Mejides, Andres |
| Lomber, Jonathan | Masck, Beth | Mellsop, Hayden |
| Lopez-Tello, Valle | Masi, Janie | Melody, Patricia |
| Loula, Catherine | Masley, Michael | Menard, Rose Marie |
| Lovejoy, Nancy | Massey, Eileen | Mencik, Jitka |
| Lowde, Sean | Mateos, Risha | Merrill, Karen |
| Lowry, Blythe | Matthews, Jonathan | Meyer, Twyla |
| Lowry, Marsha | Mattingly, Georgia | Meyette, Ann |
| Lund, Rob | Mattoon, Jerry | Michaels, Patricia |
| Lustig, Hermine | Mattos,Kenneth | Michaux, George |
| Lyles, Jeff | Mauer, Michael | Middlebrooks, Ethan |
| Lynn, Sandra | Maxwell, Susan | Mierisch, George |
| Lynnea, Cara | Mayer, Fred | Mieyal, Timothy |
| Lyslo-Mora, Han/Kirsten | Mazeaud, Dominique | Miley, Suzanne |
| Macdonell, Julia | Mazzetti, Michael | Miller, Bill |
| MacDougall, John | Mazzotta, Antony | Miller, Brad |
| MacFarland, Cynthia | Mc Williams, Lillie | Miller, Nancy |
| MacIver, Yaney | McBride, Joan | Miller, Nicole |
| Miller, Patricia | Nash, Jonathan | Omic, Tara |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Milliken, Elizabeth | Nash, Tom | O'Neil, Jenny |
| Mills, Cheri | Nass, Thomas | O'Neil, Sean |
| Milne, Martha | Navarette, Justin | O'Neill, Carol |
| Milner, Tara | Navez, Ren | Oravec, Lora |
| Mitchell, Glenn | Neary, Michael | Oric, Rhet |
| Mitchell, Heather | Needham, Gail | Orlando, Robert |
| Mitsuda, Michael | Nelson, Andrew | Orlinski, Patricia |
| Mjos, Brita | Neral, David | Orr, Patty |
| Mobley, David | Newburg, Bonnie | Ostrander, Jr., Bill |
| Moiseyev, Maya | Newcomer, Barbara | Ott, Michael |
| Monahan, Bobbie | Newman, Ricki | Otting, Jennifer |
| Moore, Debra | Nichols, Elizabeth | Overton, Steve |
| Moore, Howard | Nichols, Nancy | Owczarczyk, Zbyslaw |
| Moore, James | Nicholson, Eric | Owen, Ken |
| Moore, Joan/Kitchen, Ruth | Nicholson, Terrence | Oxenbury, Jane |
| Moreno, Tirso | Nickerson, Judy | Paglia, Victor |
| Morford, Anthony | Nielsen, Erik | Paisley, Lorna |
| Morford, Anthony | Noah, Ian | Pakaki, Jordan |
| Morgan, Bruce | Noble, Ashley | Palermo, Mary |
| Morris, Don | Noble, Lisa | Palmer, Theodore |
| Morris, Karen | Noe, Lynn | Pan, Pinky Jain |
| Morris, Sue/John | Noel, Letitia | Parke, Melinda |
| Morrison, F. | Nolan, Mike | Parker, Cindy |
| Morrison, Fred | Norden, Michael | Parker, Rose |
| Mortimer, Claire | North, Liisa | Patane, Melinda |
| Moss, Sylvia | Norton, Susan | Patrie, Lewis E. |
| Mueller, Robert | Nowacki, D. Michael | Pavillard, Leo |
| Mulcahy, Sarah | Nowakowski, Jo | Peach, Hugh Gilbert |
| Mullarkey, Mike | Nunes, Lara | Pease, Mary |
| Muller, J. | Nutaitis, Judy | Peasley, Malinda |
| Mullins, Emilie | O, Ryan | Pedersen, John |
| Munger, Nancy | Oberheide, Margery | Pederson, Jill |
| Murphy, Judith | Obermeyer, Julie | Pedroza, Donna |
| Murphy, Tom | O'Brien, Beth | Pei, Delfina |
| Murray, Freeman | O'Brien, John | Pendergast, Betsy |
| Murrow, Gary | O'Brien, Shannon | Pendry, Bobby |
| Murti, Vasu | Ochmanek, E. | Peralta, Sharon |
| Musker, Catherine | Ochoa, Deborah | Perez, Peter |
| Myers, Corinne | Ochs, John | Perkins, Guy |
| Myers, Debra | Ofuchi, Ryu | Perniciaro, Yagino |
| Nafey, Rebecca | Okstel, Carol | Peters, Anastasia |
| Nakada, Tomas | Olander, Alan | Peterson, April |
| Nall, Deborah | Olson, Erin | Peterson, Kathryn |
| Nallamilli, Sonny | Olson, Ron | Peterson, Walker |
| Namminga, Lynn | O'Malley, Polly | Petz, Nathan |
| Pew, Stephen | Reid, John | Rothschiller, Linda |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Pezet, Rev. Antoinette | Reilly, Duncan | Rothstein, Richard |
| Pfennig, Joyce | Reilly, Jane | Roulac, John |
| Philip, Diana | Reinert, Dianne | Rousseau, Claudia |
| Philipson, Tricia | Reinman, Fred M. | Rousseau, David |
| Phillabaum, Katja | Reisman, Emil | Rouvier, Julia |
| Piekarski, John | Reiss, Brenda | Roy, Jocelyne |
| Pihl, Eric | Relander, Hanna | Royden-Bloom, Amy |
| Pillers, Barbara | Remais, Michael | Rudolph, Christian |
| Pixley, Elizabeth | Reuther, Carol | Ruiz, Vincent |
| Plourde, Adam | Rhodes, Carson | Rushing, Nancy |
| Plume, Alex White | Rice, Susan | Russell, Michael |
| Pogue, Ted | Richardson, Gail/John | Rutkowski, Robert |
| Poisson, Michael | Richardson, Roberta | Rutledge, Michael |
| Polens, Jared | Rickun, Robert | Ryan, Bela |
| Porter, Brent | Rider, Dianne | Ryan, Paul |
| Portney, Thomas | Ridgeway, Jessica | Ryan, Rita |
| Potter, Deborah | Ridgeway, William | Ryder, Samantha |
| Potucek, Kimberly | Rifkind, Michael | Rystrom, Barbara |
| Powell, D.A. | Riley, Ray | Sachau, Barb |
| Powers, Elena | Ritchey, Jr., Albert | Safran, Claire |
| Powers, Thomas | Ritscher, Lee | Saggan, Laurie |
| Prentiss, Eleanor | Rivard, Michael | Sakren, Paul |
| Preston, Lynne | River, Sage | Salas, Jan |
| Pretzer, Carolyn | Rivera, Juan | Salner, Rita |
| Preuss, G. | Rivera-Shapiro, Mirian | Salomon, Sherry |
| Price, Elisabeth | Roark, Warren | Salter, James |
| Price, Nancy | Robertson, Jennifer | Salteris, Laura |
| Proffitt, Susan | Robertson, Virginia | Sampat, Payal |
| Prosperie, Johnnie | Robinson, Janet | Sanchez Sr., Daniel J. |
| Provencio, Rick | Robinson, Maya | Sanderson, Diana |
| Quincey, Jayda | Rocha, Monica | Sandoval, Gustavo |
| Quinn, Debra | Rodgers, Diana | Santos, Joann |
| Rader, Darrell | Roehl, Richard Ralph | Sarovec, William E. |
| Radko, Danuta | Roemer, Megan | Saude, Debra |
| Raffaele, Marilyn | Rogan, Robert | Saveri, Elizabeth |
| Rainbow, Billy | Rogers, Charles | Sawdon, Rosemarie |
| Ramer, Carla | Rojas, Jose | Sawyer, Christine |
| Randolph, Dan | Rolen, Ce/Ht | Sawyer, Rebecca |
| Rapoport, Shana | Roode, Lora | Saykaly, Frances |
| Rapp, Kathy | Rorke-Davis, Shawn | Sbrissa, Joellen |
| Rattner, Ron | Rose, Kathryn | Schaefer, Regina |
| Rausch, Mary | Rose, Valerie | Schaefer, Stacey |
| Rechs, David | Rosenberg, Jenn | Schairer, Karen |
| Reed, Glenn | Rosenfeld, Henry | Schall, James |
| Reed, Sandy | Rosenthal, Bill | Scharf, David |
| Schauer, William | Shine, Kim | Spisak, Dennis |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Schavone, Tracey | Shinholser, Michael | Sponsler, Kristin |
| Scher, Judith | Shrewsbury, George | Spurgin, Cam |
| Schilling, Francis | Shriver, Christina | Sroat, Ena |
| Schinasi, Barbara | Shubert, Richard | Stack, Mary |
| Schloss, Richard | Siegrist, Toni | Stahl, Frieda |
| Schmidt, Sara | Silk, Robert | Stallard, Carolyn |
| Schneider, Iyawata | Silver, David | Stanley, Lisa |
| Schneider, Kimberly | Simmons, Kathleen | Stanton, J. |
| Schneider, Lynn | Simms, Twik | Statman, Paul/Becky |
| Schneider, Michelle | Simon, Samuel | Steenstra, Eric |
| Schneller, Paul | Simons, Margaret Rose | Stefani, Victoria |
| Scholz, Ernest | Simpson, Walter | Stein, Howard |
| Schuessler, Betty | Singer, Scottie | Stein, Jennie |
| Schulenberg, Richard | Siracusa, Rene | Stein, Marie |
| Schulz, Corina | Sitrick, Jr., James B. | Stephenson, Deborah |
| Schulz, Ed | Skadden, Stuart | Stephenson, James |
| Schulze, Ted | Skelton, Julie | Steuter, Don |
| Schutt, Whitney | Sklar, Stephanie | Stevenson, Brittany |
| Schwartz, Don | Slade, Kenneth | Stevenson, Jan |
| Schwartz, Jack | Slater, Terry | Stevenson, Martin |
| Schwartz, Martha | Small, Sally | Stewart, Dana |
| Schweitzer, Peter | Smith, Angela | Stewart, Glenn |
| Scoggins, Jeffery/Ann | Smith, Don | Stewart, Tim/Tracy |
| Scott, Gary | Smith, Ellen | Stockwell, Brent |
| Scott, Sidney Ramsden | Smith, Eric | Stokes, Bettina |
| Scuder, Amanda | Smith, Fred | Stokes, Debra |
| Sechi, Laura | Smith, Ian | Stolpe, Tammi |
| Segal, Evalyn | Smith, Karen | Stone, Jane |
| Seger, Kimberly | Smith, Kevin | Stone, Peter |
| Selbin, Susan | Smith, Margaret | Stone, William |
| Sendrowitz, Mitchell | Smith, Shirley | Stout, Alan |
| Septoff, Alan | Smith, Stacey | Stradel-Graf, Julie |
| Septoff, Naomi | Smith-Lavoie, Kris | Strauss, Paul |
| Sewall, Christopher | Snook, Richard | Struhsaker, Thomas |
| Shabazian, Steve | Snow, Susan | Suarez, Cassandra |
| Shadrick, Roxann | Sobo, Naomi | Sucidlo, Nan |
| Shafer, Margaret | Sokolow, Fred | Sullivan, James |
| Shaw, Fred | Solano, Renee | Sullivan, Paul |
| Sheffield, Regina | Solomon, Beverly | Sumi, Lisa |
| Shematek, Judith | Sonenstein, Joann | Sunshine, Jane |
| Shemwell, Misty | Sookne, Judith | Swan, Julie |
| Shenberger, Ronald | Sorensen, Frances | Swanson, John |
| Sheng, Richard | Sorkin, David | Swers, Arthur |
| Sherman, Marcia | Sorrentino, Betty | Swift, Charles H. |
| Sherwood, Robin | Spindelilus, Earendil | Sydney, Savannah |
| Sykes, Fred | Unger, Elda | Waser, Carol |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Sykes, Shirley | Unruh, Jerry | Washington, Leslie |
| Szymczak, Nancy | Valentin, Gabriela | Waters, Michelle |
| T.C. | Valentine, Jeffrey | Watšon, Andrea |
| Tafanelli, Robert | Valentine, Jennifer | Watson, Fran |
| Takagi,Richard | Van Alyne, Emily | Watson, Thomas |
| Tamblyn, Larry | Van Davis, Barbara | Watters, Jeff |
| Taplinger, Arthur | Van Der Leest, Felieke | Watts-Rosenfeld, Susan |
| Taranowski, Heath Ashli | van der Voort, Suzanna | Weaver, Eric |
| Taslitz, Joan | van Doren, Harold | Weaver, Rachel |
| Tattersall, Ann | Vancompernolle, Geert | Webb, Dean |
| Tava, Jennifer | Vanderkooi, Lois | Webb, Mike |
| Taylor, Imogen | Vanderleelie, Roy | Webber, Storme |
| Teeple, Jennifer | Vandermay, Lisa | Weber, Mary |
| Terbot, Lee/Charlotte | Vargas, Roberto Angarita | Wedge, Gene |
| Tezla, Michael | Varias, Stamatios | Weinberg, Phyllis |
| Thomas, Autumn | Vaught, Kevin | Weinstein, Diane |
| Thomas, Linda Garrish | Verruni, Lauren | Weir, Joyce |
| Thomas, Randy | Verry, Loretta | Weiss, Dave |
| Thompson, Arleen | Vertova, Livia | Welch, Benjamin |
| Thompson, Linda | Vieau, Diane | Welch, Joanna |
| Thompson, Peter | Vigneault, Jacinthe | Welde, Logan |
| Thompson-LaPerle/Kelly | Vogelman, Diane | Wellander, Cal |
| Thrantell, Mary | Vollmer, Alex | Welms, James |
| Tice, Paula | Von Tobel, Robert | Werzinski, Joseph |
| Tildes, Katherine | Voorhies, Bill/Marilyn | Weston-Roberts, Gail |
| Tjessem, Sandra | Voss, Dennis | Wheeler, Bruce |
| Tolberg, Margaret | Voth Jr., Ted | Wheller, Noreen |
| Tom, Kevin | Vrabec, Serge | Whipple, Dave |
| Tomb, Jessica | Wagner, Carol | Whipple, Wyman |
| Tomczyszyn, Michael | Wagner, Vickie | Whippo, Robert |
| Tomlin, Patricia | Wald, Susan | White, Lois |
| Tonoff, Lois | Waldmann, Richard | White, Shirley |
| Tonsberg, Barbara | Waldron, Chip | White, Ward |
| Torrence, Paul | Waldron, Susan | Whiteside, Glenn |
| Treece, Ed | Walker, Brad | Whitethorn, Sheri |
| Trible-Lowe, Victoria | Walker, Gary | Wick, Karen |
| Troyano, Paul | Walker, Nancy | Wiener, Steven |
| Tumarkin, Alexandra | Waller, Paul/Joan | Wiesner, Karen |
| Turley, Steven | Walsh, David | Wiggins, Frances |
| Turner, David | Walsh, Mark | Wiggins, Robert |
| Turner, Hope | Waltasti, Marilyn | Wilcox, Theodore |
| Turner, Rene | Walvoord, Frederick | Wilkinson, Liam |
| Tyler, Janet | Ward, Emma | Williams, Ayla |
| Tyler, Tobi | Warnke, Cassie | Williams, Beverly |
| Undewood, Gerald | Warren, Pauline | Williams, Janet |
| Williams, John | Wolf, Anne | Wyatt, Maria |

| Table G3.1-5. Name of Individuals Submitting Duplicate Comments on the GEIS Via E-Mail (continued) | | |
|---|---|---|
| Williams, T. | Wolf, Joe | Wygant, Mike |
| Williamsi, Mina | Wolf, Sascha | Wyke, Kimberly |
| Wilson, Ann Marie | Wolfe, Kathleen | Yearian, Angela |
| Wilson, Dina | Wolff, Lois | Yeuell, Kay |
| Wilson, Sharon | WolffWood, Jennifer | Yoho, Nick |
| Wincek, Robert | Womble, Rev. Jeffrey | York, Sandra |
| Wingard, Michel | Womum, Claudia | Young, Nancy |
| Winholtz, Betty | Wood, Barbara | Youngman, Callie |
| Winkle, Stephen | Wood, Gordon | Yourke, Oliver |
| Wirth, Charles | Woodconstable, Mary | Zarchin, Paul |
| Wittman, Charles | Woodward, Joan | Ziegler, Jacqueline |
| Witzeman, Robert | Woollard, Deidre | Zimmer, Sister Dianne |
| Woessner, William | Wright, Peter | Zlotnick, Jan |
| Wojtalik, Alan | Wright, Susan | |

In addition to the numbering, each unique comment was also assigned a topic category to facilitate sorting and reviewing comments on similar topics. Topic categories aligned with the topics addressed in Section G.5 of this appendix. Following the initial comment identification review, the identified comments were reviewed for consistency and then entered into a database that allowed individual comments to be sorted by topic and distributed to GEIS authors for further consideration. GEIS authors then continued sorting and reviewing all comments within specific topic categories, developed comment summaries and responses for this Appendix, and made changes to the draft GEIS, as necessary, to address the public comments.

Based on the similarity of comments related to a specific topic, as appropriate, staff consolidated same or similar comments within each topic to facilitate developing responses. This approach allowed multiple similar comments to be addressed with a single response to avoid duplication of effort and enhance readability of this report. For each comment, or group of comments, a response has been provided. Each response indicates whether or not the draft GEIS was modified as a result of the comment.

# G4 MAJOR ISSUES AND TOPICS OF CONCERN

The majority of comments received specifically addressed items within the scope of the GEIS including a variety of concerns about the purpose, need, and scope of the GEIS; the description of the ISL process and operating history of past ISL facilities; regulatory issues; public involvement; NEPA-related concerns; public health concerns; groundwater; historic, cultural, and Native American concerns; socioeconomic issues; land use; and cumulative impacts. Other comments addressed topics and issues that are not applicable to the GEIS including the domestic energy supply, national energy sources, energy crisis, energy independence, the nuclear fuel cycle, global warming, nuclear weapons, nuclear power, the international uranium market, the legacy of past uranium mining and milling, and detailed site-specific issues.

## G4.1 Comments on Out-of-Scope Topics

As identified in GEIS Appendix A (i.e., scoping report), the following topics are considered out of scope of the GEIS. Some of these topics, such as the legacy of uranium mining and milling, may be considered as cumulative effects during site-specific reviews.

- NRC's licensing process
- General support or opposition for 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

# G5 COMMENT SUMMARIES AND RESPONSES

Detailed responses to comments are provided in this section. The structure of this section is based on the topics of comments provided. Within each topic-specific subsection, the detailed presentation of comment and response information includes the applicable comment identification numbers, comment summaries, and the NRC staff's responses.

## G5.1 General Opposition

**Comment: 005-003; 014-001; CH05-001; CH06-020; GA03-003; GA05-008; GA12-007; GA26-001; GA27-003; GI01-013; GR01-007; GR22-001; NE03-004**
A number of commenters expressed general opposition to uranium mining, the uranium extraction industry, the *in-situ* leach (ISL) process and facilities, and the GEIS. One commenter expressed opposition to any nuclear technology. Other commenters recommended NRC choose the no-action alternative described in the GEIS (i.e., no additional ISL activities in the four milling regions considered in the GEIS).

*Response: The NRC recognizes that some commenters are not supportive of conventional uranium mining, ISL uranium milling, or of the development of the GEIS. These comments are beyond the scope of the GEIS.*

**Comment: 011-002; 026-003; 049-002; 1322-001; 1322-004; 1539-001; 1547-001; AL05-147; AL13-031; AL25-113; AL33-162; GR25-001; GR34-002; HC007-004**
Some commenters opposed to uranium mining expressed more specific concerns. These concerns included potential health impacts to current residents and future generations and the consumptive use of scarce water resources. Other commenters' concerns were based on their understanding of past conventional mining impacts. One suggested historic abandoned

uranium mines and associated wells should be cleaned up before NRC licenses new ones. Another suggested disturbing uranium deposits was like playing Russian roulette. One commenter was opposed to any mining or construction in the Black Hills region of South Dakota. Another commenter did not want the uranium industry to restart in the Grants area of New Mexico.

*Response: The NRC recognizes that some commenters are not supportive of conventional uranium mining. These comments are beyond the scope of the GEIS.*

**Comment: 021-001; 040-003; 041-002; 060-001; 1315-002; 1323-001; 1482-001; AL24-104; GA05-003; HC014-006**
Some commenters opposed to *in-situ* milling described it as a messy process that spreads contamination. Others repeated concerns about groundwater contamination and consumptive use of groundwater as a scarce resource in arid regions of the west.

Response: *The NRC recognizes that some commenters are not supportive of in-situ uranium milling. These comments are beyond the scope of the GEIS.*

**Comment: 027-009; 031-003; 032-001; 037-001; 038-001; 042-001; 047-001; 059-001; 059-016; 0694-005; 1015-001; 1015-002; 1302-005; 1317-003; 1317-012; 1318-012; 1319-001; 1602-001; 963-003; AL14-032; AL15-043; GA21-001; GI01-003; GR01-011; GR08-005; GR12-009; GR14-001; GR21-001; GR31-001; GR32-001; GR34-007; NE06-024**
A number of commenters who expressed opposition to the GEIS referred to the document in adverse terms. Some commenters suggested the GEIS was a flawed document that needed to be revised, while others recommended withdrawing the document entirely and doing site-specific environmental impact statements (EIS) for each ISL license application. One commenter was concerned about additional truck traffic, potential groundwater problems, and what was referred to as uncontrolled situations. Another commenter noted the GEIS was not in the best interest of the public and suggested it was developed to serve the interests of mining companies.

*Response: The NRC recognizes that some commenters are not supportive of the development of the GEIS. These comments are beyond the scope of the GEIS.*

*For detailed comments and responses on topics related to those expressed in some of the general opposition comments, see the following sections of the comment response report: ISL Process Description (G5.14); Purpose, Need, and Scope of the GEIS (G5.5); Regulatory Issues and Process (G5.9); Credibility (G5.10); History and Legacy of Uranium Mining (G5.17); Groundwater Resources (G5.22); and Public and Occupational Health (G5.31).*

*In response to these and other comments, the sections of Chapter 1 that discuss the purpose and need of the GEIS have been revised to further clarify the intended use of the document in NRC environmental reviews.*

## G5.2 General Support

**Comment: 008-001; 029-001; AL08-015; AL10-018; AL19-071; AL22-084; AL29-139; GA09-001; GA11-006; GA22-002; GI03-007; GR06-001; GR07-002; GR13-001; GR17-001; GR19-001; GR28-003**
These commenters were supportive of uranium production mining. Some stated it would provide clean fuel to address domestic energy demand and lessen our dependence on fossil fuel. One was supportive because of all the new technologies and research that could be used. Another was supportive because mining in the community had occurred with no issues. One supported the mining because of confidence that the mining could be conducted in a safe manner based on the information in the GEIS. Some were supportive because of the land grants. One stated a desire for the resurgence of uranium in the area. One stated that current facilities were doing a great job.

*Response: The NRC recognizes that some commenters are supportive of uranium mining. These comments are beyond the scope of the GEIS.*

**Comment: AL26-126; GA08-009; GA20-001; GI08-001; GR05-004; GR06-006; GR20-001; NE11-001**
These commenters were supportive of the ISL process. Some thought this was vital for New Mexico and the United States. Several commenters indicated they were confident that it could be done safely. Another commenter indicated hearing of no past problems. One commenter was supportive because of the jobs it could bring to the area, which would secure the future and that of families.

*Response: The NRC recognizes that some commenters are supportive of ISL uranium milling. These comments are beyond the scope of the GEIS.*

**Comment: 007-001; 009-001; 017-004; 022-001; 023-001; 024-003; 028-001; 030-002; 036-001; 036-003; AL09-016; AL11-021; AL12-022; AL18-070; AL21-081; AL23-093; AL28-138; AL30-148; CA02-002; CA02-007; CA07-001; CA08-001; CH08-001; GA08-001; GA17-004; GA18-005; GA22-001; GR05-001; GR07-001; GR09-005; GR10-004; GR27-002; GR29-001; GR30-003; NE12-001; SP10-001; SP11-001; SP18-002**
These commenters were generally supportive of the development of the GEIS. Several thought it was needed to provide a foundation to expedite future site-specific reviews. One felt the information provided in the GEIS would be very helpful in evaluating environmental impacts and would become a reference document for many years to come. Another commenter was supportive of the NRC process, believing it would safeguard workers and the environment.

*Response: The NRC recognizes that some commenters are supportive of the development of the GEIS. These comments are beyond the scope of the GEIS.*

## G5.3 General Environmental Concerns

**Comment: 005-004; 018-002; 027-002; 027-004; 037-002; 038-007; 062-002; 1313-004; 1318-009; 1323-002; AL24-102; CH05-002; CH05-003; GA15-004; GA16-002; GA27-002; GA28-002; GA28-003; GR14-010; GR32-004; HC002-001; HC005-003**
A number of commenters expressed opinions that ISL facilities were bad for the environment. One thought construction of such facilities created a danger to lives and health of persons in the vicinity and contaminated the Earth, water, and air. Two commenters thought it would impact

air and water quality, land use, and quality of life. One commenter specifically said it was detrimental to the soil, water, and air. One was concerned with the possibility of things going wrong and having disastrous consequences (as had happened at Three Mile Island and Chernobyl). One had the opinion that the nature of the GEIS would not spotlight potential problems in any of the proposed areas and could lead to devastating impacts on the environment, ecosystems, and communities. Another commenter had the view that historical mistakes would be neglected and repeated and said that messing with Mother Nature is hazardous to our health. One commenter was concerned that ISL mining would cause environmental degradation and destroy the beauty of our surroundings for future generations.

Many commenters expressed concerns about the environment in general. Several were concerned about harm to the Earth that could be caused. One commenter was concerned in particular about birds, wildlife, and other animals and plants. Another commenter stated that ISL facilities had a potential to impact land use, geology, water resources, ecology, historical and cultural resources, socioeconomics, and public and occupational health. One commenter stated the land needed to be preserved so people all around the world would have a place where they could go and appreciate the wonder of God's creation. Another was concerned about protection of water. Concerns about additional stress on local roads, schools, and hospitals from the influx of workers and construction activities were noted by another commenter. Negative impacts of the loss of grazing rights, depletion of water, loss of property values, threat to health and wildlife, and complete destruction of quality of life were mentioned by another commenter.

*Response: Congress authorized NRC to license and regulate the nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, and promote the common defense and security. The NRC staff accomplishes this mission by performing the following activities:*

- *Develop regulations and guidance for the regulated community.*
- *Conduct safety reviews of license applications and amendments.*
- *Conduct environmental reviews of license applications and amendments, consistent with NEPA.*
- *Inspect uranium recovery facilities.*
- *Review decommissioning plans and activities.*

*NEPA was enacted to ensure that information on the environmental impacts of any federal, or federally funded, action is available to public officials and citizens before decisions are made and before actions are taken. Site-specific environmental reviews will be conducted when an application is submitted.*

*NRC grants licenses to ISL facilities only if NRC finds that public health and safety and the environment would be adequately protected. Based on the nature of operations at ISL facilities, accidents like those at Three Mile Island and Chernobyl are impossible. Because the comments in this group were general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-062; 1317-005; 1319-015; AL05-143; AL24-096; AL24-107; GR11-003**
These commenters suggested the GEIS did not adequately address environmental impacts. One stated the GEIS glossed over environmental impacts, ignored cumulative impacts and shortchanged public participation. Another expressed the view that NRC should not facilitate the issuance of licenses and that the purpose and need were unrelated to the impacts, or alternatives analyzed and therefore violated NEPA and should be withdrawn. Another suggested the GEIS did not adequately address the unique cultural and environmental threats posed to Native lands, Native people, and Native resources. One commenter thought the GEIS was inadequate because it did not focus on ecological health of landscapes. Another commenter stated the GEIS did not adequately address the human or ecological fatalities, nor did it really look at the future well-being of generations of all species, peoples, creatures, and the ecology. One commenter stated the GEIS did not take into account human and Earth rights. Another commenter stated the GEIS did not have a thorough analysis of the impacts to groundwater and surface water and to vegetation and threatened species. One suggested that economic benefits to milling would be at the expense of the environment.

*Response: The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC regulations at 10 CFR Part 51 that implement NEPA. As a result, the GEIS addresses a variety of topics of concern with regard to potential environmental impacts from possible ISL facilities that could be licensed in the regions addressed in the GEIS. This includes assessment of potential ecological, historic and cultural, health, and water resource impacts. The GEIS is a programmatic assessment analyzing the use of ISL technology for uranium extraction in four regional areas and is intended to support the site-specific environmental review portion of the NRC licensing process as described in GEIS Section 1.7.1. While the GEIS is intended to support the environmental review, it is not the entirety of that review nor does it represent the entirety of the NRC licensing process. The NRC licensing process also includes a detailed and comprehensive safety review of a mining facility described in a license application beyond the environmental review. The NRC environmental review, as discussed in the GEIS, Section 1.8.3, includes a detailed site-specific environmental review of every proposed ISL license application. Some areas of environmental concern require detailed understanding and assessment of site-specific conditions and would be addressed during the site-specific environmental review. Unique local concerns and information about environmental conditions applicable to site-specific licensing decisions would be solicited by NRC as part of the licensing process for specific proposals. Because the comments were general in nature, no changes were made to the GEIS beyond the information provided in this response. Additional detailed comments and responses on related topics are addressed in the following sections of this appendix: G5.5, G5.18, G5.8, G5.25, and G5.28.*

## G5.3.1 References

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

## G5.4 NEPA Process

### G5.4.1 Generic Environmental Impact Statements

**Comment: 017-008; 1302-004; 1311-004; 1311-017; CA02-005; CA07-004; CH02-001; GR32-002**
Several commenters expressed views or posed questions on the use of a generic or programmatic EIS. Several commenters supported the use of the generic or programmatic impact statement. These commenters stated that the Council on Environmental Quality (CEQ) recognizes the appropriateness of the programmatic or generic EIS approach. Other commenters did not support the use of the programmatic or generic EIS. One had never heard of a broad "blanket" EIS and thought the GEIS was an abrogation of proper environmental review. Another commenter stated that the GEIS should be withdrawn in favor of an EIS that includes concrete proposals with specific license actions and rulemakings. One commenter feared that the NRC created the "generic" EIS concept to short change the NEPA process. One commenter asked where the concept of generic EISs followed by subsequent site-specific environmental reviews is expressed in NEPA.

*Response: NRC staff considers the programmatic/generic EIS approach appropriate. The GEIS is a programmatic assessment analyzing the use of ISL technology for uranium extraction in four regional areas. The GEIS is intended to be used to support site-specific environmental reviews. As stated in GEIS Section 1.8, the use of generic or programmatic EISs is a practice supported in CEQ regulations (see 40 CFR 1502.4). NRC plans to use tiering and incorporation by reference for environmental reviews of site-specific ISL license applications as allowed by NRC NEPA implementing regulations in 10 CFR Part 51, Appendix A. As stated in GEIS Section 1.8, tiering (defined in 40 CFR 1508.28) is a procedure by which more specific or more narrowly focused environmental documents can be prepared without duplicating relevant parts of previously prepared, more general, or broader documents. Because the comments were general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1305-001; 1311-010; 1311-019; 1312-001; 1314-001**
Several commenters addressed the GEIS compliance with relevant NEPA regulations. Several commenters stated that the GEIS failed to meet NEPA regulations. Some commenters requested the GEIS be withdrawn. One commenter stated that NRC must comply with NEPA regulations.

*Response: The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC regulations at 10 CFR Part 51 that implement the NEPA. As stated in GEIS Section 1.8, the use of generic or programmatic EISs is a practice supported in CEQ regulations. The GEIS is a regional programmatic assessment analyzing the use of ISL technology for uranium extraction in four regional areas. NRC intends to use the GEIS to support site-specific environmental reviews. The GEIS does not represent the entirety of the NRC environmental review process for a specific application to receive, amend, or renew an ISL facility license. Because the topic was addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-002**
One commenter stated that (1) the GEIS violates NEPA because the GEIS was issued before adopting regulations governing ISL operations and (2) the GEIS appears to be nothing more than a way to expedite the NRC's licensing process.

*Response: The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC regulations at 10 CFR Part 51 that implement NEPA. As stated in GEIS Section 1.5.2 regarding applicable rulemaking activities, the GEIS is based on regulations in effect at the time of writing. ISL facilities are licensed by NRC in accordance with requirements in 10 CFR Part 40 and 10 CFR Part 51. Requirements specific to uranium milling facilities are located at 10 CFR Part 40, Appendix A. ISL facilities are also required to protect workers and the public as required by NRC regulations at 10 CFR Part 20 and to comply with any conditions in their license. The purpose of the GEIS is to improve the efficiency and consistency of NRC's site-specific environmental reviews for ISL license applications required under NEPA. This response is considered sufficient to address the comment; therefore, no changes were made to the GEIS.*

**Comment: NE06-009**
One commenter requested that NRC provide examples of other federal agencies' programmatic EISs and how these EISs have been compliant with NEPA.

*Response: The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC regulations at 10 CFR Part 51 that implement NEPA. As stated in GEIS Section 1.8, the use of generic or programmatic EISs is a practice supported in CEQ regulations. While NRC has chosen to use the term "generic" in labeling these assessments, these types of assessments are typically referred to as "programmatic" EISs. Programmatic EISs have been developed by a variety of federal and state regulatory agencies. Individuals interested in exploring examples from other agencies are encouraged to check the document collections of the U.S. Department of Interior, U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), U.S. Department of the Army, or U.S. Department of Agriculture and relevant case law. As this is a long-standing and well-established practice, NRC staff considers a demonstration of how these EISs have been compliant with NEPA to be not necessary and beyond the scope of the GEIS. Based on this response, no changes were made to the GEIS beyond the information provided in this response.*

## G5.4.2 Impact Assessment

**Comment: 003-002; 1305-002; 1305-110; 1312-001**
Several commenters stated that the GEIS fails to take a hard look at the potential environmental impacts. One commenter focused this concern on issues related to public health and the environment. Another commenter focused this concern on aquifer restoration.

*Response: As stated in GEIS Section 1.8.5, the GEIS is not the final environmental review for any site-specific license application. The NRC environmental review, as discussed in GEIS Section 1.8.3, includes a detailed site-specific environmental review of each proposed ISL license application. Detailed site-specific information on the characteristics of the local environment and proposed facility will be provided in site-specific license applications. Each license application for an ISL facility submitted to NRC for review receives a detailed site-specific safety review and a detailed site-specific environmental review. These reviews provide information necessary for NRC to make a decision on whether to grant or deny an* *application to receive, amend, or renew a license to operate an ISL facility. The GEIS is intended to support (not replace) the site-specific environmental reviews by providing a programmatic assessment of potential impacts by analyzing the use of ISL technology for uranium extraction in four regional areas. During the site-specific reviews, as noted in GEIS Section 1.2, NRC will assess the applicability of GEIS analyses to the specific conditions of the site to determine applicability of GEIS conclusions. Conclusions of NRC site-specific environmental reviews would be supported by sufficient technical bases whether tiered from the GEIS or based on supplemental staff analyses. In response to these and other comments discussed in Section G5.5, the discussions of the GEIS purpose and need in Chapter 1 were clarified.*

**Comment: 059-023**
One commenter stated that disregarding significant impacts in the interest of streamlining the permitting process is not compliant with the spirit of the regulations.

*Response: The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC regulations at 10 CFR Part 51 that implement NEPA. The GEIS provides a complete assessment of the potential impacts from ISL facilities based on consideration of 30 years of operating history at ISL facilities in the regions addressed by the GEIS. Staff has gained insights into local conditions and potential impacts based on input received during the public scoping process and in public comments received on the Draft GEIS and associated public meetings. Impact conclusions in the GEIS range from SMALL to LARGE and vary depending on consideration of both the affected environmental resource area and the phase in the ISL facility's lifecycle. Detailed description, analysis, and significance categorization of potential impacts are provided in GEIS Chapter 4. GEIS Chapter 10 summarizes the impact conclusions for all resource areas by milling region. No further changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1311-006; 1314-039**
A few commenters expressed concerns about the impacts classification used in the GEIS. One commenter stated the GEIS effectively redefined the term "significance" and used significance categories inconsistent with CEQ usage. One commenter stated the GEIS impact classifications are meaningless under NEPA and should be changed or explained in the final GEIS.

*Response: The impact classifications used in the GEIS (i.e., SMALL, MODERATE, LARGE) are discussed in Section 1.4.3. According to CEQ, the significance of impacts is determined by examining both context and intensity (40 CFR 1508.27). NRC originally established these significance levels in the Generic EIS for License Renewal of Nuclear Plants (NRC, 1996), using as a basis the CEQ regulations. The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003), which incorporates these significance level categories. No changes to the GEIS were made beyond the information provided in this response.*

**Comment: 1311-015; 1314-022; 1314-029; AL27-134**
Several commenters raised the issue of the adequacy of the cumulative effects analysis in the GEIS. Several commenters stated the cumulative analysis does not meet NEPA standards. One commenter stated that NEPA requires more than simply listing or briefly acknowledging past impacts. Another indicated the GEIS fails to evaluate cumulative impacts of reasonably foreseeable non-Federal projects. One requested a cumulative impacts analysis based on the full range of licensing proposals.

*Response: Cumulative effects are discussed in GEIS Section 1.5.2, Chapter 5, and Appendix A (scoping). As noted in GEIS Section 1.5.2, due to the complex and site-specific nature of a cumulative impact assessment, the GEIS provides useful information for understanding the potential for cumulative impacts when licensing future ISL facilities in the region, but does not make conclusions regarding cumulative impacts for specific sites. Thus, the GEIS does not include a cumulative impacts analysis. Site-specific environmental reviews will include cumulative impact analyses consistent with the guidance provided for these analyses in NUREG–1748 (NRC, 2003) that make use of the information provided in the GEIS. In response to these and other comments, the texts in Sections 1.5.2, 1.5.4, Chapter 5, and Appendix A discussing cumulative impacts were reviewed and clarified as necessary.*

### G5.4.3 General

**Comment: 016-006; CA01-003; GR14-005**
Commenters raised concerns about the nature of the subsequent site-specific environmental reviews. One commenter suggested ISL facilities will cause a significant impact and believed NRC was planning on doing EAs in site-specific reviews and trying to avoid doing EISs required by NEPA. One commenter expressed the view that the site-specific environmental reviews should include more extensive EISs because the allowance of public involvement. Another commenter was concerned that the GEIS includes arbitrary significance determinations and expressed the view that NRC has already decided site-specific environmental reviews would be documented in EAs rather than an EIS.

*Response: In response to these and similar comments, NRC has determined that its environmental reviews for each new ISL license application will result in the preparation of a site-specific environmental impact statement that supplements the GEIS. This determination was based on the need to defer some impact analysis to the site-specific environmental review (e.g., for those resource areas and facility lifecycle phases for which significance levels were expected to be "SMALL to LARGE"). For its environmental reviews of applications to renew or amend existing ISL licenses, NRC will prepare either a site-specific environmental assessment or environmental impact statement, consistent with NRC's process for making that determination as described in GEIS Section 1.7.1. NRC will make draft EAs and accompanying FONSIs available for public comment.*

*As part of the environmental review for new applications, NRC may conduct a scoping process, consistent with its regulations at 10 CFR 51.26(d), 51.28, and 51.29. Additionally, NRC will publish the draft SEIS for public comment in accordance with 10 CFR 51.73 and 51.117. The NRC staff will address public comments received on the draft SEIS prior to making a final licensing decision.*

*Regarding the significance determinations in the GEIS, the impact conclusions are accompanied by bases supported by information provided in the GEIS and the professional judgment of the authors, who are experts in the topics they evaluated.*

*In response to these and similar comments, the text in GEIS Section 1.8 was modified to indicate NRC's determination to prepare a SEIS to document its environment review for new ISL license applications.*

**Comment: 1314-031**
The GEIS contains factual errors, incomplete information, and contradictory information and therefore cannot serve as a basis for a reasonable environmental analysis.

*Response: To address the variety and volume of concerns expressed in this comment (10 pages of text), NRC has assigned an individual comment number to each concern and each has been addressed in the applicable section of this appendix as shown next. Note Comment 1314-039 also applies to this set of comments and was addressed previously in this (NEPA Process) section of Appendix G.*

- *G5.3 General Environmental Concerns (1314-044)*
- *G5.5 Purpose, Need, and Scope of GEIS (1314-042)*
- *G5.7 GEIS Methods and Approach (1314-034; 1314-036; 1314-038)*
- *G5.8 Public Involvement (1314-043)*
- *G5.9 Regulatory Issues and Process (1314-037)*
- *G5.17 History and Legacy of Uranium Mining (1314-040; 1314-041; 1314-049; 1314-052; 1314-053; 1314-055; 1314-058)*
- *G5.21 Geology and Soils (1314-048)*
- *G5.22 Groundwater (1314-032; 1314-045;1314-046; 1314-047; 1314-054; 1314-056; 1314-059)*
- *G5.30 Socioeconomic (1314-050;1314-051)*
- *G5.32 Waste Management (1314-033)*
- *G5.37 Monitoring (1314-057)*
- *G5.39 Editorial (1314-035)*

**Comment: AL27-134**
One commenter stated that the document was inadequate in terms of NEPA standards for the full analysis of ISL activities.

*Response: GEIS Section 2.1.3 provides a general description of ISL facilities. A more detailed description of the individual stages of ISL uranium recovery (construction, operations, aquifer restoration, and decommissioning/reclamation) is provided in GEIS Sections 2.3 through 2.6. As stated in GEIS Section 4.1, the potential impacts to environmental resources are analyzed for each of the four phases of an ISL facility's lifecycle. As discussed in GEIS Section 1.2, the analysis in the GEIS, in combination with the site-specific environmental review and along with NRC's site-specific safety review, will provide the bases for the NRC's final licensing decision. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: CH10-010**
One commenter stated in the context of protecting the environment that people and environment are indivisible.

*Response: GEIS Section 1.4.2 identifies the various resource areas that are covered in the document. These resource areas address natural (e.g., ecology, water resources) and human (e.g., public and occupational health, socioeconomics, transportation, noise, historic and cultural) aspects. For readability, this information and analysis of these resource areas are included in specific sections of the GEIS, but important interrelationships among these elements of the environment are included in each section (for example, potential surface water impacts could also affect aquatic ecology as well as human uses such as fisheries, agriculture, and drinking water). Section 3 provides the description of the affected environment for these resource areas. GEIS Section 4 describes the potential impacts from ISL facilities to these resource areas. Because the comment was general in nature, no changes were made to the GEIS beyond the information provided in this response.*

### G5.4.4 References

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

NRC. NUREG–1437, "Generic EIS for License Renewal of Nuclear Plants." Washington, DC: NRC. May 1996.

## G5.5 Purpose, Need, and Scope of the GEIS

### G5.5.1 Description of the GEIS Purpose and Need

**Comment: 050-055; 1305-091; 1311-001; 1311-002; 1311-014; 1314-060; CH01-001**
A number of commenters provided comments about the statement of purpose and need in the GEIS. Some commenters noted that the purpose of the GEIS was unclear and not well defined. Another suggested the ISL proposals addressed by the GEIS were not clearly defined. One noted the stated purpose to prepare a GEIS was circular. Another indicated the statement regarding streamlining licensing was unclear, and that if streamlining licensing were the intent, then NRC was using the NEPA to revise NRC rules. One reminded NRC that it needs to notify the public of licensing actions, regulatory changes, and purpose and need for federal actions. Another asked about who decided on the GEIS or who would make the decision.

*Response: NRC agrees with the commenters on the need to clarify the purpose and intended use of the GEIS. Various sections in GEIS Chapter 1 have been revised to reflect the following discussion.*

*NRC's rationale for preparing the GEIS was the recognition that ISL facilities in the United States use the same or very similar technology, such that the potential environmental impacts associated with the technology could be assessed on a generic (programmatic) basis. In this way, repetitive reviews of certain of these impacts could be avoided, thus focusing NRC's evaluation on unique issues of concern for each site.*

*NRC's generic assessment of the potential environmental impacts associated with construction, operation, aquifer restoration, and decommissioning of ISL milling facilities in portions of*

*Wyoming, Nebraska, South Dakota, and New Mexico is documented in the GEIS. NRC will use the GEIS to support its site-specific environmental reviews of future license applications for ISL facilities in the aforementioned regions. Thus, the GEIS provides a starting point for the site-specific environmental reviews by (1) providing an evaluation of the types of environmental impacts that may occur from licensing an ISL facility; (2) identifying and assessing impacts that are expected to be generic (the same or very similar) at ISL facilities with specified plant or site characteristics; and (3) defining the number and scope of environmental impacts that need to be addressed in the site-specific environmental review.*

*Each license application for an ISL facility submitted to NRC for review will receive a detailed site-specific safety review and a detailed site-specific environmental review. These reviews provide information necessary for NRC to make a decision on whether to grant or deny an application to receive, amend, or renew a license to operate an ISL facility.*

*As stated previously, the discussions of the purpose and need and the intended use of the GEIS included in Chapter 1 were reviewed in response to the comments and were revised for clarity and consistency.*

### G5.5.2 Use of the GEIS in Site-Specific Environmental Reviews

**Comment: 011-001 ;015-012; 017-003; 017-005; 024-008; 027-001; 033-005; 061-012; 061-016; 061-018; 0694-004; 0829-006; 0963-007; 1109-001; 1205-001;1210-001; 1300-001; 1309-016; 1321-022; 1479-003; 1500-001; 1585-001; AL15-048; CA02-006; CA02-010; CA07-006; CA08-005; CA10-005; CH02-002; CH06-017; CH07-005; CH08-002; CH08-003; CH08-006; GA17-001; GI01-005; GI03-001; GR09-001; GR15-001; GR17-002; GR18-003; GR30-004; NE06-008; NE06-020; SP10-004; SP11-002; SP11-004**
A number of commenters asked questions, expressed concerns, and provided comments regarding the purpose and intended use of the GEIS by NRC in site-specific license application reviews. Some noted the importance of conducting a site-specific review of each license application, while others questioned whether there would be any site-specific environmental review. Others were concerned that the programmatic nature of the GEIS would limit careful consideration of unique local site-specific characteristics in a license application review. One commenter mentioned the GEIS is an initial step in the review process and there would be a site-specific review and applicable state agencies would be involved in permitting for a proposed site. A number of other commenters expressed the view that the GEIS does not preclude NRC site-specific environmental reviews of ISL license applications and consideration of site-specific environmental impacts. One of these commenters thought the GEIS would be a valuable tool for reviewing future license applications. Another commenter was concerned that a number of misperceptions exist about the purpose of the GEIS, noting that NRC review of license applications would be substantial. One thought site-specific EAs tiered from the GEIS would be insufficient. A regional EIS developed by the U.S. Department of Interior in the 1970s was mentioned by one commenter as an example of how impacts were assessed regionally in a broad EIS, while individual actions still required specific environmental reviews. A milling industry representative mentioned that even with the GEIS, the evaluation of site-specific environmental impacts not evaluated in the GEIS would be an important aspect of each license application. Another milling company representative noted that the GEIS would not reduce the extent of site characterization conducted by license applicants. A member of the public in Gallup, New Mexico thought a 2-year review by NRC was a fairly lengthy time in which to study the potential impacts.

*Response: The GEIS is a programmatic EIS that assesses potential impacts from ISL facilities in the four aforementioned regions. NRC has developed similar documents in the past, one example being a GEIS developed for renewal of nuclear power plant licenses (NRC, 1996). The current GEIS is intended to support NRC's detailed site-specific environmental reviews of individual ISL site proposals. The GEIS provides a broad impacts analysis, recognizing that additional site-specific information may be needed to assess potential impacts for some environmental resource areas. The NRC site-specific environmental reviews would be conducted for each license application. As discussed in GEIS Section 1.8, each site-specific environmental review will evaluate information provided on all resource areas to ensure sufficient information to assess environmental impacts has been provided in a license applicant's environmental report. The applicant's environmental report includes detailed description and assessment of the proposed action, alternatives, site characterization information, and potential environmental impacts. If sufficient information was not provided, NRC would request additional information to ensure the information is complete. The existence of the GEIS does not relieve the applicant of the need to adequately document site-specific information in its application.*

*NRC staff initially relies on information provided by the licensee as well as information and conclusions from a separate detailed safety review conducted by NRC staff in documenting the staff's environmental review. NRC staff confirms important attributes of the license information through visits to the proposed site location and vicinity, independent research activities, and consultations with appropriate federal, tribal, state, and/or local agencies. If, after reviewing the detailed information on the site-specific proposal provided by the applicant, the NRC staff finds commonality between site conditions and those evaluated in the GEIS, the staff may incorporate by reference the applicable portions or conclusions from the GEIS into the documentation of the site-specific environmental review. Whether information from the GEIS is used or not by the staff in completing their site-specific environmental review, the conclusions in the site-specific environmental review documentation would be required to have sufficient technical bases. On average, an NRC license application review for an ISL facility takes about 2 years.*

*Based on the variety of interpretations conveyed in the comments about the intended use of the GEIS, applicable portions of GEIS Chapter 1 were revised to clarify the intended use.*

**Comment: 050-004; 050-009; 050-028; 050-030; 050-101; 059-018; 1300-003; 1300-007; 1305-006; 1312-002; 1319-014**
A variety of comments was received regarding the methods and approach NRC intends to use for tiering from the GEIS to site-specific environmental reviews. One commenter mentioned it was unclear what common elements the GEIS was analyzing that would be appropriate for referencing in future environmental reviews. An additional comment recommended the GEIS limit the applicability of tiering to common elements. Another requested the GEIS provide specific standards and technical criteria that would be used by NRC to determine whether site-specific conclusions can be tiered from the GEIS noting that without criteria, it might be an arbitrary process. Another commenter noted it was unclear how land agencies such as the U.S. Bureau of Land Management (BLM) would tier off the GEIS. One wanted clarification on how restarts and expansions would tier off the GEIS. Another asked how generalized GEIS section information would be used in site-specific environmental reviews. Clarification of the methodology for site-specific EAs was requested by one commenter. Another noted the GEIS did not mention the requirement for licensees to submit environmental reports and requested clarification in the GEIS on how an applicant would be allowed to reference GEIS analyses rather than conduct its own assessment. Additional clarification was requested on what NRC does if an applicant's environmental report differs from the GEIS. One commenter suggested

there was no basis to suggest the GEIS will be legally sufficient for identifying impacts in site-specific reviews.

*Response: When NRC reviews a license application for an ISL facility, NRC staff, familiar with the GEIS, would conduct an environmental review of that application. As part of that application, the license applicant provides a detailed environmental report that the NRC staff assesses along with other site-specific information to evaluate whether information or conclusions in the GEIS are applicable to site conditions and sufficient to support conclusions on potential impacts of the proposed ISL facility. Those portions that are applicable and sufficient could be incorporated by reference in the site-specific assessment. If portions of the GEIS are found to be applicable but are insufficient as the sole basis for making impact conclusions for a particular site, additional bases including information or analyses would be provided by staff. In some cases, the GEIS may provide the framework or starting point for a site-specific analysis, but the staff might need to apply it to the specific conditions at the site. In other cases, the GEIS may provide a broader view or context that will aid in reviewing site-specific details. Portions of the GEIS that are found to be not applicable to site conditions would not be used. Ultimately, the applicability of the GEIS is determined at the time the site-specific proposals are reviewed, whether those proposals are new licenses, renewals, or amendments. Without knowing the site-specific details, it is not practical to attempt to prejudge what portions of the GEIS might be referenced in a site-specific environmental review document.*

*The availability of the GEIS does not change the basic practices and guidance that NRC staff uses to conduct environmental reviews. In particular, the GEIS does not change the need for a detailed review of the information submitted by the applicant, nor does it change the need for conclusions in site-specific environmental reviews to be supported by sufficient technical bases that are transparent and traceable to supporting information. NRC staff conducting environmental reviews is responsible for ensuring the conclusions in the environmental reviews are adequately supported by sufficient technical bases and determining whether that information is tiered off the GEIS or based on unique site-specific analyses. As a result, detailed criteria on the use of the GEIS are not needed, because NRC staff familiar with the NRC environmental review guidance and experienced in conducting environmental reviews will be able to assess whether the GEIS is applicable to site conditions and whether information can be incorporated by reference into site-specific reviews.*

*Regarding the use of the GEIS by others, be they potential applicants or other federal or state agencies, the primary intended use of the GEIS is to support NRC staff reviews of future ISL license applications. To the degree the GEIS is useful for other regulatory agencies, the document would be generally available for others to use. NRC has developed the GEIS in accordance with NRC authority to regulate ISL facilities. NRC has also received important input from the Wyoming Department of Environmental Quality (WDEQ) as a cooperating agency. NRC has also received and incorporated, as applicable, the comments of a variety of federal, state, and tribal agencies. How other agencies choose to use or not use the GEIS is a matter for those agencies to decide. Regarding license applicants' use of the GEIS, the GEIS in no way relieves license applicants from the responsibility to adequately characterize and describe the proposed facility and site conditions in license application submittals. Information, methods, or analyses included in the GEIS that are applicable to a particular proposal could be used or referenced by license applicants provided the applicability and suitability of such referenced information is clear and its use does not significantly affect the completeness of any application. This clarification is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

**Comment: 034-005; 050-006; 050-008; 1602-005; CH07-008**
A number of commenters asked or made recommendations about the useful life of the GEIS and how or when the GEIS would be updated in the future. One commenter suggested information in the GEIS would become dated. Another commenter asked NRC to clarify the expected useful life of the GEIS.

*Response: The purpose of the GEIS is to provide a programmatic analysis of potential environmental impacts from ISL facilities in the aforementioned four milling regions. This regional analysis is expected to be an initial first step that will support the detailed site-specific reviews of ISL applications. While NRC recognizes that some detailed information in the GEIS will eventually become less relevant over time, the concepts in the GEIS are expected to be applicable to ISL licensing for many years to come. For example, a simple concept in the GEIS regarding evaluation of potential endangered species impacts includes whether endangered species exist on the site or not (potential impacts could be LARGE if such species are found and SMALL if not found). This would be evaluated during the site-specific environmental review. While the lists of endangered species included in the GEIS would not remain current for long, the concept of verifying the existence of such species on or in the vicinity of the site is more likely to remain applicable over time. Because the intended use of the GEIS involves the NRC staff assessing the applicability of GEIS information to site conditions during site-specific reviews, any information found by NRC staff to be no longer applicable to those reviews would not be used. Because ISL methods are fairly standardized and have been used for decades, a substantial amount of the concepts and information in the GEIS is expected to be applicable to future license application reviews for years to come. This clarification is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

### G5.5.3 GEIS and Anticipated Efficiencies in NRC Reviews

**Comment: 024-002; 024-005; 031-011; 031-014; 033-008; 045-001; 0694-001; 1311-003; AL15-046; AL24-099; AL30-150; CA02-004; CA02-008; CA07-002; CA07-003; CA07-005; CA08-002; CA08-004; CH07-010; CH10-006; GA02-002; GA08-006; GA11-004; GA18-004; GI02-001; GI02-003; GI02-003; GI02-007; GR01-004; GR01-005; GR03-001; GR10-002; GR10-003; GR14-003; GR27-001; GR29-002; GR31-002; GR34-001; SP10-003; SP18-003; SP19-001; SP19-002**
A number of commenters expressed opinions on whether the GEIS would make the license review process more efficient. A number of these comments appeared to suggest the reviews would take less time, reduce NRC workload, or would otherwise be reduced in detail or scope from what has been done in the past. Some suggested NRC was cutting corners, or reducing safety or oversight perhaps to reduce the cost of conducting full EISs. Some commenters suggested the GEIS is just another way to make the licensing process easier for applicants. One commenter thought the GEIS would not streamline the process, but the information would help companies develop their license applications. Other commenters suggested the GEIS would streamline general topics and allow site-specific reviews to focus more attention on unique site-specific topics. One commenter noted the GEIS would standardize requirements for license applications. A number of commenters suggested that streamlining licensing was necessary to achieve timely NRC review. Commenters suggested streamlining was appropriate due to similarities among ISL sites or to meet public demands for government efficiency. Others suggested streamlined licensing was needed due to limited NRC resources for license reviews. One questioned why the GEIS was needed if licensing was working okay in the past. Another asked whether the number of license applications was driving the need for the GEIS.

*Response: GEIS Sections 1.1 and 1.3 discuss the rationale and need for the GEIS. Recognizing that a large number of ISL milling license applications are expected in the coming years, that such applications would propose the use of a relatively standardized ISL technology, and that the potential ISL facilities would be located in relatively discrete areas of the western United States, NRC decided to prepare a GEIS to avoid unnecessary duplicative efforts and to identify environmental issues of concern to focus on in site-specific environmental reviews. In this way, NRC could increase the efficiency and consistency in site-specific reviews for new ISL license applications. NRC intends the GEIS to provide a starting point and not to be a replacement for the site-specific environmental reviews. The availability of the GEIS does not change the basic practices and guidance that NRC staff uses to conduct environmental reviews. In particular, the GEIS does not change the need for a detailed review of the information submitted by the applicant, nor does it change the need for conclusions in site-specific environmental reviews to be supported by sufficient technical bases that are transparent and traceable to supporting information. .*

*10 CFR Part 51, Appendix A provides the NRC format for presentation of material in EISs. This appendix of NRC regulations adopts CEQ regulations for tiering EISs. These regulations allow broad programmatic assessments to be developed so that material from such assessments can be summarized and incorporated by reference in more site-specific assessments that address actions within the scope of the broad assessment. This is done to eliminate repetitive discussions of issues and focus attention on issues ripe for decision in the site-specific environmental review. The intent is to allow an agency to reduce bulk in environmental reviews without impeding agency and public review of the action. The GEIS is based on and consistent with this concept that originated in CEQ regulations.*

*The GEIS provides a structure and framework that can help focus site-specific environmental reviews on those important unique site-specific topics (for example, hydrology, historic and cultural issues, ecology, socioeconomics, environmental justice, cumulative impacts) while allowing tiering of impact conclusions for those topics that are common among ISL facilities and tend to vary less based on site-specific conditions. The specific topics that are suitable for tiering from the GEIS will vary from site to site based on the details of the proposed ISL action and the detailed information on local characteristics (i.e., the information that is submitted in support of a license application). Therefore, these topics cannot be predetermined for any future license application. During a site-specific review staff will evaluate the site-specific information for all resource areas to assess whether any topics evaluated in the GEIS are applicable to the conditions at a proposed site and therefore appropriate for tiering. Whether tiering is used or not, the NRC staff will conduct a complete site-specific review for each application to receive, amend, or renew an ISL license. The purpose and need discussions in the GEIS Chapter 1 were clarified in response to these comments.*

*NRC only reviews the number of license applications that it has resources allocated for and conducts these licensing reviews on a first-come, first-serve basis. This approach avoids a circumstance where an increase in license applications would stretch resources thin and reduce the quality and depth of NRC reviews. NRC also monitors anticipated demands for staff resources and works to effectively allocate resources. This approach is particularly important to meet the fluctuating demands of programs such as uranium recovery that vary with market conditions.*

### G5.5.4 Concerns About the Broad Scope of the GEIS

**Comment: 013-002; 017-006; 018-001; 027-003; 031-004; 031-009; 033-001; 044-001; 050-001; 050-037; 059-003; 0694-002; 0829-003; 0829-007; 1015-003; 1109-002;1173-009; 1205-002; 1210-002; 1302-001; 1305-015; 1309-004; 1309-008; 1314-012; 1318-004; 1319-011; 1320-002; 1321-025; 1388-010; 1479-004; 1500-002; 1585-002; 1601-004; AL24-101; CH07-014; CH08-005; GA13-001; GA16-001; GI01-014; GR08-002; GR11-001; GR14-002; GR16-005; GR31-007; GR32-003; HC009-001; HC009-005; HC010-007; HC010-015; HC013-004; HC016-001; SP10-002**
A number of commenters expressed concerns about the broad geographic scope of the GEIS and that it does not address site-specific topics. These commenters noted the unique nature of sites and local communities and that a “one size fits all” approach is too general and too idealized to address unique local conditions. Others noted a broad analysis is insufficient to identify impacts. Other similar comments emphasized that the GEIS needed more detailed information on facilities or environmental characteristics to adequately assess local conditions and potential impacts. Factors such as health, water, ecosystems, spiritual sites, size and number of sites, number of wells, roads, acres, electricity consumption, number of ISL sites, property values, taxes, and reclamation costs were provided as examples of additional details that were needed. One noted that local populations needed respect and individual attention. Others indicated the level of detail was insufficient to meet the requirements of the NEPA or CEQ requirements for programmatic EISs. Another noted that CEQ allows a programmatic EIS. One asked NRC whether the qualitative discussion of preconstruction activities in the GEIS Chapter 2 absolved the NRC of presenting or discussing quantitative baseline information in a site-specific environmental document. Another claimed the GEIS did not provide full disclosure. Still another suggested the impact conclusions appeared to be based on professional opinion rather than detailed analyses and recommended collecting species-specific population data, consulting with agencies like U.S. Fish and Wildlife Service, and conducting site-specific analyses for local fauna such as antelope wintering and sage-grouse nesting in the vicinity of ISL sites. A few commenters noted that the GEIS does not address the specific details of individual ISL projects. Another commenter noted that site-specific license applications provide volumes of detailed site characterization information for specific sites, normally taking about 2 years to complete.

*Response: The purpose of the GEIS is described in GEIS Section 1.1. The GEIS was developed in accordance with NRC NEPA-implementing regulations at 10 CFR Part 51. These regulations allow the development of EISs on broad programmatic actions and tiering of issues from these broad assessments to narrower assessments of site-specific actions to limit redundancies. NRC developed the GEIS to support the review of future license applications for ISL facilities in the aforementioned regions. Detailed site-specific information on the characteristics of the local environment and proposed facility will be provided in site-specific license applications. Each license application for an ISL facility submitted to NRC for review receives a site-specific safety review and a site-specific environmental review. These reviews provide information necessary for NRC to make a decision on whether to grant or deny an application to receive, amend, or renew a license to operate an ISL facility. The GEIS is intended to support (not replace) the site-specific environmental reviews by providing a programmatic assessment of potential impacts by analyzing the use of ISL technology for uranium extraction in four regional areas. During the site-specific reviews, as noted in GEIS Section 1.1, NRC will assess the applicability of GEIS analyses to the specific conditions of the site to determine applicability of GEIS conclusions.*

*The availability of the GEIS does not change the basic practices and guidance that NRC staff uses to conduct environmental reviews. In particular, the GEIS does not change the need for a detailed review of the information submitted by the applicant, nor does it change the need for conclusions in site-specific environmental reviews to be supported by sufficient technical bases that are transparent and traceable to supporting information. NRC staff conducting environmental reviews is responsible for ensuring the conclusions of environmental reviews are adequately supported by sufficient technical bases, whether that information is tiered off the GEIS or based on unique site-specific analyses.*

*While the GEIS includes impact assessments for all resource areas, some resource areas were identified that are more site-specific by nature and can only be addressed in the GEIS at a more general level of detail. For those resource areas, futher site-specific information is needed to analyze the impacts. Such topics, such as hydrology and ecology are addressed by discussing the factors that, based on historical experience, can lead to various levels of impacts at an ISL site. The corresponding impact conclusions in the GEIS for these more site-specific topics reflect this uncertainty by presenting a range of potential impacts based on various circumstances that might be encountered at a specific site. Impact conclusions in the GEIS are based on the information included and referenced in the document and the professional judgments of the authors who are experts in their respective fields. In this regard, the GEIS is not the final analysis; rather, it is a starting point for a review that can only be completed when the details in a proposed license application are known and reviewed. The bases for final impact conclusions will be documented in the site-specific review. In response to the comments received, the purpose and need discussions in Chapter 1 were further clarified.*

### G5.5.5 Views on Site-Specific Environmental Assessments and Environmental Impact Statements

**Comment: 032-003; 032-004; 048-001; 050-019; 059-002; 062-001; 0694-006; 1015-006; 1045-001; 1097-001; 1097-002; 1142-001; 1259-001; 1300-004; 1305-011; 1305-016; 1314-016; 1314-017; 1314-018; 1319-012; 1371-001; 1523-001; 1542-001; 345-001; 396-001; 495-001; 829-001; 829-004; 963-004; CH07-011; GI01-005; HC015-001; HC017-001; HC020-002; GA23-013; GR32-005**
A large number of commenters expressed views on NRC site-specific EAs or EISs for future ISL licensing actions. Some commenters suggested the use of the GEIS for site-specific license application reviews will result in NRC publication of EAs to document the results of the site-specific environmental review rather than EISs. Commenters suggested an EA is not as complete as an EIS and will not address unique local issues. Others suggested NRC reconsider the GEIS and do site-specific EISs for every ISL application review. A variety of reasons was provided by commenters to support their view that an EIS would be needed, including the variability in site-specific conditions and a need for site-specific details. Others noted that the NEPA required a full EIS for site-specific licensing actions. Another suggested the cost for restoration of an existing ISL facility should be a trigger for requiring EISs for future facilities. Many commenters implied the GEIS was all that would be done by NRC for assessing potential impacts of proposed ISL facilities and expressed the view that the GEIS "one size fits all" approach would not work. Others requested NRC specify criteria (or describe circumstances) for deciding whether an environmental review would be documented in an EA or an EIS.

*Response: In response to these and other similar comments, NRC has determined that its environmental reviews for each new ISL license application will result in the preparation of a* *site-specific environmental impact statement that supplements the GEIS. This determination was based on the need to defer some impact analyses to the site-specific environmental review (e.g., for those resource areas and facility lifecycle phases for which significance levels were expected to be SMALL to LARGE). For its environmental reviews of applications to renew or amend existing ISL licenses, NRC will prepare either a site-specific environmental assessment or environmental impact statement, consistent with NRC's process for making that determination as described in GEIS Section 1.7.1.*

*As discussed in GEIS Section 1.8, each site-specific environmental review will consider information and conclusions in the GEIS, detailed information about the proposed action and site characterization information from the license application (including an environmental report), and information from the NRC safety review. This is a detailed and comprehensive review that will be sufficient to identify potentially significant environmental impacts for each site-specific license application; therefore, NRC considers it a complete environmental review.*

*The discussions of the purpose and need and the intended use of the GEIS included in Chapter 1 were reviewed in response to the comments and were revised for clarity and consistency.*

### G5.5.6 Scope of the GEIS

**Comment: 028-004; 036-011; 036-016; 039-001; 050-005; 050-021; 050-056; 061-023; 1305-092; 1311-012; 1311-013; 1314-023; 1314-041; CH06-013; GR12-003; NE06-005**
Various commenters identified specific topics that they thought should be addressed by the GEIS. Some of these commenters also disagreed with NRC scoping decisions discussed in GEIS Chapter 1 and Appendix A. Topics recommended for inclusion in the GEIS include the following:

- Include legacy site information (i.e., consideration of impacts from prior conventional mining or milling operations and how to prevent or mitigate environmental impacts).
- Consider past mining impacts combined with new ISL milling impacts.
- Address health topics.
- Provide analysis of cumulative impacts.
- Evaluate impacts of ISL facilities processing various alternative feed materials including toll milling of water treatment ion exchange resins.
- Include discussion of the concept of performance-based licensing (including adding the definition of the term to the GEIS glossary).
- Analyze programmatic needs for new uranium mines.
- Evaluate the adequacy of NRC regulations for ISL licensing.
- Identify regulatory standards applicable to ISL and any gaps in statutory or regulatory coverage to address environmental impacts from uranium recovery.

- Include Texas ISL facility experience.

- Assess the consequences of a tornado impacting an ISL facility.

- Analyze the broader national program for increased domestic uranium.

- Perform interagency assessment of alternatives.

*Response: Scoping for the GEIS is documented in the scoping report included in GEIS Appendix A. A majority of the topics suggested for inclusion in the GEIS in the aforementioned comments have already been addressed in the GEIS Appendix A and will not be repeated here. Specific exceptions and clarifications follow.*

*Section 4.5 of the scoping report addresses legacy impacts from prior conventional uranium mining as outside the scope of the GEIS due to the focus on ISL licensing; however, that section notes that legacy impacts should be considered as part of a cumulative impacts assessment. Table 5.3-5, for example, which lists concurrent actions in the Northwestern New Mexico Uranium Milling Region that should be considered in a cumulative impact assessment, includes conventional mining and milling as well as reclaimed open pit mines as subtopics within the Uranium Activities section of that table. Section 4.5 of the scoping report also indicates that a detailed cumulative impacts assessment is a site-specific analysis. As a result, potential impacts of past uranium mining are expected to be included, where applicable, in site-specific cumulative impact assessments associated with NRC license application reviews. Additional discussion of legacy comments is provided in Section G5.17.*

*Potential public and occupational health impacts from ISL facilities are included in the scope of the GEIS including related discussions in Sections 2.9, 3.2.11, 3.3.11, 3.4.11, 3.5.11, 4.2.11, 4.3.11, 4.4.11, 4.5.11, and portions of Chapters 6, 7, and 8.*

*Analysis of cumulative impacts, as noted previously, was considered in the GEIS scoping to require a site-specific analysis and therefore would be addressed during a site-specific environmental review. Nonetheless, useful information to support future cumulative impact analyses, including documentation of concurrent and reasonably foreseeable future actions (RFFA) in each milling region, is provided in GEIS Chapter 5.*

*While the concept of performance-based licensing is an important concept in NRC licensing practice, the request for NRC to describe performance-based licensing in the GEIS is considered unnecessary because this concept is defined and discussed in other NRC documents (NRC, 2007) available on the NRC website. Analysis of the adequacy of NRC regulations is beyond the purpose and scope of the GEIS. As noted in GEIS Section 1.5.2, the GEIS was based on existing regulations and practices. As noted in Section 1.5.4, matters regulated by NRC Agreement States are outside the scope and the GEIS is limited to area under NRC regulatory authority.*

*Consideration of potential impacts of extreme weather events is influenced by site-specific weather conditions and aspects of facility design and is best addressed during a site-specific license application review. As discussed in NRC guidance for environmental reviews in NUREG–1748 (NRC, 2003), the NRC safety review, which is conducted in parallel with the NRC environmental review, would address potential accident scenarios. The environmental review would use this information to discuss potential environmental impacts of those accidents* *considered in the safety review. License applicants must submit for NRC review information on local meteorology, including the incidence of extreme weather events. The information would be accompanied by an assessment of potential impacts from reasonably foreseeable adverse weather conditions.*

*Regarding the request to perform an interagency evaluation of alternatives, as discussed in GEIS Section 2.13, alternatives can be influenced by site-specific conditions and would be addressed in a site-specific environmental review. NRC may conduct consultations with other federal, tribal, and state agencies and as appropriate, affected members of the public, as part of a site-specific environmental review to elicit comments on a range of topics related to the environmental review, including the alternatives considered.*

*These responses were considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

**Comment: 829-002; CA02-001; 036-005; 036-031**
A few commenters suggested the NRC clarify in the GEIS whether the GEIS is applicable (or state that it will be applicable) to proposed sites outside the defined milling regions, in particular in Sections 1.2, 1.3, 1.4, and 3.1.1. One commenter stated that the Pine Ridge Indian Reservation is outside the GEIS region of interest but is impacted by the Crow Butte facility.

*Response: The GEIS contains a statement in Section 3.1.1 that the applicability of the GEIS to proposed facilities outside the defined regions depends on the similarities of the proposed site and regional conditions with those described in the GEIS. The boundaries of the milling regions are intended to encompass the areas where future ISL facilities may be located and the affected environment potentially impacted by the operation of such facilities. The GEIS recognizes that for certain resource areas (e.g., socioeconomics), potential impacts may extend beyond the milling region boundaries. NRC will evaluate the potential impacts to the local affected environment in its environmental reviews for site-specific ISL license applications. The response is considered sufficient to address the comments; therefore, no changes to the GEIS were made in response to these comments.*

**Comment: 025-001**
One comment noted that NRC is proposing the largest ISL operation in the United States with approximately 30 applications.

*Response: The NRC role in ISL licensing is to conduct safety and environmental reviews of individual license applications to support a licensing decision to either grant or deny an application to receive, amend, or renew a license to operate an ISL facility. NRC does not propose or site facilities. This response is considered sufficient to address the comment; therefore, no changes were made to the GEIS.*

**Comment: AL16-053**
A commenter suggested the GEIS excludes past uranium milling from scope but does not mention mining.

*Response: Mining, whether by open pit or through underground means, is not regulated by NRC and is therefore outside the scope of the GEIS. Conventional milling, while an activity that is regulated by NRC, was also considered outside the scope of the GEIS because the GEIS's focus was on assessing potential impacts from the ISL method. Past activities such as mining and milling are appropriate for consideration in a cumulative impact assessment, which, as* *discussed in GEIS Appendix A, is a site-specific analysis. In response to this comment, mining was added to the heading and statements in GEIS, Appendix A, Section 4.5 that discusses scoping considerations for impacts from past and present conventional milling.*

**Comment: SP01-001; 036-009; 036-010; 036-030; 036-034**
One commenter recommended the GEIS include additional discussion of complimentary regulatory requirements and guidance that enhance safety of ISL facilities including regulations from the EPA throughout the GEIS and on Pages xlviii–xlix in Vol. 2 and Page 8–2, Lines 14–15, in particular. The same commenter suggested NRC include more detail on licensing documents and the review process schedule on Pages 1–2, Lines 11–13 and Pages 1–17, Lines 6–19, and include discussion of the ISL rulemaking and new policy initiatives. Another commenter asked whether the GEIS will include rules and regulations.

*Response: The GEIS includes discussions of existing applicable regulations to provide context for topics where the significance level of potential impacts is influenced by existing regulatory requirements and programs. The GEIS does not establish or create regulations. Discussions of regulations or guidance documents in the GEIS are neither comprehensive nor complete with respect to NRC requirements or those of state and other federal agencies that play a role in regulating ISL facilities. While NRC has made a reasonable effort to provide basic descriptions of those agencies involved in ISL facility licensing and permitting and, in some cases, their statutory and regulatory authority (see GEIS, Sections 1.6 and 1.7), providing a complete description of participants and their authority and regulations is not practical and goes beyond the purpose of the document. Furthermore, the same applies to descriptions of NRC guidance and licensing documents, which are described at a general level necessary to gain a basic understanding of how NRC regulates ISL facilities. Schedules for the licensing review process vary from one license application review to another based on the completeness and quality of submitted information and the complexity of safety and environmental issues with each site. At the time of this writing, efforts to develop new ISL regulations are not sufficiently developed to include meaningful discussions in the GEIS. Based on this response, no changes were made to the GEIS.*

**Comment: 036-029**
One commenter suggested the statement in the GEIS Executive Summary that an EIS will be used for conventional uranium facilities is outside the scope of the GEIS because conventional milling is outside the scope of the GEIS.

*Response: NRC agrees with the commenter, and the statement was removed from GEIS Executive Summary.*

### G5.5.7 GEIS Impact Conclusions

**Comment: SP02-001**
One commenter, in discussing concepts in the GEIS, asked NRC to clarify what is meant by potential impact.

*Response: The word "potential" is used in the GEIS when discussing impacts because the conclusions are being made prior to the action under review taking place and there is some uncertainty as to whether the impacts would actually occur (e.g., likelihood), and if it did, to what degree. Impact conclusions are based on certain conditions being present at the site, and the conditions mentioned in the GEIS may not be present at all sites that are reviewed. Potential* *impacts consider the types of impacts that are plausible at any ISL facility (e.g., spills, excursions, routine radon emissions, influx of workers). The types of impacts considered are informed by three decades of NRC experience in licensing operating ISL facilities. This response is considered sufficient to address the question; therefore, no changes to the GEIS were made.*

**Comment: CA07-008; CA08-007; CH08-007; GA08-007; GR06-004; SP10-006; SP11-005**
A number of commenters mentioned the GEIS confirms or concludes that ISL facilities are low risk.

*Response: The purpose of the GEIS is to assess the potential environmental impacts that might occur from ISL facilities. The GEIS documents potential impact conclusions for a number of resource areas that are characterized as "SMALL" or "SMALL to MODERATE"; however, there are other resource areas such as groundwater, historical and cultural resources, land use, and threatened and endangered species that have potential impact conclusions that can range from "SMALL" to "LARGE" as a possibility under certain specified circumstances. This clarification is considered sufficient to address the comment; therefore no changes were made to the GEIS.*

**Comment: 036-098**
One commenter noted NRC appears to overstate the potential for adverse impacts associated with ISL operations in each of the four identified milling regions addressed in the GEIS. The commenter suggested NRC review the National Mining Association Generic Environmental Report and adjust the tone of the GEIS to be more in line with the relatively low impacts and risk of ISL operations.

*Response: The purpose of the GEIS is to assess the potential environmental impacts that might occur from ISL facilities sited in the four aforementioned milling regions. Impact conclusions are based on certain conditions being present at the site, and the conditions mentioned in the GEIS may not be present at all sites that are reviewed. Potential impacts consider the types of impacts that are plausible at any ISL facility (e.g., spills, excursions, routine radon emissions, influx of workers). The types of impacts considered are informed by three decades of NRC experience in licensing operating ISL facilities.*

*The impact conclusions in the GEIS are supported by information provided in the GEIS and include clear bases and lines of reasoning for how and why a particular conclusion was reached. This response is considered sufficient to address the comment; therefore, no changes were made to the GEIS.*

## G5.5.8 References

NRC. NUREG–1680, "Feasibility Study for a Risk-Informal and Performance-Based Regulatory Structure for Future Plant Licensing." Washington, DC: NRC. December 2007.

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

NRC. NUREG–1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants." Vol. 1. Washington, DC: NRC. May 1996.

## G5.6 Scoping Process and Scoping Report

**Comment: 039-002**
One commenter suggested uranium recovery from water treatment resins should not have been grouped with other processes in the Scoping Report (located in GEIS Appendix A).

*Response: Alternative feed materials were grouped together for scoping the GEIS because alternative feed materials as a group are considered outside the scope of the GEIS. 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 U.S. demand for uranium or what sources of uranium should be used. Because alternative feed materials can vary in origins and characteristics, each alternative feed material is reviewed by NRC on a site-specific, case-by-case basis to ensure safety and protection of the environment. As a result, no changes were made to the GEIS or scoping report (GEIS, Appendix A) in response to this comment.*

## G5.7 GEIS Methods and Approach

### G5.7.1 Provide Additional Discussion of Conditions That Limit Potential Impacts

**Comment: 017-014; 036-002; 036-015; 036-040; AL32-157**
Several commenters noted that the GEIS should include a more detailed discussion of aspects of ISL operations that may limit potential impacts. These include regulatory measures to limit impacts through permits and the imposition of license conditions. Commenters also noted that the GEIS should include more discussion of those aspects of the natural systems such as hydrologic and geochemical conditions that may tend to isolate ISL production zones and reduce potential impacts to water resources.

*Response: The concept of license conditions that may be identified as commitments during the site-specific NRC safety and environmental reviews is discussed in GEIS Section 1.7.1. Other state and federal permits required prior to and during ISL operation are also described in GEIS Section 1.7. GEIS Chapter 2 includes a general description of the types of geochemical and hydrological conditions that are considered to be favorable to ISL production and the isolation of lixiviants from surrounding aquifer systems. Specific examples of permit requirements and NRC license conditions are discussed in more detail in other sections of the GEIS. For example, GEIS Section 1.7.2.1 describes the types of Underground Injection Control (UIC) permits that are required prior to ISL operation. GEIS Section 7.3 identifies site-specific NRC license conditions as a management action used to identify and mitigate potential impacts on a case-by-case basis. GEIS Chapter 8 describes NRC license conditions that require licensees to monitor for potential excursions as part of their site-specific environmental monitoring programs. The specific details on license conditions and permit requirements are inherently site-specific, and are determined by NRC staff and other permitting agencies for individual ISL facilities on a case-by-case basis. The text of Section 1.7.1 has been revised to clarify how site-specific license conditions are identified and established.*

### G5.7.2 Consider Compliance History in Assessing Impacts

**Comment: 046-002; 1305-097; 1314-044; GA16-004; GA23-006; HC012-002; HC016-004; NE06-015; NE06-016; SP12-001**
Several commenters noted that the GEIS should consider the compliance history of ISL facilities when assessing potential impacts. Another commenter expressed concern that the GEIS did not do an adequate job of drawing on 40 years of ISL operational experience. One commenter also noted that the GEIS should consider information on past uranium mining to fully evaluate the need for environmental protection and the resultant impacts.

*Response: An historical discussion of ISL operations is presented in GEIS Section 2.11, and references to specific facilities in Wyoming, Nebraska, and New Mexico are provided in Section 2.14. The intent of the information presented in GEIS Chapter 2 is to inform the reader as to which issues have historically resulted in potential impacts at ISL facilities and provide a range of conditions that may be expected for each of the four phases of ISL activities considered in the GEIS. As described in Section 1.8, the information in the GEIS may be incorporated by reference in a site-specific ISL proposal. As described in GEIS Section 1.8.3, the NRC staff determines the appropriate level of detail necessary for an individual ISL facility depending on site-specific conditions; individual licensee performance is one of the factors that the NRC staff may consider during the site-specific safety and environmental reviews. In addition, as described in GEIS Sections 1.7.1, NRC conducts periodic inspections of ISL facilities to ensure compliance with applicable regulatory requirements, license conditions, and approved procedures. Because the comments were specifically related to a level of detail that is more appropriate to the site-specific review of individual ISL facilities, no changes were made to the GEIS beyond the information provided in this response.*

### G5.7.3 Reliance on Regulatory Compliance to Limit Impacts

**Comment: 1173-014; 1300-015; GI01-011; SP15-001**
One commenter expressed concern that the GEIS impact analysis relies on activities being temporary (e.g., spills detected quickly, soil reclaimed after decommissioning) and asked whether past experience regulating ISL facilities has shown impacts to be SMALL. Several commenters questioned the use of regulatory compliance to limit potential impacts, with one commenter specifically questioning whether NRC has sufficient resources to enforce compliance.

*Response: Consistent with CEQ regulations, NRC does not analyze NEPA unreasonable alternatives such as potential environmental impacts from unregulated uranium production at an ISL facility. As a matter of practice, the NRC staff assumes that regulations will be in existence and applied, as appropriate, to an ISL facility. NRC expects the licensee's compliance with regulatory requirements and license conditions when evaluating the potential environmental impacts of an ISL uranium recovery facility. As described in GEIS Section 1.7.1, the NRC staff will conduct periodic inspections to determine compliance with applicable regulatory requirements, license conditions, and approved procedures. Potential violations and allegations will be evaluated and addressed through the appropriate NRC enforcement or allegation programs. Enforcement actions can result in fines, corrective actions, or injunctive relief to address violations of regulatory requirements. The impact analyses presented in GEIS Chapter 4 are informed by historical information presented in Chapter 2. As described in the summary of environmental consequences presented in Chapter 10, the GEIS presents a range of potential impacts with respect to four different geographic regions, four separate phases in the life of an*

*ISL facility, and a number of different environmental resource areas. Depending on the affected resource area and the phase in the facility's lifecycle, the potential impacts may range from SMALL to LARGE. Additional site-specific information will be needed to determine where the potential impact falls within the range. Because the comments were specifically related to a level of detail that is more appropriate to the site-specific review of individual ISL facilities, no changes were made to the GEIS beyond the information provided in this response.*

### G5.7.4 Methods for Assessing Impacts From ISL Phases

**Comment: 050-011; 1601-001; 1602-002; 963-008; AL32-160**
Commenters suggested that the GEIS should include an analysis of impacts not by activity, but by temporal nature (i.e., all activities considered together), because more than one phase may be occurring at the same time. The comments expressed a general concern that by conducting separate analyses for construction, operations, aquifer restoration, and decommissioning phases, the GEIS does not present an accurate picture of potential impacts associated with overlap between phases.

*Response: The NRC staff recognizes that the analyses presented in the GEIS could be structured in different ways. The basis for selecting the structure adopted for the GEIS is described in Section 1.4. As stated in the introduction to the GEIS Chapter 2, the NRC staff recognizes that other than the preconstruction phase, aspects of the four other phases in the ISL life cycle could occur at the same time. The NRC staff considers, however, that describing the ISL process in terms of these stages aids in the discussion of the ISL process and in the evaluation of potential environmental impacts during the life cycle of an ISL facility. Toward this end, the general overview of the ISL process and the summary of historical ISL activities presented in GEIS Chapter 2 are structured according to separate phases. As described in Section 4.1, this structure has been maintained in the consequence analysis presented in GEIS Chapter 4. As appropriate, the GEIS does provide examples of where overlap among different phases has been considered. For example, potential groundwater consumption impacts were evaluated using site-specific information from a well field undergoing aquifer restoration at the same time other adjacent well fields are in operation. Overall, the NRC staff believes that structuring the GEIS in terms of ISL activities is an effective means to separate distinctive impacts that will facilitate subsequent incorporation by reference and adoption of impact conclusions from the GEIS to satisfy NEPA requirements at the site-specific level. Because the issues raised by the comments have been discussed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.7.5 GEIS Should Evaluate Impacts From Other Processing Solutions

**Comment: 050-025; 1321-003**
Commenters expressed concern that the GEIS is predicated on the use of alkaline lixiviants to mobilize and extract uranium and did not consider the impacts from other potential ore-processing solutions such as acids and ammonia-based lixiviants.

*Response: Alternate lixiviants were identified during the scoping process (see GEIS Appendix A). For practical reasons, the analyses presented in the GEIS are not intended to examine all potential variants of ISL technology, but rather to focus on the most common practices (GEIS, Appendix A, Section 4.10). GEIS Section 2.4.1.1 describes different lixiviants (e.g., acid- and ammonia-based) that have been used previously in the United States, and presents a brief summary of their strengths and weaknesses. As noted in GEIS Section 2.4.1.1,* *however, alkaline lixiviants are used in all currently active and proposed ISL facilities in Wyoming, Nebraska, and New Mexico. For this reason, the GEIS was developed assuming that alkaline lixiviants would be used for uranium mobilization and extraction. Should a licensee or applicant propose a different lixiviant for an individual ISL facility, certain aspects of the GEIS impact analyses would not be applicable and the NRC staff would evaluate site-specific impacts based on the proposed lixiviant chemistry. The text in GEIS Section 1.4.1 has been revised to clarify the focus of the GEIS.*

### G5.7.6 Methods for Defining/Use of Milling Regions

**Comment: 036-004; 036-087; 050-003; 050-007; 1173-006; 1305-093; 1305-094; 1305-098; 1305-099; 1305-101; 1305-109; CH06-007; NE06-006**
Commenters raised questions as to how the NRC staff defined different uranium milling regions considered within the GEIS. Some commenters favored the regional approach, but others found it to be too simple. Commenters suggested combining regions to reduce redundancy or preparing a separate GEIS for individual geographic regions. Some commenters expressed concern that the region boundaries were arbitrary, requesting clarification on how the GEIS would be applied to sites outside of the boundary. Several commenters identified individual uranium deposits that do not fall within the regions as described and suggested modifications to the boundaries. One commenter requested detailed latitude/longitude coordinates for the uranium milling regions and different land uses (e.g., mining districts, state and national parks, national forests, grasslands, BLM lands, cultural and archaeological resources, Native American lands, and endangered species habitats) for the Wyoming West Uranium Milling Region.

*Response: The NRC staff recognizes that the uranium milling regions could be defined differently and addressed at different geographic scales. As described in GEIS Section 1.1, the geographic regions used as the framework for the GEIS were identified considering that (1) past and existing uranium milling sites are located within the states where NRC has regulatory authority over uranium recovery and (2) potential new sites are based on NRC's understanding of where the uranium recovery industry has plans to develop uranium deposits using ISL technology. The location of historical uranium deposits within portions of Wyoming, Nebraska, South Dakota, and New Mexico was also considered. The structure of the GEIS by geographical region was intended to be practical but capture broad conditions of different regions (e.g., population centers) that should be considered in subsequent site-specific environmental reviews. The geographic regions were not intended to be rigid, nor were they intended to include every potential uranium deposit. Identifying regions for the purposes of the GEIS does not mean NRC prefers these locations or would prevent uranium recovery in other areas. As described in GEIS Section 3.1.1, the analyses presented in the GEIS may or may not be applicable or informative to the site-specific review for a given ISL facility proposed outside of the uranium milling regions. The NRC staff would evaluate the applicability of the GEIS taking into consideration factors such as the similarities of the proposed site and regional conditions with those described in the GEIS. The discussions of land use and the maps presented in the GEIS are based on publicly available information that is identified in the references cited. Because of the intent to capture broad conditions for the different regions, it is not necessary for the GEIS to include precise coordinates for this public information. Because the issues raised by the comments have been addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.7.7 How Mitigation Is Addressed

**Comment: 1314-004; 1314-068; 1314-070**
Several commenters expressed concern that the GEIS does not adequately address mitigation measures for ISL mining.

*Response: GEIS Chapter 7 provides a general description of the types of best management practices and mitigation measures that may be used at an ISL facility. GEIS Chapter 8 describes the types of monitoring that are implemented at ISL facilities to ensure that worker and public health and safety and the environment are protected against inadvertent releases. As described in the GEIS, the descriptions are based on historical practices, mitigation, and monitoring used for existing and planned ISL uranium recovery facilities. The listings are not intended to be exhaustive, nor do they imply that NRC endorses specific mitigation measures. Each practice or mitigation measure described in the GEIS may or may not be applicable to a specific proposed facility or project, but the descriptions presented in GEIS Chapters 7 and 8 provide a foundation for developing customized management and mitigation plans during the site-specific reviews for an individual facility or project. Because the issues raised by the comments have been addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.7.8 Classification of Impacts

**Comment: 050-010; 059-004; 1314-035; 1314-036; 1321-018; CH10-005; SP04-001; SP05-001**
Several commenters indicated that the GEIS does not adequately define SMALL, MEDIUM, and LARGE impacts and requested a more detailed discussion of the criteria used to establish impact significance. One commenter requested that the impact significance be established within the context of the region of influence, and another commenter suggested categorizing impacts as either significant or insignificant. One commenter expressed concern that the GEIS underestimates the impacts on all resources.

*Response: Section 1.4.3 provides a summary of the methodology and describes the types of considerations the NRC staff used to determine impact significance as SMALL, MODERATE, or LARGE. According to CEQ, the significance of impacts is determined by examining both context and intensity (40 CFR 1508.27). NRC established these significance levels originally in the Generic EIS for License Renewal of Nuclear Plants (NRC, 1996), using as a basis the CEQ regulations. The GEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003a), which incorporates these significance level categories.*

*As described throughout Chapter 4, the conclusions presented in the GEIS are informed by historical ISL operations (see GEIS Section 2.11). The GEIS is intended, however, to provide insights into the types and ranges of impacts from an ISL facility that may be expected with respect to different resource areas. As described in GEIS Section 1.8.3, the NRC staff will conduct an independent, detailed evaluation of the potential environmental impacts of an applicant's proposed action to construct, operate, restore, and decommission an ISL facility. This evaluation will use the information contained and the impact conclusions reached in the GEIS to the extent applicable to the specific site. For example, in some cases the GEIS indicates a range of potential impacts; specific impacts will be determined during the site-specific review based on conditions at the site. Because the issues raised by the* *comments have been addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

## G5.7.9 General Comments on GEIS Structure, Methods, and Approaches

**Comment: 005-006; 010-004; 015-035; 036-014; 050-065**
One commenter suggested that the NRC staff should consider using legal briefs as information sources for the GEIS. Another commenter noted that the no-action alternative could be used as a basis for comparing impacts. Several commenters suggested different structures for the GEIS, with one commenter suggesting an appendix similar to Appendix E to summarize the risks of naturally occurring constituents mobilized by the ISL process and another commenter suggesting that the discussion on radiological effluents and doses be more explicitly presented than its current location in the sections on Public and Occupational Health. One commenter questioned whether the GEIS would be tiered to 1,000- or 6,500-ha [2,500- or 16,000-acre] sites.

*Response: The NRC staff acknowledges that a tremendous amount of information is available from a number of different stakeholders in the ISL licensing process. As reflected in the cited references, the NRC staff has made every effort to use relevant, objective, publicly available information to develop a broadly applicable GEIS. For example, as described in Chapters 1 and 2, scientific information and historical information based on NRC licensing experience in the different uranium milling regions were used to identify and characterize potential impacts presented in GEIS Chapter 4. The NRC staff also used historical information in GEIS Chapters 5 through 9 to characterize potential cumulative impacts and environmental justice considerations, identify potential mitigation and monitoring measures, and summarize the types of interagency consultations that are typically involved in licensing an ISL facility. It is not practicable, nor is it the intent of the NRC in preparing the GEIS, to use every information source.*

*The NRC staff recognizes that there are a number of different ways to structure the GEIS. The general structure adopted for the GEIS, including the presentation of radiological health and safety information, is based on NRC guidance in NUREG–1748 (NRC, 2003a). As appropriate, the NRC staff developed appendixes in the GEIS to provide more detailed information on broadly applicable areas. GEIS Chapter 2 describes how site-specific groundwater chemistry is used to establish baseline preoperational baseline conditions for the production zone and the surrounding aquifers and includes references to more detailed NRC guidance such as NUREG–1569 (NRC, 2003b). On a case-by-case basis, these conditions are used to establish site-specific monitoring parameters and aquifer restoration objectives. NRC and the states authorized to implement the EPA groundwater protection program require well field restoration to protect human health and the environment.*

*As described in Section 2.11.1, a range in ISL facility areas was considered in the GEIS, and Section 1.8.3 describes how the GEIS will be used to support site-specific environmental reviews. Site-specific environmental reviews can tier off of the GEIS regardless of the size of the license area. NRC staff will use site-specific information to evaluate what relevant sections of the GEIS can be incorporated by reference into the site-specific EA, EIS, or SEIS for the various resource areas being evaluated.*

*Because the comments were specifically related to a level of detail that is more appropriate to the site-specific review of individual ISL facilities, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-034**
One commenter suggested that the GEIS be revised to disclose actual practices used by NRC related to ISL preconstruction requirements concerning baseline groundwater quality and soil background radiation levels.

*Response: NRC has produced guidance that is relevant to the type and amount of information that is to be provided in a license application to construct, operate, restore, and decommission an ISL facility. This guidance, such as NUREG–1569 (NRC, 2003b) and Regulatory Guide 3.46 (NRC, 1982), are incorporated by reference in the GEIS, as appropriate (for example, see GEIS Section 1.8.1). As another example, based on the information presented in NRC (2003b, Table 2.7.3-1), typical preoperational groundwater quality parameters that have been accepted by NRC are identified in GEIS Section 2.2. Issues related to characterization of soil background levels are discussed in section G5.31, "Public and Occupational Health." Because the comments were specifically related to more detailed information that is incorporated by reference in the GEIS for the site-specific review of individual ISL facilities, no changes were made to the GEIS beyond the information provided in this response.*

### G5.7.10 References

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

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

NRC. NUREG–1437, "Generic EIS for License Renewal of Nuclear Plants." Washington, DC: NRC. May 1996.

NRC. Regulatory Guide 3.46, "Standard Format and Content of License Applications, Including Environmental Reports, for *In-Situ* Uranium Solution Mining." Washington, DC: NRC. 1982.

## G5.8 Public Involvement

**Comment: 1300-005; 1305-016; AL02-006; CH01-002; GA03-001; GI04-002; NE01-002; NE10-003; NE10-002**
A number of commenters had questions or comments about the opportunities for public involvement during the site-specific NRC review of an ISL license application. Some wanted to know how the public knows when a license application is submitted, when a facility is cited for a violation, or when an accident occurs. One commenter thought the NRC should clarify under what circumstances new information received after the notice of hearing (e.g., in response to NRC requests for additional information) would become the basis for a subsequent hearing opportunity. Another commenter wanted to know how it would be determined whether or not an EA is adequate (rather than an EIS), and wanted to know how the public would be able to comment on the accuracy of the data when an EA is done. One commenter wanted to know whether what was said mattered. Another wanted to know the purpose of the public comment meetings. One commenter wanted to know whether there would be another public comment

opportunity before the license is granted. Another commenter wanted to know whether any companies had applied for licenses.

*Response: NRC provides multiple avenues for public involvement in its licensing process. The NRC licensing process that would be used to review individual ISL facility applications is summarized in GEIS Section 1.7.*

*In the NRC license review process, once an application is received, reviewed for completeness, and accepted for detailed review, the NRC formally dockets the application and publishes a notice in the Federal Register. The Federal Register notice announces the availability of the application and provides an opportunity for affected individuals or entities to request a hearing under the NRC formal hearing process. 10 CFR Part 2 provides the requirements that must be met to be granted a hearing.*

*The notice of availability (NOA) also would include the relevant identifying information for the license application so that an interested member of the public could view the application either electronically through the NRC Agencywide Documents Access and Management System (ADAMS) [at www.nrc.gov/reading-rm/adams.html] or in person by visiting NRC's public document room.*

*NRC previously stated in the Federal Register on September 27, 2007 (72 FR 54947) that all draft EAs prepared for ISL facility license applications would be available for public comment. This statement was made in anticipation that NRC would be preparing EAs for applications for new ISL facilities. Based on public comments NRC received on the draft GEIS, NRC has decided to prepare a supplemental environmental impact statement (SEIS) for all license applications for new ISL facilities. NRC will follow the public participation procedures outlined in 10 CFR Part 51, which can include requests for public input on the scope of the SEIS and requires public comment on the draft SEIS.*

*Additionally, for new ISL license applications, NRC also will publish in the Federal Register a notice of intent (NOI) to prepare the site-specific SEIS and provide details on the scoping process for the SEIS, if applicable. The scoping process may include public meetings where affected stakeholders and interested members of the public could provide comments on what they consider to be within the scope (i.e., at issue or of concern) for the site-specific environmental review. Following the scoping period, NRC would prepare a summary of scoping comments received and the determinations and conclusions reached regarding the subsequent scope of the SEIS. This scoping summary would be provided to interested parties and made available through NRC's publicly available ADAMS website.*

*NRC also will publish for public comment a draft SEIS. An NOA for the draft SEIS will be published in the Federal Register, and copies of the draft SEIS will be sent to affected stakeholders and interested members of the public. The NOA also would announce the dates for the public comment period on the draft SEIS and the times, dates, and locations of any public comment meetings on the document. NRC will accept public comments on the draft SEIS offered orally or in writing at the meetings, as well as comments sent by regular mail or electronically to NRC. NRC will address the public comments received in its final SEIS.*

*NRC will prepare an EA, SEIS or an EIS for applications to renew or amend licenses at existing ISL facilities. NRC may make the draft EA and accompanying draft FONSI available for public comment. The decision to submit a draft EA for public comment would take into account the provisions in 10 CFR 51.33 concerning the similarity of the proposed action to actions normally* *requiring preparation of an EIS and the precedent-setting nature of the proposed action. Additionally, NRC may consider the level of public interest and the contentious nature of the proposed action in determining whether to publish a draft EA/FONSI for public comment. The NRC staff would address public comments received on the draft environmental assessment/FONSI in the staff's final environmental review document. This approach is consistent with NRC regulations.*

*During the licensing process, the license application, any NRC requests for additional information, and the licensee responses to those requests would be publicly available on the NRC website or through NRC public document rooms. The NRC website (www.nrc.gov/materials/uranium-recovery.html) also provides information on currently licensed ISL facilities, license applications that have been submitted and are under review, letters of intent from companies preparing to submit applications in the future, and notices of violations or enforcement actions.*

*With respect to the comment concerning the circumstances under which a subsequent opportunity for hearing might be provided, the applicable NRC regulations are found at 10 CFR 2.309. Absent the exceptional case where an applicant's or licensee's responses to NRC staff requests for additional information (RAIs) equate, in effect, to a new license application, the Commission, in its role as an NRC adjudicator, and not the NRC staff, would make the decision on whether to publish another opportunity for hearing. Additionally, it is possible for non-timely requests for hearing to be made under the provisions of 10 CFR 2.309(c), and such filings would need to meet the contention requirements under 10 CFR 2.309(f).*

*Regarding accidents at NRC-licensed ISL facilities, while it would be unlikely for an accident at an ISL facility to threaten the safety of residents beyond the site boundary, should such an event occur, NRC would communicate with, and provide advice, technical support, and guidance to state and local agencies responsible for responding to emergencies.*

*In response to this and other comments, Chapter 1 of the GEIS was revised.*

**Comment: 013-003; 016-005; 031-002; 059-022; AL15-041; HC005-001; HC005-002; HC005-004; HC015-002; NE06-004; NE06-007; SP08-006**
These commenters stated additional public meetings should be held and the public should be involved. Several commenters requested that a public meeting be held in Crook County, Wyoming, which is closer to the potential ISL areas. Some pointed out that those affected should not have to drive for hours to comment and that this fact limited attendance. Another commenter did not like the fact that the meeting was held on a Friday night of Labor Day weekend. Another commenter wanted clarification of how and when the public would be involved. One commenter thought public meetings should be held on tribal reservations. One commenter wanted to know whether the public really had a say in this.

*Response: The NRC encourages public involvement in the GEIS process and has solicited public comments during both the scoping period and the draft GEIS public comment period. A series of public meetings were held at specific locations within the four milling regions addressed in the GEIS: Spearfish, South Dakota; Chadron, Nebraska; Newcastle, Wyoming; Gallup, New Mexico; Grants, New Mexico; Albuquerque, New Mexico; Gillette, Wyoming; and Casper, Wyoming. These locations were selected due to their proximity to potentially affected stakeholders and their capability to provide appropriate venues for the meetings. Comments were accepted orally or in writing at those meetings, and the NRC staff also accepted* *comments sent via e-mail and regular mail. Because these comments were general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 024-001; 025-005; 050-016; AL21-082; AL34-166; GA11-001; GR25-004**
Some commenters suggested that NRC had not properly informed the public. One commenter noted that many people may not know about the public meetings. They noted people would be less likely to disagree with NRC if there were more opportunities for public comment. One commenter thought the NRC website was a potential tool to keep the public informed but thought local press releases should be used in affected localities because not everyone in rural areas has internet access. Another commenter mentioned locals do not have personal computers and that also limits public involvement. They also suggested that trial-like hearings should not be considered a surrogate for NEPA public participation, which was designed to be more open and accessible. Other commenters were appreciative of the opportunity to comment on the GEIS. One commenter thanked NRC for traveling to three different locations in New Mexico and credited NRC with their interest in involving the public. Another expressed appreciation to NRC for encouraging public involvement.

*Response: Public participation is an essential part of the NRC licensing review process. The NRC conducted an open, public GEIS development process consistent with the requirements of the NRC's NEPA-implementing regulations in 10 CFR Part 51. NRC held three scoping meetings for the GEIS. The scoping process conducted for the GEIS is described in GEIS Section 1.5.1, and the issues identified during the meetings are summarized in Appendix A. NRC also held eight public comment meetings on the draft GEIS throughout the regions addressed in the GEIS. The purpose of these meetings was to receive public comments on the draft GEIS. The public meetings were noticed in the Federal Register and on NRC's public website, additional notices were published in local newspapers to the extent practical, and public service announcements were broadcast over radio stations in the vicinity of the planned meetings.*

*NRC accepted comments at the public meetings and also accepted comments via e-mail and regular mail. In response to public request, the comment period was extended to allow people more time to submit comments. As described in GEIS Section 1.8.4, NRC will continue to encourage public involvement during the site-specific environmental review process. Regarding the comment on hearings, NRC appreciates feedback on its licensing process and will take the comment into consideration.*

*Because the comments were general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 017-007; 017-009; 031-005; 032-002; 032-006; 050-017; 0694-003; 1142-002; 1314-007; 1317-006; 0963-005; AL09-017; AL24-100; AL30-149; CA01-004; CA07-007; CA08-006; CA10-006; CH08-004; GI01-005; GI03-002; GR08-003; GR18-004; NE06-007; SP10-005; SP11-003**
A number of commenters expressed views that the GEIS would limit public involvement in NRC site-specific environmental reviews. Several commenters thought future participation in the licensing process would not be allowed for the site-specific assessments. One commenter said it was contrary to the state's commitment to full public participation in the permitting process. Another commenter mentioned that he thought the NRC did not view public participation as important. One commenter thought the GEIS limited public involvement because its environmental analyses were so thin as to be meaningless. One commenter thought the GEIS would make the public lose its rights to be involved in decisions that will affect a way of

life. In contrast, a number of other commenters expressed views that the GEIS would not limit public participation in site-specific environmental reviews. Many commenters pointed out that the public would have additional opportunities to comment during site-specific reviews. Another commenter thought the GEIS would be a useful tool to help educate the public and state regulators.

*Response: The NRC supports public involvement in site-specific licensing reviews and has incorporated opportunities for public involvement in the licensing process. Opportunities for public involvement in future site-specific environmental reviews are also discussed in detail in response to comments at the beginning of this section. As discussed in Section 1.8.4, whether an EIS or SEIS is conducted to document the NRC environmental review for site-specific ISL licensing actions, opportunities for public involvement are provided when the license application is docketed at the beginning of the NRC detailed technical review and when a draft EIS or SEIS is completed. In addition, the EIS process incorporates a formal scoping process.*

*NRC may make the draft EA and accompanying draft FONSI available for public comment. The decision to submit a draft EA for public comment would take into account the provisions in 10 CFR 51.33 concerning the similarity of the proposed action to actions normally requiring preparation of an EIS and the precedent-setting nature of the proposed action. Additionally, NRC may consider the level of public interest and the contentious nature of the proposed action in determining whether to publish a draft EA/FONSI for public comment. The NRC staff would address public comments received on the draft environmental assessment/FONSI in the staff's final environmental review document. This approach is consistent with NRC regulations.*

*The license application, NRC requests for additional information, and licensee responses would be publicly available on the NRC website or at NRC public document rooms. As a result, NRC considers the formal opportunities for public involvement included in the licensing process for ISL facilities to be sufficient. In response to this and other comments, Chapter 1 of the GEIS was revised.*

**Comment: 1300-008**
One commenter expressed a view that the NRC public participation process described in GEIS Section 1.8.4 was flawed. It was suggested that NRC would first determine whether there were significant impacts for a proposed or restarted ISL operation and then start the NEPA public involvement process. It was thought that this process was backwards with regard to public interest and that the public should have input in the beginning.

*Response: As indicated in GEIS Section 1.8.4, the regulations that govern the NRC environmental review process, including public participation, are contained in 10 CFR Part 51. The NRC licensing process is described in GEIS Section 1.7. Additional detailed information is available in published NRC guidance (NRC, 2003a,b).*

*As discussed in the response to comments at the start of this section, NRC will be preparing a SEIS to document its environmental review of new ISL license applications. For renewals or amendments to existing ISL licenses, NRC may prepare either an EA, SEIS or an EIS to document its environmental review. As stated in 10 CFR 51.25, NRC makes a decision to prepare the appropriate environmental document to support its review of an applicant's or licensee's proposed action.*

*One of the determinations should an EA be prepared is whether the proposed action could result in significant impacts on the affected environment. The staff could issue, based on the*

*EA, a FONSI or conclude that significant impacts are possible, thereby leading to an EIS. As discussed in Section 1.8.4, whether an EIS or SEIS is conducted to document the NRC environmental review, opportunities for public involvement are provided when the license application is docketed at the beginning of the NRC detailed technical review and when a draft EIS or SEIS is completed. In addition, the EIS process incorporates a formal scoping process. During this process, any public meetings are announced through sources such as the NRC website (www.nrc.gov), the Federal Register, and local newspapers. The public is informed during the meetings and through these sources as to how it can effectively participate in the process. Additionally, the NRC website has information updated throughout the licensing process. NRC may conduct a scoping process for preparation of a SEIS.*

*NRC may make the draft EA and accompanying draft FONSI available for public comment. The decision to submit a draft EA for public comment would take into account the provisions in 10 CFR 51.33 concerning the similarity of the proposed action to actions normally requiring preparation of an EIS and the precedent-setting nature of the proposed action. Additionally, NRC may consider the level of public interest and the contentious nature of the proposed action in determining whether to publish a draft EA/FONSI for public comment. The NRC staff would address public comments received on the draft environmental assessment/FONSI in the staff's final environmental review document. This approach is consistent with NRC regulations.*

*In response to this and other comments, Chapter 1 of the GEIS was revised.*

**Comment: 050-015; 1300-013; 1321-023; 1321-031; 1388-007; AL05-141; CA02-011; SP08-002; SP08-009**
These commenters had recommendations for changes to the public involvement process. One commenter recommended enhanced public involvement for tiered EAs. Several commenters wanted to ensure NRC would publish site-specific EAs for public comment and stated this should be specified by regulation including the length of public comment period. One commenter recommended discussing restoration standards in the site-specific analyses and including the opportunity for public comment. Another commenter suggested the GEIS was not written with the American public in mind. One wanted the GEIS and related meetings to be translated into different languages to allow for participation. Another commenter noted the GEIS was not public-friendly and that it contained too many things that require experts to explain. One requested NRC place older NRC licensing documents in the NRC document system (ADAMS) to facilitate public input.

*Response: NRC staff welcomes comments on how to improve the public participation process. The GEIS is intended to be used within the context of existing NRC practices with regard to public participation in the NEPA process. Therefore, it is beyond the scope of the effort to develop the GEIS to change NRC regulations and practices for public involvement. With regard to commenters who requested NRC publish site-specific assessments for public comment, as discussed previously in response to other comments, NRC will publish the site-specific SEISs and EISs for public comment prior to making licensing decisions. NRC may make the draft EA and accompanying draft FONSI available for public comment. The decision to submit a draft EA for public comment would take into account the provisions in 10 CFR 51.33 concerning the similarity of the proposed action to actions normally requiring preparation of an EIS and the precedent-setting nature of the proposed action. Additionally, NRC may consider the level of public interest and the contentious nature of the proposed action in determining whether to publish a draft EA/FONSI for public comment. The NRC staff would address public comments received on the draft environmental assessment/FONSI in the staff's final environmental review document. This approach is consistent with NRC regulations.*

*Regarding the comment on discussing restoration standards in site-specific analysis, the public could provide comments related to this information or the NRC review during the aforementioned opportunities for public comment that are also discussed in GEIS Section 1.8.4. While it is true the ISL process involves many detailed technical issues, the NRC staff continues to try to make the GEIS accessible to the public through the use of tables, figures, and maps. While NRC has tried to facilitate communications in multilingual settings (for example, interpreting the scoping meeting held in Gallup, New Mexico, in Navajo), NRC does not have the resources to translate a document the size of the GEIS into multiple languages. Regarding placing older NRC ISL licensing documents on ADAMS, this suggestion will be considered by staff. In response to this and other comments, Chapter 1 of the GEIS was revised.*

**Comment: GR01-002**
This commenter suggested NRC was just checking off numbers of people for or against during the public comment process.

*Response: NRC staff considers public participation an essential part of the review process. In that regard, each comment is read and addressed and any necessary changes to the GEIS are made. The final version of the GEIS includes this appendix, which contains summaries of the public comments received and NRC's responses to the comments. As noted throughout this appendix, changes were made to the GEIS in response to the comments received. Because the comment was about the public comment process and not the GEIS, no changes were made to the GEIS in response to the comment.*

**Comment: 1314-043**
This commenter thought information on past uranium mining was needed to support public involvement. They thought the public needed to know whether remediation of existing contamination had occurred in order to support whether additional contamination of natural resources should happen.

*Response: NRC staff recognizes there are serious legacy issues regarding past uranium mining and milling. Comments and response regarding the legacy of uranium mining and milling are included in Section G5.17 of this appendix. As discussed in GEIS Chapter 1 and Appendix A, legacy contamination and underground mine workings that may exist on or within the region of influence of a proposed ISL facility would be addressed as part of a cumulative impacts assessment in the site-specific environmental review. Because the comment was focused on site-specific information that is beyond the intended scope of the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: CH07-014**
One commenter suggested the GEIS does not encourage full disclosure and that the irreversible commitment of groundwater resources cannot be treated generically.

*Response: As discussed in GEIS Section 1.2, the NRC staff plans to use the GEIS as a starting point for NRC NEPA analyses of site-specific license applications for new ISL facilities. As a result, the analysis of environmental impacts for a specific proposal would be documented at the conclusion of a site-specific environmental review. NRC staff considers the GEIS to provide a complete programmatic assessment of the potential impacts from ISL facilities. This assessment includes consideration of a suite of potential impacts to groundwater resources within and adjacent to the exempt (production) aquifer in GEIS Chapter 4 (e.g., consumptive use, drawdown effects, excursions). Details regarding the specific hydrologic and local water* *use conditions for a proposed site and vicinity would be considered in the NRC site-specific environmental review. Because the comment is already addressed in the GEIS, no changes were made in response to the comment. Related comments and responses are provided in Sections G5.4, G5.5, and G5.22.*

### G5.8.1 References

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

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

## G5.9 Regulatory Issues and Process

### G5.9.1 NRC As a Federal Agency

**Comment: GA02-001; GA12-006; GR18-001**
A few commenters asked for clarification about the NRC and its role as a federal agency. In particular, one commenter wanted clarification of what it means to be an independent agency. Another commenter wanted to know which congressional committee has oversight responsibilities over the NRC. One suggested that the Atomic Energy Agency was replaced by NRC because the name sounded more civilized.

*Response: NRC was created after Congress passed the Energy Reorganization Act in 1974. This Act, along with the Atomic Energy Act (AEA) of 1954, provides the foundation of the NRC's regulatory authority. The Energy Reorganization Act of 1974 reorganized the responsibilities of the Atomic Energy Agency by creating two new agencies (NRC and DOE). The reasons for making this change were substantive, including the separation of promotional and regulatory roles of the Atomic Energy Agency with regard to civilian nuclear power generation. Interested individuals are encouraged to read the Act for more information.*

*As an independent regulatory agency, NRC is similar to the Federal Energy Regulatory Commission or the Federal Communications Commission. Independent agencies can be distinguished from regular executive agencies by their structural and functional characteristics. While most executive agencies have a single Director, Administrator, or Secretary appointed by the President, independent agencies almost always have a "commission," "board," or similar collegial body consisting of five to seven members who share power over the agency. (This is why many independent agencies include the word "Commission" or "Board" in their name).*

*NRC is headed by a five member Commission, with one member designated by the President to serve as Chairman. With the advice and consent of the Senate, the President appoints each new member to serve a 5-year term. No more than three Commissioners can belong to the same political party. The Chairman is the principal executive officer and official spokesman for the Commission. NRC's current Chairman is Dale Klein (appointed Chairman on July 1, 2006). The other Commissioners are Gregory Jaczko (appointed January 21, 2005), Peter Lyons (appointed January 25, 2005), and Kristine Svinicki (appointed March 28, 2008). There is currently one vacancy on the Commission. Commissioner Jaczko is presently the only Democrat on the Commission.*

*As an independent agency, NRC reports directly to Congress. The Senate and House Committees with jurisdiction over domestic nuclear regulatory activities include the Senate Committee on Environment and Public Works and the House Committee on Energy and Air Quality. Within these committees, the subcommittees with responsibility for legislation and oversight related to NRC are the Senate Subcommittee on Clean Air and Nuclear Safety and the House Subcommittee on Energy and Air Quality. Other Congressional subcommittees have jurisdiction over certain aspects of NRC activities, such as appropriations, international affairs, and general government operations.*

## G5.9.2 NRC Authority and Jurisdiction

**Comment: 050-052; CH06-014; GR03-004**
Commenters asked for clarification of NRC jurisdiction with regard to foreign-owned companies that may proposed ISL facilities. One commenter suggested NRC regulations prevent granting licenses to companies that are owned by foreign companies or governments. Another commenter asked how NRC ensures foreign and domestic uranium companies do not sell uranium to enemies of the United States.

*Response: There is no prohibition against the NRC issuing a license to an ISL facility owned by a foreign corporation or a U.S. foreign-owned corporation. The Section 103 of the AEA prohibition against issuing licenses to foreign corporations only applies to utilization and production facilities. The references to utilization and production facilities in Section 103 do not apply to ISL facilities.*

*Before issuing the license, the Commission determines the issuance of a license will not be inimical to the common defense and security or to the health and safety of the public. ISL licensing guidance does not list specific factors to consider in making this determination. However, NRC has considered the following factors when licensing nuclear reactors: (1) the company's use of foreign entities or foreign personnel to operate the proposed facility or otherwise carry out the terms of the license; (2) whether any aspect of the application raises a clear proliferation threat, terrorist threat, or other threat to the defense or security of the United States; and (3) the status of the nation in which the foreign owner is based, including its alliances with the United States and adherence to international nuclear nonproliferation treaties and safety standards.*

*Section 64 of the AEA authorizes the NRC to cooperate with any nation by distributing source material pursuant to the terms of agreements for cooperation entered into with these nations. The Commission must make a determination that the exportation of source material will not be inimical to the interests of the United States before issuing the license. NRC regulations concerning the exportation of source material outside the United States are contained in 10 CFR Part 110.*

*Because these details are beyond the scope of the summaries in GEIS Chapter 1 and the information is not necessary to support the evaluation of potential environmental impacts from ISL facilities in the GEIS, no changes to the GEIS were made in response to these comments.*

**Comment: 036-039**
One commenter suggested NRC clarify GEIS Section 1.7.5 to state that other federal, state, or tribal permits are independent of NRC authority. The commenter further noted that typically, NRC mandatory license conditions for ISL sites require the licensee to have an aquifer

exemption and an UIC permit before beginning active uranium recovery operations. Moreover, they noted that to begin ISL operations without the required Safe Drinking Water Act (SDWA) authorizations would result in an enforcement action by EPA or the primacy state for violation of the SDWA.

*Response: GEIS Section 1.7 already clarifies that beyond the NRC license, ISL facilities also must obtain permits from federal, tribal, and state agencies. Therefore, a separate statement within a subsection of Section 1.7 is not needed and no changes to the GEIS were made in response to this comment.*

**Comment: 036-095; 036-097; 036-139**
A commenter recommended NRC describe the NRC statutory and regulatory safeguards and license conditions to protect historic and cultural resources in the Historic and Cultural Resources sections of GEIS Chapter 3. This commenter also requested explanation of the statutory and regulatory basis for the statement in the New Mexico Historic and Cultural Resources Section that traditional cultural landscapes are playing an increasing role in decision-making. They also requested an evaluation of the relevance of the Religious Freedom Restoration Act in GEIS Appendix B.

*Response: To meet NRC statutory obligations under NHPA an NRC environmental review involves assessment of potential impacts to cultural, traditional, or historic properties. Properties identified as having important traditional, cultural, or historic value, including those designated by state or federal agencies, are identified as part of the NRC environmental review. These important properties are considered in NRC assessments of potential impacts to historic and cultural resources as discussed in NRC guidance (NRC, 2003a). The statutory and regulatory safeguards and license conditions to protect historic and cultural resources are discussed in GEIS Chapter 4 impact sections and should not be included in Chapter 3 as the focus of Chapter 3 is the affected environment. As a result, no changes were made to the GEIS in response to the comment.*

*The statement about traditional cultural landscapes was included in the GEIS as a general statement in the context of describing the recognition of traditional cultural landscapes by agencies and archeologists and was therefore not intended as a specific discussion of NRC decision-making or statutory authority. GEIS Appendix D describes cultural and historical resource management processes including how traditional landscapes may be part of that process, and GEIS Appendix B describes the National Historic Preservation Act (NHPA) of 1966, as amended. Additional information or changes to the GEIS are, therefore, not needed.*

*With regard to Appendix B, it includes potentially applicable statutes, regulations, and executive orders. As stated in Section B1.1, the list is not intended to be exhaustive but provides a general overview of the kinds of statutes and regulations that should be considered in subsequent environmental reviews tiered from the GEIS. Therefore, no changes were made to Appendix B in response to this comment.*

**Comment: SP08-010**
One commenter asked if the GEIS addresses Nuclear Free Zones. They provided examples of tribal governments that have declared such zones.
*Response: An example of a local ban is described in GEIS Section 1.7.4 is the Dine Natural Resources Protection Act of 2005 enacted by the Navajo Nation. Section 1.7.4 discusses the Navajo ban on uranium milling and describes the related legal and policy issues that have been subject to litigation. This discussion should be generally applicable to other types of bans*

*enacted by Native American tribes. The NRC approach to such jurisdictional issues has been to fulfill its statutory mandate to evaluate license application and determine whether a particular application complies with the AEA and NRC regulations.*

*NRC's statutory authority requires NRC to process license applications and issue licenses when applicants fulfill NRC's statutory and regulatory requirements. NRC also requires licensees to obtain all necessary permits and licenses from the appropriate regulatory authorities prior to operating their facility. Simply put, if a licensee cannot satisfy applicable Federal, Tribal, and State requirements, it cannot go forward with the project. However, it is beyond the NRC's authority or the scope of the NRC's licensing process to resolve jurisdictional questions that ultimately may determine whether a licensee is able to proceed with a uranium recovery project.*

### G5.9.3 NRC Policies and Practices

**Comment: 031-015**
One commenter requested sound science should be used to protect the public.

*Response: The NRC approach to regulation is rooted in sound scientific principles, analyses, and information. The NRC staff applies a multidisciplinary approach to conduct both safety and environmental reviews of license applications for proposed ISL facilities. This includes teams of qualified scientists and engineers including hydrologists, geologists, ecologists, health physicists, social scientists, nuclear engineers, and chemical engineers. These staff conduct detailed technical reviews of license applications as described in GEIS Section 1.7.1. Licensing reviews commonly take 2 years to complete and produce documentation of the staff's detailed technical and regulatory reviews in a safety evaluation report for the safety review and EA, SEIS or EIS for the environmental review. As the comment was general in nature no changes were made to the GEIS in response to the comment.*

**Comment: AL15-044**
One commenter suggested the burden of proof for safety should be on licensees not public.

*Response: NRC agrees that the burden of proof rests with license applicants and licensees. This concept is incorporated into NRC's general rules for hearings at 10 CFR 2.325. Licensees are responsible for complying with all NRC regulations and all other applicable requirements. During the NRC review of license applications for ISL facilities, the NRC staff ensure the license applicant has provided sufficient documentation of the proposed action and has addressed the requirements for safety and has assessed and documented the potential environmental impacts of the proposed action. As the comment was general in nature, no changes were made to the GEIS in response to the comment.*

**Comment: 035-003**
One commenter expressed concern that NRC developed no public records of government-to-government meetings.

*Response: NRC is not required to generate public records of government- to-government meetings. Conducting these meetings without creating a formal record is considered an efficient communications practice that encourages a free and open exchange of information and ideas on pre-decisional issues among the meeting attendees. .As the comment was focused on NRC practices rather than the GEIS no changes were made to the GEIS in response to the comment.*

**Comment: 039-003**
One commenter suggested the GEIS should include an assessment of the impacts from processing uranium-loaded ion exchange resins generated from the treatment of drinking water and conclude no license amendment or EA is needed for ISL license applications.

*Response: The requested analysis was considered to be outside the scope of the GEIS because the GEIS was intended to focus on common practices at ISL facilities and the processing of uranium-loaded resins from water treatment facilities is considered an alternative feed material. NRC presently evaluates such proposals on a case-by-case basis and therefore requires license amendments for proposals involving processing of such resins at licensed ISL facilities. The discussion of alternative feed materials being outside the scope of the GEIS is already discussed in GEIS Appendix A; therefore no changes were made in response to this comment.*

**Comment: 028-009**
A commenter agreed with statement in Section 2.5 about aquifer restoration being done to protect adjacent aquifers. The commenter also requested the GEIS note that no aquifer exemption has ever been rescinded.

*Response: The GEIS discusses aquifer exemptions as part of EPA UIC permitting in GEIS Section 1.7.2.1. Because the commenter did not provide any reference or other substantiating information for the statement about aquifer exemptions it was not added to the GEIS.*

**Comment: 011-004**
One commenter recommended NRC make environmental justice part of its mission in accordance with Executive Order No. 12898.

*Response: NRC is considered an independent regulatory agency under the definition provided in 44 U.S.C. §3502(5) and is excluded from the mandates of Executive Order 12898. However, NRC, in exercising its regulatory authority, acts in a manner consistent with the fundamental precepts expressed in the Order by adopting practices to ensure potential environmental justice impacts are evaluated in NRC environmental reviews. The NRC environmental justice analysis practices are described in a policy statement that was published in the Federal Register on August 24, 2004 (NRC, 2004).*

*The GEIS evaluates potential environmental justice impacts from ISL facilities in the four milling regions in Chapter 6. This analysis initially evaluated the impact conclusions from all resource areas addressed in the GEIS (in Chapter 4) within the context of the environmental justice analysis. As discussed in GEIS Chapter 6, this evaluation includes consideration of historic and cultural resource impacts to Native American tribes that exist within or near the milling regions. This analysis was conducted in a manner consistent with the aforementioned NRC policy statement on environmental justice (NRC, 2004). These analyses have concluded for three of the four milling regions that additional site-specific information is needed to complete the environmental justice analyses. Environmental justice analyses would be completed during site-specific licensing reviews. As the comment pertained to general NRC environmental justice policy rather than the GEIS, no changes were made to the GEIS in response to this comment.*

**Comment: AL13-025; HC014-004**
A few commenters raised concerns that NRC licensing of ISL facilities is allowing deliberate contamination of groundwater. One asked why NRC promotes ISL when it deliberately

contaminates groundwater. Another suggested it was a crime for NRC to permit deliberate radionuclide contamination of high quality groundwater.

*Response: NRC authority to license ISL facilities is executed by reviewing license applications that are submitted to NRC. NRC has no promotional role with regard to technologies that applicants decide to propose in their license applications. NRC-licensed ISL facilities cannot operate until they have obtained the necessary UIC authorizations including an aquifer exemption. This means an ISL facility can only operate in an aquifer or portion of an aquifer that is exempted from EPA SDWA requirements as described in GEIS Section 1.7.2.1. The criteria EPA uses for granting an aquifer exemption include whether the aquifer is currently a source of drinking water and whether the water quality is such that it would be economically or technologically impractical to use the water to supply a public water system. Therefore, based on the EPA criteria, an ISL facility would not be granted an exemption if the aquifer they were proposing to operate in was a source of drinking water. In addition to operating in an exempted aquifer, as described in GEIS Section 2.4, ISL facilities are required to demonstrate their ability to control process solutions (including monitoring) within the portion of the aquifer where operations occur, and (Section 2.5) are required to restore groundwater to baseline quality or to other acceptable standards once operations are completed. Because the comments were general in nature or addressed topics that are already addressed in the GEIS, no changes were made in response to these comments.*

**Comment: AL13-028**
One commenter requested NRC provide names of NRC staff that will be responsible for contamination in the Crownpoint area of New Mexico if an ISL license is granted. They suggested that NRC has not been responsible for cleanup of contamination in the past.

*Response: NRC management responsible for implementing NRC's regulatory programs are identified on the NRC website at www.nrc.gov. Licensees are responsible for operating their facilities in a safe manner. Once a license is granted, NRC continues oversight of operations to ensure compliance with applicable safety requirements and license conditions. NRC is responsible for ensuring that it effectively implements its regulatory programs under the authority granted by Congress. NRC licenses facilities that satisfy the applicable licensing requirements including demonstrating that facilities can be operated in a safe manner in accordance with NRC regulations. A number of similar comments were provided to NRC regarding legacy contamination from historical uranium mining and milling activities and these comments are discussed further in Section G5.17 of this appendix. As this comment pertained to general NRC regulatory responsibilities and not the GEIS, no changes were made to the GEIS.*

**Comment: 050-013**
One commenter asked how NRC will ensure ISL workers are adequately qualified for ISL work.

*Response: NRC addresses worker qualifications in the safety review of a license application. As discussed in the Standard Review Plan for ISL facilities (NRC, 2003b) which is referenced in GEIS Chapter 1, NRC requires license applicants to submit detailed descriptions of the proposed organization and administrative procedures including key positions in the management structure and responsibilities and functions of each with respect to development, review, approval, implementation, and adherence to operating procedures, radiation safety programs, environmental and groundwater monitoring programs, quality assurance programs, routine and nonroutine maintenance activities, and changes to any of these. This requirement includes descriptions of the minimum qualifications and experience levels required for personnel* *who will be assigned the responsibility for developing, conducting, and administering the radiation safety program. If a license is granted, NRC inspectors would verify that personnel involved in implementing the radiation safety program at the operating facility meet the minimum qualifications documented in the license application. As the comment pertained to detailed topics addressed in the NRC safety review already discussed in the referenced guidance, no changes were made to the GEIS.*

**Comment: 050-053**
One commenter requested the GEIS address the financial condition of the uranium mining sector. The commenter questioned whether some mining companies have the financial resources to complete a license application, post bond, and carry out the project and restoration.

*Response: As discussed in GEIS Section 2.10, NRC regulations at 10 CFR Part 40, Appendix A, Criterion (9) require that applicants or licensees cover the costs for a third party to conduct decommissioning, reclamation of disturbed areas, waste disposal, and groundwater restoration. This requirement ensures that any ISL facilities operated by licensees that run out of funds can be decommissioned using funds that were set aside when the license was granted. NRC reviews ISL facility surety arrangements annually, and such arrangements are adjusted as necessary to reflect changes to facility operations. As a result of this policy, a separate economic analysis of the industry is not needed. License applicants that are not able to complete a license application or provide sufficient funds for a financial surety may not be granted a license to operate an ISL facility. Because the concern about financial assurance is already addressed in the GEIS, no changes were made in response to the comment.*

**Comment: 027-008; 050-012; 963-009; NE06-017; NE06-018; SP19-003**
A number of commenters expressed concerns about the sufficiency of NRC regulations, resources, and staffing to meet the needs of another uranium boom and conduct detailed site-specific license application reviews. One commenter suggested the GEIS was being used to streamline licensing as a means to address staff shortages at NRC.

*Response: NRC has approximately 30 years of experience regulating ISL facilities. This experience has been incorporated into the applicable regulations, guidance, and license conditions that have been used to regulate ISL facilities throughout that period. NRC has qualified staff and contractors with experience regulating ISL facilities that would be used to conduct detailed site-specific licensing reviews. Resources are allocated to ISL reviews based on the anticipated workload. NRC reviews license applications on a first come, first serve, basis and, if necessary, would limit the number of applications it would review at any given time period based on the available resources to conduct the reviews. Therefore, NRC manages the license review workload in a manner that reduces the likelihood of staff becoming overburdened to such a degree that it would impact the quality of license application reviews. While NRC expects the GEIS could result in some efficiency gains, the availability of the GEIS is not intended to limit the quality or depth of site-specific environmental reviews. Additional comments and discussion on the intended use of the GEIS and what commenters have referred to as streamlining is provided in Section G5.5 and is not repeated here. Because these comments pertained to staffing and resource issues, no changes were made to the GEIS in response to the comments.*

## G5.9.4 Adequacy of NRC Regulations and Practices

**Comment: CA07-013; SP10-013**
A few commenters suggested domestic uranium production was lagging due to uncertainties in the regulatory climate.

*Response: A major uncertainty that effects the regulation of uranium milling facilities is the level of interest in uranium extraction which fluctuates with the market price of uranium. Historically, the market price of uranium has been highly variable. This results in long periods of little to no interest in uranium milling to very strong interest when the price is high. The GEIS is expected to enhance consistency of future NRC ISL license application reviews. As the comments were focused on NRC regulatory programs and were not specific to the GEIS, no changes to the GEIS were made.*

**Comment: 059-024; 1314-009; 1314-010**
Some commenters expressed the view that the NRC does not have adequate regulations to protect public health from ISL facilities or assess environmental impacts. One commenter recommended a review of the regulations was needed to assess whether changes were needed. Another suggested NRC had no groundwater restoration requirements for ISL facilities.

*Response: NRC regulations that address ISL facility licensing include 10 CFR Part 20, 10 CFR Part 40 Appendix A, and 10 CFR Part 51. NRC has approximately 30 years of experience regulating ISL facilities. This experience has been incorporated into the applicable regulations, guidance, and license conditions that have been used to regulate ISL facilities throughout that period to protect public health and safety. As discussed in GEIS Section 1.5.2 (rulemaking activities), the GEIS is based on existing regulations in effect at the time of writing. Groundwater restoration requirements are discussed in Section G5.22. As a result, no changes were made to the GEIS in response to these comments.*

## G5.9.5 Requests for Changes to NRC Regulations and Practices

**Comment: 015-008; 015-009; 018-010; 027-010; 028-010; 028-011; 028-014; 035-005; 050-026; 050-034; 050-093; 057-002; 059-025; 059-026; 1311-009; 1311-011; 1311-016; 1314-008; 1319-009; CH06-008; GA16-008; GA16-009; HC016-007; HC020-004**
A number of commenters suggested NRC change or establish new requirements or regulatory practices with regard to regulation of ISL facilities. The suggestions included the following:

- Establish new rules for ISL facilities before issuing the GEIS
- Require site characterization
- Require leak detection in wells to protect against leaks
- Prohibit land application of waste water if it presents risk of selenium food chain accumulation, soil contamination, or groundwater contamination
- Totally ban uranium recovery in Black Hills

- GEIS should clarify and exempt licensees from being required to remediate natural background radionuclides based on the anomalous and highly variable background radionuclide concentrations in soil and water

- Clarify and resolve EPA plans to regulate all 11e.(2) impoundments under 40 CFR Part 61, Subpart W

- Centralize regulation of ISL and make it business friendly

- Establish enforceable mitigation measures to mitigate environmental concerns

- Establish Best Management Practices as regulatory requirements

- Use regulations in place of voluntary practices

- Limit the number of ISL sites or licenses in a geographic area based on cumulative impact analysis

- Delay licensing an ISL until an aquifer exemption is obtained

*Response: As discussed in GEIS Section 1.5.2 (rulemaking activities) the GEIS is based on existing regulations in effect at the time of writing. The GEIS does not evaluate the adequacy of nor make changes to NRC regulations, guidance, or regulatory practices and comments requesting changes to NRC regulations and practices are therefore beyond the scope of the GEIS. The process for requesting changes to existing NRC regulations can be found in 10 CFR Part 2. The status of ongoing rulemaking activities is provided on the NRC's public website at www.nrc.gov. As a result, no changes were made to the GEIS in response to these comments.*

### G5.9.6 Applicable Rulemaking Efforts

**Comment: 1305-079**
A commenter suggested adding an explanation in GEIS Section 2.10 of the planned schedule for any rulemakings related to uranium recovery including the relationship of the GEIS, if any, to NEPA coverage of these potential proposed rulemakings.

*Response: As discussed in GEIS Section 1.5.2 (rulemaking activities), the GEIS is based on existing regulations in effect at the time of writing. NRC rules under 10 CFR Part 51 can require a NEPA analysis for rulemaking action. Site-specific environmental reviews will evaluate compliance against the regulations in effect at the time an application is reviewed. The status of ongoing rulemaking activities is provided on the NRC's public website at www.nrc.gov. As a result, no changes were made to the GEIS in response to these comments.*

**Comment: 003-003; 031-007; 050-020; 1173-023; CA01-002; CA10-003**
A number of comments were received regarding the ongoing NRC rulemaking effort to draft a proposed rule with new standards applicable to ISL facilities. One commenter wanted to know if license applications already submitted would have to comply with the new ISL rule. Others wanted an update on ISL rulemaking and discussion of the impact on the GEIS. Another wanted any proposed groundwater requirements to be included in the GEIS. One requested an extension of comment period to understand the ISL rulemaking effort. Another suggested

the proposed rule that ISL will not impact groundwater beyond a quarter mile is not backed by science.

*Response: NRC has undertaken an effort to draft a proposed rule in cooperation with the EPA. At the time of this writing, this effort is still in the early stages and no proposed rule has been submitted for public comment. As a result, it would be premature to discuss details. As discussed in GEIS Section 1.5.2 (rulemaking activities), the GEIS is based on existing regulations in effect at the time of writing. Because no proposed rule is available to discuss, no changes were made to the GEIS in response to these comments.*

### G5.9.7 NRC NEPA Process Implementation

**Comment: CH06-006**
One comment, in response to reports of spills and leaks at ISL facilities, requested the NRC environmental impact review process become more stringent, more technical, more investigative, and more of a problem preventer.

*Response: The purpose of the GEIS is to assess potential impacts from ISL facilities when operated in accordance with current regulations, guidance, and practices. As discussed in GEIS Section 1.5.2 (rulemaking activities) the GEIS is based on existing regulations in effect at the time of writing. The GEIS is not intended to change existing NRC regulations, guidance, or practices. The potential impacts from spills or leaks are discussed or addressed in the GEIS in a variety of contexts including in discussions of the ISL process (Section 2.4), liquid waste management (Section 2.7.2), radiological health and safety program (Section 2.9), historical operational experience (Section 2.11.2), and in the assessment of impacts to soils, ecology, water resources, and public and occupational health. During a site-specific review, if potential environmental impacts are identified, mitigation measures can be identified to reduce the magnitude of the potential impacts. Nonetheless, it is in the safety review, rather than the environmental review where NRC evaluates whether ISL facilities propose sufficient design features and procedures to limit exposures from spills and leaks to as low as is reasonably achievable (ALARA) (including alarms for loss or excess pressure in production circuits, pond leak detection, sump capacity for tanks, freeboard capacity for ponds, leak and spill contingency planning, notification, corrective actions, recordkeeping to allow later decommissioning, emergency procedures, radiation monitoring). Because the comment was focused on changing the NRC environmental review process and such changes are outside the scope of the GEIS, no changes were made to the GEIS in response to the comment.*

**Comment: HC009-006**
A commenter requested NRC discuss the applicability of categorical exclusions under 10 CFR 51.22 to ISL facilities in GEIS Section 1.8.3.

*Response: NRC does not expect a categorical exclusion to be applicable to new license applications but for other types of licensing actions (e.g., renewals, amendments) it may apply but would be evaluated on a case-specific basis. As this is a matter of general NRC NEPA policy that is already documented in NRC guidance (NRC, 2003a) cited in the GEIS, mention of categorical exclusions in the GEIS was considered unnecessary and no changes were made to the GEIS in response to this comment.*

**Comment: 036-041; 1305-010**
A commenter asked NRC to clarify that an EIS is needed only for license applications not amendments in GEIS Section 1.8. Another commenter requested clarification in Section 1.8.3 to identify triggers for preparing an EIS instead of an EA (e.g., geologic or hydrologic characteristics, milling techniques, aquifer restoration).

*Response: In response to these and similar comments, NRC has determined that it is appropriate to issue a SEIS for new license applications that, to a limited extent, will address site specific environmental issues. The relevant sections of GEIS will be incorporated by reference in those documents and the SEIS will address environmental impacts not completed or not included in the GEIS analyses. It is not the NRC intention that the SEIS will re-consider environmental impacts addressed in the GEIS. Because the NRC licensing process, including determination of when a SEIS is needed, is already discussed further in Section 1.7.1 and 1.8, and details are included in the referenced guidance, no changes were made to the GEIS in response to these comments.*

**Comment: 1028-003; 1300-002**
One commenter suggested the policy statement at the end of proposed action section of the GEIS Executive Summary (stating that 10 CFR 51.20(b)(8) requires preparation of site-specific EISs for conventional uranium milling operations) also applies to ISL operations. Another claimed the same statement was outside the scope of the GEIS because it discussed conventional mills and the focus of the GEIS was on impacts of ISL facilities.

*Response: In response to other comments, NRC has clarified its environmental review process (as discussed above and in Section G5.5.2 of this Appendix). As discussed previously, NRC regards the GEIS, in combination with a subsequent site-specific SEIS to fulfill 10 CFR 51.20(b)(8) as it applies to issuance of a source material license for a new ISL uranium recovery facility. In response to the other comment recommending the statement in the Executive Summary be deleted because conventional milling is outside the scope of the GEIS, the statement was deleted.*

**Comment: GA10-008**
One commenter expressed a view that a paradigm that considers Earth as collection of resources to be exploited for profit is not sustainable.

*Response: The NRC acknowleges the comment is the expressed opinion of the commenter. As the comment is general in nature and not specific to the GEIS, no changes to the GEIS were made in response to the comment.*

**Comment: 1300-006**
One commenter suggested a consultation process for the GEIS itself is not described in Section 1.8.3. The commenter noted the EIS consultation process must include all relevant stakeholders and also claimed a scoping process for proposed ISL facilities was not described.

*Response: Public participation is an essential part of the NRC licensing review process. The NRC conducted an open, public GEIS development process consistent with the requirements of the NRC's NEPA-implementing regulations in 10 CFR Part 51. NRC held three scoping meetings for the GEIS. The scoping process conducted for the GEIS is described in GEIS Section 1.5.1, and the issues identified during the meetings are summarized in Appendix A. NRC also held eight public comment meetings on the draft GEIS throughout the regions addressed in the GEIS. The purpose of these meetings was to receive public comments on the* *draft GEIS. The public meetings were noticed in the Federal Register and on NRC's public website, additional notices were published in local newspapers to the extent practical, and public service announcements were broadcast over radio stations in the vicinity of the planned meetings.*

*NRC accepted comments at the public meetings and also accepted comments via e-mail and regular mail. In response to public request, the comment period was extended to allow the public more time to submit comments. As described in GEIS Section 1.8.4, NRC will continue to encourage public involvement during the site-specific environmental review process.*

*The NRC licensing process that would be used to review individual ISL facility applications is summarized in GEIS Section 1.7.*

*In the NRC license review process, once an application is received, reviewed for completeness, and accepted for detailed review, the NRC formally dockets the application and publishes a notice in the Federal Register. The Federal Register notice announces the availability of the application and provides an opportunity for affected individuals or entities to request a hearing under the NRC formal hearing process. 10 CFR Part 2 provides the requirements that must be met to be granted a hearing.*

*The notice of availability (NOA) also would include the relevant identifying information for the license application so that an interested member of the public could view the application either electronically through NRC Agencywide Documents Access and Management System (ADAMS) at www.nrc.gov/reading-rm/adams.html or in person by visiting NRC's public document room.*

*NRC previously stated in the Federal Register on September 27, 2007 (72 FR 54947) that all draft EAs prepared for ISL facility license applications would be available for public comment. This statement was made in anticipation that NRC would be preparing EAs for applications for new ISL facilities. Based on public comments NRC received on the draft GEIS, NRC has decided to prepare a supplemental environmental impact statement (SEIS) for all license applications for new ISL facilities. NRC will follow the public participation procedures outlined in 10 CFR Part 51, which can include requests for public input on the scope of the SEIS and requires public comment on the draft SEIS.*

*Additionally, for new ISL license applications, NRC also will publish in the Federal Register a notice of intent (NOI) to prepare the site-specific SEIS and provide details on the scoping process for the SEIS, if applicable. The scoping process may include public meetings where affected stakeholders and interested members of the public could provide comments on what they consider to be within the scope (i.e., at issue or of concern) for the site-specific environmental review. Following the scoping period, NRC would prepare a summary of scoping comments received and the determinations and conclusions reached regarding the subsequent scope of the SEIS. This scoping summary would be provided to interested parties and made available through NRC's publicly available ADAMS website.*

*NRC also will publish for public comment a draft SEIS. An NOA for the draft SEIS will be published in the Federal Register, and copies of the draft SEIS will be sent to affected stakeholders and interested members of the public. The NOA also would announce the dates for the public comment period on the draft SEIS and the times, dates, and locations of any public comment meetings on the document. NRC will accept public comments on the draft*

*SEIS offered orally or in writing at the meetings, as well as comments sent by regular mail or electronically to NRC. NRC will address the public comments received in its final SEIS.*

*NRC will prepare an EA, SEIS or an EIS for applications to renew or amend licenses at existing ISL facilities. NRC may make the draft EA and accompanying draft FONSI available for public comment. The decision to submit a draft EA for public comment would take into account the provisions in 10 CFR 51.33 concerning the similarity of the proposed action to actions normally requiring preparation of an EIS and the precedent-setting nature of the proposed action. Additionally, NRC may consider the level of public interest and the contentious nature of the proposed action in determining whether to publish a draft EA/FONSI for public comment. The NRC staff would address public comments received on the draft environmental assessment/FONSI in the staff's final environmental review document. This approach is consistent with NRC regulations.*

*In response to this and other comments, Chapter 1 of the GEIS was revised.*

**Comment: 1311-005; 1314-037**
A commenter expressed the view that the NRC's failure to classify impacts as significant or insignificant violates the Administrative Procedure Act and its own regulations. Another commenter referred to the GEIS as trying to redefine significance without rulemaking which was claimed to be a violation of the Administrative Procedures Act.

*Response: The GEIS was developed in manner consistent with NRC regulations in 10 CFR Part 51 and NRC environmental guidance in NUREG–1748 (NRC, 2003a). The GEIS is not a regulation, and development of the GEIS does not require a formal rulemaking process. No changes to the GEIS were made in response to this comment.*

### G5.9.8 NRC Licensing Process

**Comment: AL03-007**
One commenter asked how the public is involved in the licensing process and whether there is any follow up after a license is granted (e.g., opportunity to intervene). The commenter also asked for clarification on the NRC involvement after license is granted.

*Response: As discussed previously in Sections G5.4.3 and G5.5.5, NRC has determined that it will prepare a SEIS to document its environmental review for new ISL license applications. GEIS Section 1.8.4 describes opportunities for public participation in the NRC environmental review. For the environmental review of a new license application, NRC will publish in the Federal Register a NOI to prepare the SEIS, may conduct a scoping process, and will publish a draft SEIS for public comment, in accordance with the public participation procedures outlined in 10 CFR Part 51.*

*NRC will prepare an EA, SEIS or an EIS for applications to renew or amend licenses at existing ISL facilities. NRC may make the draft EA and accompanying draft FONSI available for public comment. The decision to submit a draft EA for public comment would take into account the provisions in 10 CFR 51.33 concerning the similarity of the proposed action to actions normally requiring preparation of an EIS and the precedent-setting nature of the proposed action. Additionally, NRC may consider the level of public interest and the contentious nature of the proposed action in determining whether to publish a draft EA/FONSI for public comment. The NRC staff would address public comments received on the draft environmental* *assessment/FONSI in the staff's final environmental review document. This approach is consistent with NRC regulations.*

*As noted in Section 1.8.2, upon acceptance of a new license or license renewal application for detailed technical review, NRC publishes in the Federal Register a notice of opportunity for hearing on the application. Individuals or entities that may be affected by the potential issuance of the site-specific ISL license may request a hearing under NRC's formal hearing process. 10 CFR Part 2 provides the requirements for hearings. NRC may publish in the Federal Register a notice of opportunity for hearing on the application for license amendment applications. In response to this and other comments, Chapter 1 of the GEIS was revised.*

*Once a license is granted, as discussed in the GEIS Section 1.7.1, NRC ensures the licensee complies with the conditions of its license and applicable regulations through an inspection program managed out of one of its four regional offices. NRC inspectors follow guidance in the NRC inspection manual which contains objectives and procedures for each type of inspection. The inspection manual and procedures can be found on the NRC website at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/. In addition to inspections, NRC staff reviews any changes to facility operations proposed by the licensee, either as part of a license amendment request or during a site inspection, to ensure license conditions continue to be met. The NRC staff also reviews required semi-annual effluent and monitoring reports submitted by licensees and provides follow-up on other required reporting that licensees may provide (e.g., spills, excursions, and other reportable events). In response to this comment, additional information was added to Section 1.7.1 to clarify the types of NRC oversight activities that take place after a license is granted.*

**Comment: NE09-002**
A commenter asked for the duration of a site-specific review.

*Response: NRC licensing reviews include a safety review and an environmental review. The safety review evaluates compliance with NRC safety regulations and the environmental review assess environmental impacts based on NRC NEPA implementing requirements at 10 CFR Part 51. These reviews can normally be completed within a period of 18 to 24 months if there is no formal NRC hearing associated with the license application. The duration of the NRC review can be affected by the completeness and quality of a license application, the complexity of the proposed action, the complexity of the environment where the licensee proposes to operate, and whether any requests for hearings are granted. As the comment was a clarifying question about NRC licensing reviews and not focused on the GEIS, no changes were made to the GEIS.*

**Comment: GA05-001**
A commenter asked about the duration of an NRC license granted to an ISL facility

*Response: NRC normally issues licenses to ISL facilities for a period of 10 years. Before the 10 years elapse, licensees can apply for renewal. An NRC decision regarding license renewal would be based on the results of detailed safety and environmental reviews of the renewal application that staff performs. As the comment was a clarifying question about NRC licenses and not focused on the GEIS, no changes were made to the GEIS.*

**Comment: CA02-003; GR10-001**
A few commenters expressed views that the NRC licensing process for ISL facilities has been unnecessarily burdensome. One mentioned this was because it has required redundant

reviews of common elements. Another mentioned it has been difficult to sort out all the applicable regulations.

*Response: NRC expects the GEIS may provide context and clarification of important aspects of the licensing process and regulations by summarizing this information in a single document. The GEIS also provides transparency regarding the types of potential environmental impacts that could result from ISL facilities and is expected to help reduce unnecessary redundancy in NRC environmental reviews. The GEIS does not affect the responsibility of license applicants to fully characterize their sites, submit complete license applications, and ensure that they understand and comply with all applicable regulatory requirements. As the topic of the comments was focused on the NRC licensing process rather than the GEIS, no changes were made to the GEIS in response to the comments.*

**Comment: 050-066; 1305-009; AL04-008; GI01-014; NE10-001**
A number of commenters raised questions or expressed concerns about how NRC conducts license application reviews of ISL facilities. One suggested that careful analysis of each site was needed. Another, referring to the process where applicants provide site characterization information in a license application and then proceed to collect information during operations, asked how NRC could license a facility without full site characterization information. Another asked if the NRC would verify the applicant's modeling during a licensing review. One asked how NRC would determine which parts of an applicant's analysis are worthy of independent confirmation and verification. They requested the proportion of NRC effort that would be devoted to gathering data to challenge or test an applicant's analysis. This commenter also asked how NRC uses codes to verify information in a license application, what other methods of verification could be or have been used for licensing reviews, and how the accuracy in verification efforts is monitored by NRC.

*Response: NRC is committed to conducting a site-specific safety and environmental review of each license application. These reviews include an acceptance review and a detailed technical review. The acceptance review checks the completeness of the application. A detailed technical review evaluates the sufficiency of the applicant's information and analyses relative to the provisions in 10 CFR Parts 20 and 40 and the significance of potential environmental impacts. The results of these two detailed reviews support NRC's licensing decision.*

*The statement in the GEIS Section 2.2 that during the initial licensing review for a new ISL facility the NRC does not require a comprehensive discussion of all aspects of the site and operations is not intended to mean NRC accepts an incomplete application. Rather, sufficient information on the site and proposed action is needed to support an initial licensing decision but additional information and data would be gathered during operations that would supplement the initial information.*

*NRC technical staff conduct their detailed technical reviews of the license application based on NRC guidance and the staff's technical expertise and judgment. Much of the staff's review involves checking and verifying the applicant's information by a variety of means including collection and use of independent information, technical expertise and judgment, and confirmatory analyses and calculations. NRC independent collection of field data is less common, although NRC staff may conduct early site visits to review the applicant's site characterization plans and ongoing efforts. The staff's initial review of the information would help determine which, if any, calculations in the license application would need to be verified through confirmatory calculations. Such calculations could involve simple methods or executing detailed models and codes. The topics that are often evaluated by confirmatory calculations are* *usually addressed in the NRC safety review and incorporated by reference into the environmental review as applicable. Detailed guidance for the NRC safety review of ISL license applications is provided in NUREG–1569 (NRC, 2003b). This guidance would include, for example, facility design and process engineering calculations, hydrologic modeling, and dose calculations for workers and the public for normal operations and potential accident conditions. The results of NRC environmental reviews are subjected to a series of concurrence reviews prior to publication to ensure information is correct and appropriate techniques are used. As the comments involved clarifying questions about NRC reviews that are documented in guidance already cited in the GEIS, no changes were made to the GEIS.*

**Comment: GI02-002**
One commenter asked whether the GEIS was needed because current licensing system is broken.

*Response: The purpose and need for the GEIS is described in the GEIS Section 1.3. The GEIS is developed to help support and focus NRC site-specific environmental reviews of license applications for ISL facilities. The development of the GEIS does not mean the current licensing practices are not working. The fundamental approach to license application reviews at NRC is not changing with the development of the GEIS. The use of a GEIS to facilitate and focus site-specific environmental reviews has been applied to other NRC programs in the past (e.g., nuclear power plant license renewal, facility decommissioning); therefore, this does not represent a change to NRC licensing practices. In response to this and other comments the purpose and need section in Chapter 1 of the GEIS was clarified.*

**Comment: AL01-001; AL04-008**
One commenter requested NRC provide an example of a rejected license application from the past year. Another commenter indicated applications take time and money and are complete when submitted and therefore the rejection rate is low.

*Response: In the last 2 years, NRC has received four applications for ISL facilities. Following the NRC acceptance review, where the completeness of submittals is checked, one of these applications was withdrawn by the applicant and resubmitted based on discussions with NRC staff. The application was not rejected, but the NRC review process caused the licensee to revise and resubmit to ensure the application was sufficiently complete for staff to begin a detailed technical review. It is common during the detailed technical review of a license application for NRC to request additional information from the licensee to ensure the application is complete. In some cases, multiple rounds of requests for additional information are possible. For applications that are not complete, this iterative process is designed to provide the applicant the necessary feedback they need to supplement the application so it is complete. As the comments related to NRC licensing and were not specific to the GEIS, no changes were made to the GEIS.*

**Comment: 1311-008**
One commenter made an assertion that NRC rules, regulations, and definition of statutory terms are put into effect by NRC without promulgation in accordance with notice and comment provisions of the Administrative Procedures Act. An example was provided of the NRC guidance documents addressing alternate feed materials.

*Response: NRC regulations are established by a formal rulemaking process that is compliant with applicable statutory requirements. The GEIS does not set new standards, rather it is based on existing NRC regulations at 10 CFR Part 51, guidance including NUREG–1748*

*(NRC, 2003a), and NRC current practices. The NRC issues guidance to describe and make available to the public methods that the NRC staff considers acceptable for use in implementing specific parts of the agency's regulations, techniques that the staff uses in evaluating specific problems, and data the staff needs in reviewing applications for permits and licenses. NRC guidance is not a substitute for regulations and compliance with NRC guidance is not required. Methods and solutions that differ from those discussed in guidance will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission. As the comment was directed at general NRC regulatory practices rather than the GEIS, no changes to the GEIS were made.*

**Comment: 050-103**
In regards to a statement in the GEIS Section 4.2.4.1.2 that most if not all ISL operations would be expected to occur where the ore-bearing aquifers are confined, one commenter asked how ISL could be permitted at a site with unconfined aquifers and whether additional NEPA analyses would be completed for such a case.

*Response: If a license applicant can demonstrate it satisfies NRC regulations, then it is possible such actions could be granted. The GEIS focuses on ISL in confined aquifers because this is what is common from past licensed operations. Other variants from what is considered in the GEIS could be proposed and would be evaluated by NRC based on the details of the proposal and the site-specific conditions. Such proposals would be evaluated on a case-specific basis and could result in more in-depth reviews by NRC staff than the more common and familiar proposals. As discussed in the GEIS, Appendix A, Section 4.10, it is not intended to discuss all variants of ISL technology, therefore additional discussion on uncommon proposals such as operating in an unconfined aquifer was not added to the GEIS in response to this comment.*

**Comment: GA03-004; GR14-011**
One commenter suggested that before NRC grant new licenses they must determine the environmental impacts from past uranium recovery operations. They noted the NRC must also identify and remedy past practices that have contributed to adverse environmental impacts.

*Response: As discussed in Appendix A of the GEIS, because the GEIS addresses NRC licensing reviews for ISL facilities, topics related to conventional milling are not addressed in the GEIS. In response to comments, this statement was further clarified to refer to past mining as also being outside the scope. The legacy of past conventional milling activities was intended to be identified in terms of cumulative impacts in the GEIS (as stated in Appendix A) but was not explicitly mentioned in Chapter 5 of the document. Additional text has been added to Chapter 5 of the GEIS to clarify that abandoned uranium mining and milling sites and related environmental contamination and/or underground workings may need to be considered in site-specific cumulative impact assessments to the degree they are found on or near proposed ISL sites and their region of influence on the environment overlaps with that of the proposed ISL facility. Additional discussion of uranium legacy issues is included in Section G5.17.*

### G5.9.9 Consideration of ISL Facility Safety Record and Compliance History

**Comment: AL13-024; GA17-002; GA19-002; GA23-002; GI02-004; HC016-004**
A number of commenters expressed views on the safety record and compliance history of ISL facilities and some recommended these factors be evaluated in the GEIS. A few commenters

suggested ISL facilities have a good safety record with one noting there are some risks as with any industry but the risks can be managed. Others indicated a lack of trust in the industry and suggested there was a bad track record including spills, excursions, and regulatory violations. One asked why NRC would grant a license to a company with a bad track record.

*Response: GEIS Section 2.11 discusses historical operating experiences at ISL facilities to provide basic information about licensed ISL facilities and the types of operational challenges and potential environmental impacts that are encountered including measures implemented to mitigate potential impacts. This section of the GEIS discusses historical experience with spills, leaks, consumptive groundwater use, excursions, aquifer restoration, and socioeconomic effects. The documentation of this operating experience is sufficient, when considered with the rest of the information describing the ISL process in Chapter 2, to inform the impact analyses discussed in Chapter 4 of the GEIS. It is worth noting that the existence of off-normal occurrences such as leaks, spills, and excursions at ISL facilities do not automatically translate to significant safety or environmental impacts; however, facilities must be prepared to respond to such events when they occur to limit the potential for impacts to safety or the environment.*

*Regarding the compliance history of specific licensees or applicants, the GEIS is an evaluation of potential environmental impacts and not an evaluation of regulatory programs nor is it focused on evaluating the compliance status of specific sites or licensees. NRC reviews each license application using standard practices to evaluate whether the application is sufficient to demonstrate compliance with NRC regulations. If a license is granted, NRC oversight of operations including inspection activities verify that compliance is maintained during operations, aquifer restoration, and decommissioning. NRC has existing enforcement programs and policies that are effective at verifying licensees are in compliance with NRC regulations. NRC takes appropriate enforcement action if licensees are found to be out of compliance with NRC regulations. NRC applies penalties of increasing severity and may increase the frequency of inspections for licensees that fail to take the necessary corrective actions to ensure compliance with NRC regulations. Because evaluating compliance history of NRC licensees or applicants is beyond the scope of the GEIS, no changes were made to the GEIS in response to the comments.*

### G5.9.10 Incident Response

**Comment: CH11-001**
A commenter was concerned about how NRC responds to incidents at ISL facilities.

*Response: While NRC is not a "first responder" to incidents requiring an emergency response, NRC reviews licensee proposed incident response plans, as needed, to verify appropriate response measures are in place to ensure safety. In accordance with NRC safety regulations, applicants are required to report incidents involving release of radioactive material in accordance with NRC regulations at 10 CFR 20.2202 and 20.2203. As discussed in Chapter 8 of the GEIS, licensees are also responsible for reporting excursions by telephone within 24 hours of occurrence and in writing within 7 days. Licensee incident response plans address a variety of potential incident conditions and include the necessary measures to ensure worker and public safety. Detailed technical reviews of potential incidents and incident response measures for ISL facilities are addressed in the NRC safety review of a license application. While this is a separate review from the NRC environmental review, the results of the safety review inform the environmental review. As the comment pertains to matters addressed in the NRC safety review, no changes to the GEIS were made.*

**Comment: HC018-005; HC019-006**
A few commenters suggested NRC provide training for local fire fighters and emergency medical services. Another suggested such training should be provided at the company's expense.

*Response: Support for local firefighters and emergency services is not a responsibility of the NRC, but rather is a state and local issue. NRC requires licensees to have a spill contingency plan or emergency response procedures to deal with yellowcake or other spills of radioactive materials. Typically, coordination with local emergency responders and local hospitals would be an element of these emergency plans if local emergency services are expected to respond to a uranium recovery facility or to treat injured workers. No changes were made to the GEIS beyond the information provided in this response.*

### G5.9.11 Inspection and Enforcement Activities

**Comment: CH06-022; NE02-002**
A few commenters at public meetings asked general questions about NRC inspections. One commenter asked what NRC does when it visits the ISL facilities. Another asked why a license can be granted for 40 years without any subsequent inspection of environmental effects.

*Response: NRC normally issues licenses to ISL facilities for a period of 10 years. After the 10 years has elapsed, licensees can apply for renewal. Applications for license renewal follow the same NRC review and approval process as new license application. NRC conducts inspections of ISL facilities to verify they are being operated in a safe manner and to ensure compliance with NRC regulations and license conditions. The authority to conduct inspections is provided in Section 161 of the AEA. The inspection program is controlled by Manual Chapter 2641, "In-Situ Leach Facilities Inspection Program." NRC inspectors typically plan and conduct inspections using the guidance provide in this Manual Chapter.*

*Inspectors conduct site tours to verify operating parameters and health physics controls. Many operating parameters have upper limits that are specified in the license or in the licensee's procedures. The yellowcake dryer and associated effluent support equipment, for example, commonly have licensed limits of operation. If any adverse conditions are identified during inspections, the adverse condition is reported to licensee management. Corrective actions are reviewed during subsequent inspections.*

*In accordance with Manual Chapter 2641, the inspectors are required to conduct reviews of the effluent and environmental monitoring programs. This inspection is conducted at least annually. The inspectors verify that the licensee has collected the require number of samples, and the inspectors verify that the sample results do no exceed license or regulatory limits. If any sample result exceeds a licensed or regulatory limit, then the licensee is subjected to the NRC's enforcement process. The results of this review are documented in the routine inspection reports for the respective facilities. In response to this and other comments on inspections, additional information on inspections and enforcement was added to GEIS Chapter 1.*

**Comment: GA05-002; GI03-006; HC018-003**
One commenter questioned the sufficiency of NRC postlicensing regulatory oversight of licensed operations at ISL facilities. Another was concerned that the time interval for licensees to submit effluent and environmental monitoring reports (on a semi-annual basis) is insufficient

for NRC to detect problems in time. One requested NRC monitor ISL process as frequently as every 30 days of processing.

*Response: Licensees are required to conduct environmental and effluent monitoring. The licensees are required by regulation to submit the results of their monitoring to the NRC on a semiannual basis. NRC staff believes that the semi-annual reporting interval for effluent and environmental monitoring is sufficient for reporting routine monitoring activities. In addition to the routine reporting requirements, regulations and some license conditions require that certain events be reported to the NRC in a prompt manner. Failure to report incidents in a timely manner can result in enforcement action.*

*The NRC conducts inspections of ISLs in accordance with guidance provided in Manual Chapter 2641, "In-Situ Leach Facilities Inspection Program." This Manual Chapter allows the staff to adjust the inspection frequency based on a number of variables, including licensee performance. For example, the NRC staff has the flexibility to adjust the inspection frequency in response to poor performance.*

*Inspections can be announced or unannounced. The decision to announce the inspection is typically made by the NRC Regional staff who would lead the inspection and is discussed with NRC headquarters licensing staff who may accompany the inspection. Announced inspections have the advantage of ensuring that key licensee staff is available to support the inspectors. Unannounced inspections are conducted primarily to observe licensee performance, including transportation activities and site operations. In response to this and other comments on inspections, additional information on inspections and enforcement was added to GEIS Chapter 1.*

**Comment: 016-002; 1602-0030**
A few commenters expressed a lack of trust regarding ISL companies. One referenced various companies and asked how NRC can effectively monitor companies with a history of site violations.

*Response: The NRC implements an inspection program in accordance with NRC Manual Chapters 2801, "Uranium Mill 11e.(2) Byproduct Material Disposal Site and Facility Inspection Program," and 2641, "In-Situ Leach Facilities Inspection Program." (These Manual Chapters are available for download at http://www.nrc.gov/reading-rm/doc-collections/insp-manual/manual-chapter/index.html.) The NRC staff schedules and conducts inspections in accordance with these guidance documents.*

*When the NRC prepares for an inspection, the enforcement history of the licensee is considered. The inspectors will also consider previous unresolved items, allegations, and other safety significant findings. The inspectors then conduct the inspection using a nonpublicly available inspection plan. The inspection process may identify violations that are subjected to enforcement actions by the Agency. As part of the enforcement process, the NRC considers the recent performance history and the number and severity of violations for a given licensee.*

*As noted in Manual Chapters 2801 and 2641, there is a clear nexus between licensee performance and the inspection frequency. The enforcement history of a licensee is only one measure of performance. Poor-performing licensees tend to be inspected more frequently than good performing licensees. The increased inspection frequency will continue until the NRC has determined that the licensee's performance has improved. In response to* *this and other comments, additional information on inspections and enforcement was added to GEIS Chapter 1.*

**Comment: HC012-006**
One commenter asked how NRC can allow violations to take place while the State of Wyoming issues numerous violations and NRC does nothing.

*Response: The GEIS is not intended to address the status of specific licenses. In general, NRC inspects to enforce NRC regulations and the state authorities inspect to enforce matters that the state has authority to regulate. As the comment was not specific to the GEIS, no changes were made to the GEIS in response to the comment.*

**Comment: CA06-002, 050-014**
Two commenters requested NRC establish a regional office in or near Wyoming based on the number of potential new license applications expected. One suggested having a closer regional presence would facilitate NRC licensing and inspection activities and allow closer interaction with other federal and state agencies involved in ISL regulation.

*Response: Modification to existing NRC practices, including the location of regional or field offices, is beyond the scope of GEIS development activities. However, the suggestion of locating a regional office near locations of new ISL licensing is a suggestion that has been raised by several organizations involved in uranium recovery activities.*

*The NRC maintained a Uranium Recovery Field Office in Denver, Colorado, until 1994. At that time, the uranium recovery industry was suffering from low growth and low uranium product prices and uranium recovery activities had shifted from production to decommissioning. In 1994, the NRC elected to transfer all licensing responsibilities to headquarters and all inspection responsibilities to the Region IV office. Whether the NRC elects to reopen a field office in the Colorado-Wyoming area will most likely depend on a number of factors including sustainability of growth in the uranium recovery industry. As the comment pertains to NRC offices and not the GEIS, no changes were made to the GEIS.*

*Licensees and applicants are encouraged to provide recommendations and suggestions of potential improvements in the industry and the regulatory process to NRC management during public forums (national meetings) or during private conversations.*

### G5.9.11.1 Enforcement and Self Reporting

**Comment: 016-003; CH07-009; CH09-002; CH09-004; NE10-004**
A number of commenters expressed a lack of confidence in self-reporting for enforcing compliance with regulations. Some noted that licensees could bias self reported information and that overall self reporting was a less than ideal approach.

*Response: As noted in the NRC's Enforcement Policy (available online at http://www.nrc.gov/about-nrc/regulatory/enforcement/enforc-pol.pdf), safety is the fundamental regulatory objective. To give the NRC confidence that safety is being maintained, the NRC expects licensees to comply with NRC requirements. NRC requirements—including regulations and license conditions—are designed to ensure adequate protection through acceptable design, construction, operation, maintenance, modification, and quality assurance measures. In the context of risk-informed regulation, compliance plays an important role in ensuring that key assumptions used in underlying risk and engineering analyses remain valid.*

*The NRC's Enforcement Policy endeavors to deter noncompliances by emphasizing the importance of compliance with NRC requirements. The Enforcement Policy also encourages prompt identification and comprehensive correction of violations. Accordingly, licensees, contractors, and their employees who do not achieve the high standard of compliance, as expected by the NRC, are subject to enforcement sanctions. Further, licensees, employees, and contractors who engage in deliberate misconduct or who deliberately submit incomplete or inaccurate information to the NRC are subjected to significant enforcement sanctions, including civil penalties and legally binding orders.*

*A licensee who adopts the practice of self-reporting violations will have several distinct advantages over other licensees. For example, a licensee who self-reports and self-corrects a violation is less likely to be subjected to an NRC-cited violation if the NRC staff were to identify the violation. Second, the NRC is more likely to grant performance-based licenses to licensees who have demonstrated adequate levels of integrity. A performance-based license allows the licensee to implement certain program changes without prior NRC approval. Third, licensees who fail to identify weaknesses, or licensees who fail to correct recurring problems, may be viewed by the NRC as poor performers. The NRC inspection frequency is typically increased for poor-performing licensees. An increase in inspection frequency has a negative cost effect because of increases in license staff time to support the inspection and increased inspection fees. Because the comments were focused on existing NRC practice rather than the GEIS, no changes to the GEIS were made in response to the comment.*

### G5.9.11.2 Enforcement and Third Party Verification

**Comment: 031-008; 033-003; 033-009; 061-021; 1309-006; 1601-003; GI02-010; HC019-005**
A number of commenters suggested third-party (independent of NRC or licensee) sampling and analysis of samples was needed to ensure safety.

*Response: As part of the inspection process, the NRC may elect to conduct radiological sampling to ensure compliance with license or regulatory requirements. The inspectors may measure ambient gamma radiation levels or collect soil, water, or swipe samples. The NRC occasionally uses third-party contractors when the Agency needs technical expertise that it does not have. For example, the Oak Ridge Institute for Science and Education may be used to conduct complex radiological sampling on behalf of NRC. Because NRC no longer maintains the capability for conducting soil or water sample analyse, these samples are shipped to the Oak Ridge Institute for Science and Education for analysis.*

*The decision to collect radiological or environmental samples depends on a number of variables. Samples are usually collected to verify if a facility is ready to be released from the license. The NRC inspectors have also collected samples for comparison against the licensee's sample results. These samples are used to ensure that the licensee's sample results are accurate. Occasionally, the inspectors may collect samples in response to specific allegations. As the comments requested implementing a regulatory practice and did not affect information in the GEIS, no changes were made to the GEIS in response to this comment.*

### G5.9.11.3 Enforcement and Inspection Staffing

**Comment: 018-004; 050-014; CH-07-012; GA03-002; GI01-001; GI01-011; HC007-002; HC012-005; HC016-005; HC018-003; HC018-004; SP15-001; SP16-001**
Various commenters were concerned that NRC resources for ISL licensing and enforcement are insufficient and could impact NRC execution of these activities. Several asked about the

number of inspectors NRC employs to inspect ISL facilities and a number of other commenters expressed concern that NRC does not have a sufficient number of inspectors to provide adequate regulatory oversight for the number of facilities expected to be licensed. Another commenter asked what difficulty NRC, state agencies, and companies may have in finding qualified staff that would limit mitigation of environmental and public health impacts.

*Response: NRC staffing levels and resources are appropriately managed by NRC management. If the number of applications submitted by applicants or licensees exceeds the resources available for conducting the reviews, then the NRC will review the applications based on the order received. This prevents a situation where the number of applications submitted can impact the completeness or quality of NRC licensing reviews. The various applicants and licensees also have the option of requesting consultations with NRC management, including the Commissioners. If an applicant or licensee has a special situation, this information can be presented to NRC management for consideration. With proper justification, NRC management may elect to reprioritize the work assigned to the staff.*

*NRC management controls the number of qualified staff in all program areas. NRC's Region IV office is commonly responsible for conducting inspections of uranium recovery facilities. The Region is allocated a certain number of full time employee staff hours to conduct the inspections, and the amount of staff time assigned to the Region is established during routine budgeting activities. In addition to Region IV staff, headquarters staff provide support to the Regional staff during site inspections. For example, the project manager and technical staff experts are invited to attend the inspections.*

*The NRC has established a formal training and qualification program to ensure that qualified inspectors and license reviewers are available to conduct inspections and license reviews. Through the budgeting process, NRC management controls the number of individuals that are assigned to the uranium recovery program. NRC management also controls the number of individuals who enter the training and qualification program, and, as such, is tasked to ensure that an adequate number of qualified individuals are available for licensing and inspection activities. No further change was made to the GEIS beyond the information provided in this response.*

**Comment: 006-001; 1388-009; HC013-001**
One commenter mentioned the GEIS lacks information on actions to be taken for violations nor does not provide information on the various jurisdictions having authority to regulate ISL facilities. Another commenter expressed a concern about lack of oversight; noting that WDEQ is responsible for implementing EPA programs but they are understaffed. One suggested the GEIS should investigate enforcement of state and federal laws to determine fully implemented at field level (e.g., water quality standards).

*Response: The purpose of the GEIS is to evaluate potential environmental impacts from ISL facilities that may be licensed to operate in the four milling regions. Chapter 1 of the GEIS provides basic descriptions of authorities and roles of the various federal, tribal, and state agencies that can play a role in ISL facility permitting. While, in response to public comments and questions, additional information has been added to Chapter 1 describing NRC enforcement and inspection activities (for context), detailed discussions of NRC or other agency enforcement actions and capabilities is not necessary in the GEIS for the evaluation of potential impacts from ISL facilities. For the purpose of evaluating impacts in the GEIS, NRC assumes licensees comply with regulatory requirements and license conditions and regulatory agencies effectively implement and enforce their regulations. This assumption is common in NRC NEPA* *analyses and is not unique to the GEIS. In response to this and other comments additional information on NRC inspection and enforcement was added to Chapter 1 of the GEIS.*

## G5.9.12 Groundwater Restoration Criteria and Methods

**Comment: 032-033; GA23-009**
One commenter suggested characterization of baseline groundwater quality should consider and subtract impacts to groundwater from past operations. Another commenter suggested Section 8.3.1.1 should indicate how preoperational baseline water quality is calculated.

*Response: The GEIS assesses potential impacts from ISL facilities based on current NRC regulations and practices. Detailed NRC guidance on methods for characterizing baseline groundwater quality are provided in the Standard Review Plan for In-Situ Leach Uranium Extraction License Applications in NUREG–1569 (NRC, 2003b). Changes to NRC guidance or practices are therefore outside the scope of the GEIS. The discussion in GEIS Section 8.3.1.1 specifically references NUREG–1569 regarding baseline water quality and therefore it is not necessary to repeat the information in the GEIS. As a result, no changes were made to the GEIS in response to the comments.*

**Comment: 036-006; 038-003; AL16-061; CH06-019**
A set of comments related to groundwater restoration and criteria. One commenter recommended NRC require applicants to prove they have restored groundwater. Another commenter requested NRC clarify that groundwater restoration standards are "goals" and offered that 10 CFR Part 40, Appendix A, Criterion 5 requires restoration to background or an maximum contaminant level (MCL) or an Alternate Concentration Limits (ACLs). Other commenters indicated ISL facilities have not restored groundwater without relaxing or changing standards. Another commenter suggested ACLs were supposed to be the exception but now are becoming the rule (noting ACLs allow more contamination than baseline water quality).

*Response: As discussed in GEIS Section 2.5, the states authorized to implement the EPA groundwater protection program and the NRC require well field restoration at ISL facilities to protect human health and the environment. Prior to operations, the groundwater in the portion of the aquifer designated for uranium recovery is exempted from EPA regulatory protection in accordance with the SDWA. To protect adjacent (nonexempted) aquifers NRC requires licensees to restore the groundwater in well fields. Restoration criteria are determined on a site-specific and well field-by-well field basis. Applicants must submit for NRC review and approval the baseline water quality determinations and groundwater restoration plans. NRC licensees are required to restore groundwater parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5 or to an alternate NRC-approved standard. Meeting these standards satisfies the restoration criteria and protects the regional groundwater. To date, no ACLs have been granted to any operating ISL facilities. Because groundwater restoration is already described in sufficient detail in the GEIS to support the evaluation of potential impacts, no changes were made in response to the comments.*

**Comment: 036-052**
A commenter requested the GEIS Sections 2.4.1.3 and 2.4.1.4 should include clarifications of the point of compliance and point of exposure for groundwater restoration plans based on concerns that the practices are changing.

*Response: Consistent with the NRC regulations in 10 CFR Part 40, Appendix A, the determination of point of compliance and point of exposure are made on a case-by-case basis for each site. As such, providing additional clarification in the GEIS is not necessary for the evaluation of potential impacts from proposed ISL facilities. As a result, no changes were made to the GEIS.*

**Comment: 036-007**
One commenter requested NRC characterize groundwater restoration as a mitigation measure to minimize potential for migration to an adjacent aquifer.

*Response: NRC staff consider the GEIS discussion of groundwater restoration uses the appropriate terminology and context. As a result, no changes were made to the GEIS in response to this comment.*

**Comment: 036-055**
Regarding the GEIS Section 2.5 discussion of aquifer restoration, one commenter suggested the discussion be revised to clarify restoration standards in 10 CFR Part 40, Appendix A, are not presently applicable to ISL facilities but are imposed by license conditions.

*Response: As stated in Section 2.5, NRC has historically supplemented these standards (in Appendix A) through the use of guidance documents and license conditions. No further clarification is needed, therefore, no changes were made to the GEIS in response to this comment.*

**Comment: CA06-001; CA10-007**
A few comments were provided on the duration of aquifer restoration at ISL facilities. One commenter suggested regulators and the regulated industry need to achieve more timely groundwater restoration. Another commenter noted the reason for long groundwater restoration could be that the well field is still productive.

*Response: The GEIS discusses historical aquifer restoration experience in Section 2.11.5. Past examples suggest considerable site-specific variability in the duration of aquifer restoration with the longer times reaching 10 years or more. Licensees are required to begin aquifer restoration efforts as soon as practicable following productive use of a well field, to fulfill the 2-year requirement in 10 CFR 40.42 or an alternate time standard approved by NRC (NRC, 2008). NRC continues to require monitoring during the restoration period to provide assurance that solutions do not migrate beyond the operational wells. Financial assurance estimates may also be increased at facilities that take longer than expected to restore well fields. These efforts provide additional assurance that safety and protection of the environment would be maintained during the aquifer restoration period. Because the comments were general in nature and not specifically focused on the GEIS, no changes to the GEIS were made in response to the comments.*

**Comment: 036-124**
One commenter requested the statement in the GEIS Section 8.3.1.2 about ceasing active operations after 60 days of excursion should be modified since some states allow partial stoppage.

*Response: In response to the comment, the statement about the actions taken after 60 days of excursion status were clarified to be more consistent with NRC guidance in NUREG–1569 (NRC, 2003b). This clarification includes an option to cease injection at the well field that is on* *excursion status or provide an increase in surety amount to cover the expected full cost of correcting and cleaning up the excursion.*

**Comment: 036-022**
One commenter suggested NRC address whether continued consumptive use of groundwater to meet baseline aquifer restoration makes sense in terms of the NRC ALARA policy.

*Response: Evaluation of the applicability of the ALARA policy to ISL aquifer restoration is not needed in the GEIS to support the evaluation of potential environmental impacts from ISL facilities. The potential consumptive water use impacts from aquifer restoration activities are already addressed in the GEIS in the Chapter 4 sections (groundwater) based on current regulations and practices. Because the requested information is not needed in the GEIS, no changes to the GEIS were made in response to the comment.*

## G5.9.13 Concerns About Impacts to DOE Sites

**Comment: 019-003**
One commenter requested that the GEIS clarify the applicability of a statement in NUREG–1569, Appendix B that transfer of byproduct title for long-term care is not applicable to DOE.

*Response: The purpose of the GEIS is to assess the potential environmental impacts from ISL facilities. The requested clarification of NRC guidance is not needed to support the evaluation of potential environmental impacts from ISL facilities. An ISL facility, by itself, would not be expected to require long-term caretaking following completion of restoration and decommissioning due to the provisions of 10 CFR Part 40, Appendix A, Criterion 2. No further changes were made to the GEIS beyond the information in this response.*

**Comment: 019-004; 019-005; 019-006**
A commenter provided a series of comments expressing concerns about potential ISL impacts to nearby DOE facilities including Title II tailings impoundments. These include changes to groundwater chemistry that could potentially impact remedies at nearby DOE sites.

*Response: Potential ISL impacts to other types of sites that may be located in the vicinity of the ISL site would be included in a cumulative impact analysis. Such an analysis, as stated in Sections 1.5.2 and Appendix A (Section 4.5) of the GEIS, is a site-specific analysis that would be conducted during the NRC environmental review of an ISL license application for a specific site. Should any DOE sites exist in the vicinity of a proposed ISL facility, NRC would have consultations with the appropriate DOE office(s) to ensure all applicable potential impacts are considered, discussed, and addressed. In response to these and other comments, GEIS Section 1.6.1.6, which discusses other federal agencies that would be consulted, if applicable, during an ISL license application review, was modified to include the DOE Office of Legacy Management.*

**Comment: 019-007; 019-008**
A commenter recommended that NRC consider aquifer restoration monitoring for sufficient time at ISL facilities to ensure long-term stability. They also recommended the GEIS should maintain data quality objectives to establish downgradient or offsite groundwater conditions.

*Response: GEIS Section 2.5.4 discusses geochemical stability monitoring that would be conducted to ensure that chemical species of concern do not increase in concentration prior to completion of restoration. This part of the restoration plan would be evaluated in an NRC site-specific safety review. Applicants would propose the length of time for stability monitoring, the number of monitoring wells, chemical indicators to be monitored, and the frequency of monitoring. The details of such a program would vary based on site-specific postextraction water quality and geohydrologic and geochemical characteristics. Both the state permitting agency and NRC would have to review and approve the monitoring results before aquifer restoration was considered complete. Because stabilization is already discussed in the GEIS, no changes were made in response to the comment. Regarding the request for establishing data quality objectives for offsite groundwater conditions in the GEIS, such information is not needed to support the evaluation of potential environmental impacts from ISL facilities and therefore has not been added to the GEIS in response to the comment.*

**Comment: 019-009**
One commenter noted that they expect no additional cost associated with adjacent ISL facilities to DOE sites and therefore recommended GEIS Section 2.10 include a statement that the surety would cover impacts to third parties.

*Response: GEIS Section 2.10 provides a summary of the purpose and nature of financial surety arrangements. The surety is intended to cover the costs of aquifer restoration and site decommissioning and reclamation. Surety requirements are included at 10 CFR Part 40, Appendix A, Criterion 9. While completing restoration, decommissioning, and reclamation would be expected to be sufficient to mitigate any potential impacts to third parties, because the surety requirements include no explicit provision for covering third party impacts, no changes were made to the surety discussion in the GEIS Section 2.10.*

### G5.9.14 Definitions

**Comment: 036-126; 036-127; 036-128; 036-129; 036-130; 036-133; 036-134; 036-137**
One commenter provided a number of specific suggestions for modifying the language of definitions of terms included in the glossary. These include the following:

- Revise "agreement state" definition to reflect it is not applicable to tribes
- Revise "aquifer exemption" definition to reflect EPA must approve all such exemptions
- Revise "aquiclude" definition to convey formations confine groundwater in exempted aquifer
- Revise “byproduct material” to use AEA definition
- Revise "conventional uranium milling" definition to include uranium bearing ore that typically arrives by truck, and is typically crushed
- Revise "mill feed" to include uranium loaded ion exchange resins and yellowcake slurry
- Revise "ore" definition to reflect alternate feed guidance mandated by NRC; licensees will seek authority for toll milling

- Revise "source material" to reflect AEA definition in 10 CFR Part 40, differentiate between licensed and nonlicensed

*Response: Staff reviewed the recommendations and revised the definitions in the GEIS Chapter 12 glossary, as needed, to clarify. Note that the GEIS is not a regulation and the definitions included in the glossary are intended as an aid to the general reader.*

### G5.9.15 References

NRC. "Compliance with 10 CFR 40.42's Timely Decommissioning Requirements." Letter (July 7) from K.I. McConnell to S. Collings, Power Resources, Inc. Washington, DC: NRC. 2008.

NRC. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*. Vol. 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 2003a.

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

## G5.10 Credibility of NRC

**Comment: 059-021; 061-002; 1015-011; 1097-003; 1309-007; 1309-010; 1309-016; 1388-002; 1601-009; 1602-011; 829-005; AL15-045; AL15-049; AL20-079; AL24-095; AL25-114; GA18-003; GA23-011; GA24-001; GI02-005; GR01-008; GR16-004; GR22-005; GR23-002; GR26-001; GR28-001; GR30-002; GR31-003; HC012-001; HC013-003; HC014-001; HC014-002; NE06-019; NE06-022**
A number of individuals questioned NRC credibility in their submitted comments. These commenters suggested a lack of confidence and trust in NRC's ability to carry out its mission to protect the public and environment and expressed concerns that NRC serves the mining industry and political interests. Another set of comments provided examples of what the commenters suggested were past NRC failures to carry out its mission. A few commenters expressed support for NRC doing its job referring to high integrity and bright minds.

Some commenters suggested because NRC staff did not live in the local communities where facilities would be cited that NRC would disregard local concerns. Others suggested the GEIS was full of misinformation designed to support the uranium industry or that government regulators were not doing their job. One questioned the sufficiency of NRC expertise, ability, and regulations. Others viewed the GEIS as "fast tracking" licensing of ISL facilities to serve industry interests. Some claimed that NRC failed to protect public health/safety from legacy mining sites citing examples of the United Nuclear Corporation mine and Homestake facilities in New Mexico. Another commenter expressed a lack of trust when facilities are fined for breaking rules.

*Response: The NRC acknowledges these summarized comments, which are related to the commenters' views of the NRC credibility. Many of the comments are not related to the GEIS and do not require a detailed response. The commenters are reminded that NRC is an independent federal agency that has no ownership of any nuclear or ISL facility. NRC regulates* *licensees by conducting a thorough and independent review of each application for a license consistent with its congressional mandate and NRC's regulations for safety and environmental review. Once a license is granted, NRC enforces its regulations and license conditions by conducting regular inspections of operating facilities. If inspections detect noncompliance, fines and other punitive measures can be taken depending on the severity of the infraction.*

*The GEIS has been developed in a manner consistent with the NRC requirements in 10 CFR Part 51, which allows for the development of broad EISs and tiering from such documents in preparing narrower site-specific statements or assessments. The effort to develop the GEIS to address broad common topics related to ISL licensing is a practice focused on reducing repetitive and redundant analyses to improve efficiency of staff environmental reviews and focus attention during those reviews on important site-specific topics. The intended result is that the GEIS will improve NRC's ability to perform its mission to protect public safety and the environment. NRC developed the GEIS with particular regard for local concerns including holding three public scoping meetings and eight public comment meetings throughout the four milling regions addressed in the GEIS. During the public comment meetings, NRC staff traveled extensively throughout the milling regions and met with a variety of local, state, and federal officials. NRC staff also talked to members of the public to improve its understanding of a wide variety of local concerns and conditions. Because the comments were general in nature, no specific changes to the GEIS were made in response to the comments.*

## G5.11 Federal and State Agencies

### G5.11.1 Roles of Federal, Tribal, State, and Local Agencies

**Comment: 032-007; 036-036; 050-061; 050-062; 050-130; 1173-003; 1321-034; 1388-003; AL32-159; GI04-004; GI07-001**
A number of commenters requested NRC clarify or add information about the roles of various federal and state agencies with regard to regulation of ISL facilities. This requested clarification included reconciling various federal and state requirements, discussing permitting processes of other federal and state agencies, and clarifying authorities for water and resource management. Other commenters requested the role of the U.S. Forest Service and the state engineer be discussed. Another commenter wanted clarification of the types of wells that must receive specific UIC permits. One asked about the role of the county commission, while another wanted to know whether the state could require third party testing.

*Response: GEIS Section 1.6 summarizes the roles of other agencies involved in ISL facility licensing for context, and specific statutes and regulations are summarized in Appendix B. It is beyond the purpose and scope of the GEIS to provide a complete description of all applicable statutes, agencies, roles, and regulations. The responsibility for describing regulatory programs rests with the agencies responsible for implementing those programs, and readers should consult the responsible agencies for clarification of their regulations and programs. ISL applicants are ultimately responsible for understanding and complying with all federal, state, and local permits and regulations whether described in the GEIS or not. No further changes were made to the GEIS beyond the information in this response.*

**Comment: 032-032; 1321-038**
One commenter requested adding EPA permit-issuing authority for the National Pollutant Discharge Elimination System (NPDES) permits in Indian country in specific Chapter 3 and

Chapter 4 water resource sections. Another commenter wanted a note inserted into the Chapter 4 groundwater section that New Mexico has primacy from EPA for the UIC program.

*Response: Section 1.7.2.1 already includes a statement indicating that New Mexico has primacy from EPA for the UIC program, and therefore the NRC staff considers further reference is not needed in other chapters. A statement was added to Section 1.7.2.1 regarding EPA authority to issue NPDES permits in Indian Country.*

**Comment: 032-012**
One commenter requested adding clarification that New Mexico Environment Department authority is based on Title 20, Chapter 6, Part 2 in the GEIS Section 1.7.5.4.

*Response: The clarification was added to Section 1.7.5.4.*

### G5.11.2 Effect of Changes to Federal or State Regulations on the GEIS

**Comment: 032-013; 1173-093; 1321-010; 1321-011**
Various commenters noted potential changes to regulations that could impact information in the GEIS if such changes were to occur. Potential changes to regulations or practices that were mentioned include:

- State of Wyoming consideration of Class V rather than Class III designations for certain deep uranium disposal wells and a potential effect on aquifer restoration
- EPA reviewing 40 CFR Part 192 and 40 CFR Part 61, Subpart W for revision which might include coverage of ISL facilities
- Pending legal case regarding authority jurisdiction to regulate ISL facilities in Indian Country
- EPA consideration of the applicability of 40 CFR Part 61, Subpart W radon , National Emission Standards for Hazardous Air Pollutants and 40 CFR Part 61, Subpart A to evaporation ponds

*Response: As stated in the GEIS Section 1.5.2 (rulemaking activities), the GEIS is based on existing regulations at the time of writing. While it is not appropriate to speculate about the direction of early proposals, NRC would evaluate changes in other agency regulations applicable to ISL facilities for any impacts on NRC regulatory programs when the proposed changes are finalized and ready for discussion. Regarding Wyoming permitting of deep disposal wells, the Wyoming Department of Environmental Quality requires either a Class I or Class V UIC permit for ISL deep disposal wells, and therefore this is current practice rather than a proposal as suggested by the commenter. In response, the discussion of Wyoming UIC permitting in GEIS Section 1.7.5.1 was clarified regarding the classes of UIC permits applicable to deep disposal wells. The assessment of potential impacts of adjacent wells (including deep disposal wells, where applicable) on aquifer restoration efforts, as requested by the commenter, would be evaluated during the NRC site-specific licensing review for an ISL facility and in the later NRC review of well field restoration plans. Because the remaining regulatory change proposals listed by commenters are not sufficiently complete for discussion at this time, no changes were made to the GEIS in response to these comments.*

### G5.11.3 Clarification of Other Federal/State Regulations and Practices

**Comment: 032-014; 032-015; 032-035; 032-036; 036-140; 1321-041; CH11-008; HC011-002; HC013-005; HC017-003; HC020-001; NE01-003; NE05-003; NE06-003**
A number of commenters recommended clarification or additional discussion of other federal or state regulations and practices that apply to ISL facilities. The topics recommended include

- Description of 40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants, and approvals prior to construction,
- Applicability of 40 CFR Part 61 to evaporation ponds,
- Other potentially applicable EPA regulations,
- Scope of aquifer exemption and water use,
- Impacts of excursions on public health,
- State inspection practices,
- South Dakota Class III UIC rules,
- SDWA groundwater protection areas,
- South Dakota archaeological, cultural, and social sites and 2006 Antiquities Act and other protections,
- New Mexico State Engineer regulations on wells in confined aquifers,
- New Mexico permitting for evaporation ponds,
- NPDES permitting by New Mexico Environment Department,
- New Mexico State surface water quality standards,
- New Mexico Game and Fish guidelines for trenching, power lines and fencing

One commenter also suggested the title of the GEIS Section 1.7.2 be changed to "EPA Permitting/Approval."

*Response: A reasonable effort has been made to summarize specific aspects of applicable federal and state regulations in the GEIS. NRC appreciates the detailed descriptions of various programs and guidance provided by other federal and state agencies and interested individuals. Including increasingly detailed descriptions of regulations applicable to ISL facilities, however, is beyond the purpose and scope of the GEIS. Extensive descriptions of applicable requirements are not necessary for evaluating potential environmental impacts from ISL facilities. Details regarding applicable requirements and compliance will be handled through licensee consultations with the applicable federal and state agencies responsible for implementing the regulations. The applicable federal and state agencies are best able to describe their regulations and programs; therefore, the additional details requested in the comments were not* *added to the GEIS. Regarding the comment about potential health effects of excursions, the requirement for ISL milling to be conducted in an exempted aquifer (i.e., not suitable as a drinking water source) as described in Section 1.7.2.1, the monitoring requirements for early detection of excursions, and the required response actions (discussed in Chapter 8.3.1.2) are effective means of protecting public water supply wells in the region surrounding ISL facilities (see G5.22 for more detailed discussion of excursions and related comments). In response to one of the comments, the title of Section 1.7.2 was revised as suggested.*

**Comment: 1173-018**
One commenter suggested clarification be added to Section 1.7.5.1 regarding the Wyoming Land Quality Division holding joint bonds with the BLM for exploration and mining on BLM lands, as well as a joint memorandum of understanding for surface management of locatable mineral operations.

*Response: In response to the comment, the recommended clarification was added to Section 1.7.5.1.*

**Comment: 050-050**
One commenter recommended discussion of split estate requirements under the 1872 Hardrock Mining Act and potential impacts in GEIS.

*Response: In response to the comment, a new subsection was added to Section 3.1.2 to describe the split estate issue and BLM authority and actions regarding split estate issues. Additional discussion of potential split estate impacts was added to land use sections in Chapter 4.*

### G5.11.4 Potential Conflicts With Other Agency Requirements

**Comment: 1314-038**
One commenter suggested the GEIS was not clear on the actions the NRC will take if ISL operations violate state or local laws.

*Response: It is the responsibility of the state and local authorities to enforce their own laws. NRC has no authority to enforce state or local laws. Nonetheless, NRC inspectors would inform the appropriate federal, state, or local authorities if NRC observed conditions at an ISL facility that appeared to be in violation of applicable laws. This is a matter of general agency inspection practice that applies to any licensed facility and therefore is not necessary to discuss in the GEIS. Therefore, no changes were made to the GEIS in response to this comment. Additional discussion on inspection-related comments is in this appendix at Section G5.9.*

**Comment: 1311-007**
One commenter suggested the GEIS was going to be used by NRC and agreement states in the same manner as the prior 1980 GEIS on conventional uranium milling. The commenter implied this would be inadequate to support NRC and agreement state licensing decisions regarding the informed decision-making and public participation requirement of NEPA.

*Response: As stated in the GEIS Chapter 1 and Appendix A, 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 licensing review for ISL facilities. The portion of the comment implying inconsistency with NEPA regarding* *informed decision making and public participation is addressed in Sections G5.4, G5.5, and G5.8. Because the comment was general in nature and focused on the idea of a GEIS rather than any specific part of the document, no changes were made in response to this comment.*

**Comment: 1305-108**
A commenter suggested the GEIS does not adequately address impacts to federal lands.

*Response: Land use sections in the GEIS Chapter 3 identify the location of federal lands that are regulated by the U.S. Forest Service, BLM, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and Bureau of Reclamation and provide percentages of surface ownership for each milling region. This information provides a regional view of the types and prevalence of federal lands in each region that could be potentially impacted by future ISL facilities. The Chapter 4 impact sections discuss the types of impacts that are possible to federally managed land uses as well as impacts to lands regardless of their ownership status. Such impacts are dependent on proximity of a proposed ISL site to the federal lands, which is a site-specific consideration that would be addressed during the NRC site-specific environmental review. For ISL proposals that are on or adjacent to federal lands, NRC would consult with the applicable federal agencies on the site-specific environmental review to ensure all potential impacts on federal lands are addressed. Because the information in the GEIS is consistent with its purpose and need, no additional information was added in response to the comment.*

**Comment: 032-017**
The commenter mentioned that upper control limits (UCLs) used by an ISL facility to detect excursions should be derived so they do not exceed state water quality standards. The commenter also disagreed with the approach discussed in Section 2.4.1.4 defining an excursion as occurring when two or more excursion indicators in a monitoring well exceed their UCL (indicating the state would define an excursion as a time when only one indicator exceeded the limit). Noting, with regard to an excursion that could not be recovered, that this would be considered an illegal discharge, thereby requiring an operator to cease injection immediately.

*Response: As discussed in GEIS Section 2.4.1.4, excursion indicators and UCL for individual well fields are proposed by applicants or licensees based on lixiviant chemistry and baseline water quality. As such, these parameters depend on site-specific conditions and are reviewed and approved by NRC on a case-by-case basis. The statement in the GEIS about an excursion defined as involving two or more indicators being above UCL was based on NRC guidance (NRC, 2003); however, the guidance does not limit NRC from considering other approaches including the use of a single indicator as the basis for defining an excursion for a specific site, if necessary to ensure safety and protection of the environment. The text in Section 2.4.1.4 was clarified to convey this flexibility.*

*Regarding compliance with state water quality standards, beyond NRC's requirements, a state that has primacy for the UIC program under the SDWA would be able to set regulatory standards under that Act and its accompanying regulations. If EPA has not granted the state primacy, EPA would set the standards. If those standards were more stringent than those of the NRC, the UIC permittee would be required to comply with them under the state UIC program. Because the licensee proposes the requirements to be incorporated into its license subject to NRC approval, a licensee may propose to incorporate requirements into its NRC license that meet state or EPA requirements. In either case, the licensee must meet both sets of requirements.*

*While the GEIS summarizes applicable authorities and regulations, it is beyond the scope of the GEIS to provide detailed discussions of the applicable regulations and the various circumstances where they may apply. Therefore, no changes were made to the GEIS in response to this portion of the comment.*

**Comment: 032-018; AL14-035**
One commenter (New Mexico Environment Department) provided clarification that New Mexico does not classify groundwater (i.e., regulate groundwater by class of use). Another commenter mentioned New Mexico has been granted primacy by EPA and that the State uses temporary aquifer designations rather than aquifer exemptions.

*Response: As noted in GEIS Section 1.7.2.1, New Mexico is authorized by EPA to administer the underground injection control program in accordance with EPA regulations (i.e., granted primacy). For New Mexico this applies to Class III wells, which are the class of wells used at ISL facilities for the injection of lixiviant. UIC permit approval is a State function, when a State has primacy for that class of injection well. An aquifer exemption, as defined under the SDWA and its regulations, is required prior to injection and can only be approved by the EPA. In response to the comment on New Mexico primacy status, no changes to the GEIS were made since the information is already in Chapter 1. In response to the comment on groundwater classification, a statement in Chapter 2 regarding class of use was qualified (e.g., as applicable) to account for the State of New Mexico not classifying groundwater.*

**Comment: 036-023**
A commenter stated that EPA excludes material regulated by AEA from regulation under NPDES permits and requested NRC consider implications of a year 2000 Commission decision that restoration fluids are 11e.(2) byproduct material. Specifically, the commenter asked for NRC to describe applicability of NPDES permits with regard to the following:

- Allowance for NPDES permitted discharge
- Applicability of state requirements for land application
- Temporary wastewater discharges from test wells prior to operations
- NPDES permits for production and restoration fluids

*Response: EPA or authorized states are the regulatory authority over the NPDES permit program. EPA or the authorized state would determine whether temporary wastewater discharges from test wells prior to operations, production, or restoration fluids could be discharge under an NPDES permit and any permit conditions on that discharge. In general, NRC allows licensees to request to treat and discharge liquid wastes to surface water bodies under an NPDES permit if the treated wastes meet applicable NRC effluent requirements. In practice, licensees typically choose other disposal methods, such as those described in Section 2.7.2. Similarly, as described in Section 2.7.2, NRC allows land application of treated wastewater if the treated waste meets NRC effluent limits, subject to the appropriate EPA and state permits. Areas of a site where land application of treated water has been used are included in NRC decommissioning surveys to ensure soil concentration limits are not exceeded.*

**Comment: 1321-009**
One commenter stated that 40 CFR Part 192 requires protection and restoration of groundwater during operations and not solely during the closure phase of operations. The commenter also suggested this applies without regard to exempted aquifers approved by EPA under UIC regulations implementing the SDWA.

*Response: NRC staff was not able to find a statement in the GEIS to the effect that 40 CFR Part 192 applies solely to the closure phase of operations. However, as discussed in various sections of the GEIS, ISL uranium recovery operations occur in aquifers that first must be exempted as underground drinking water sources pursuant to 40 CFR 146.4. EPA has the sole authority to grant aquifer exemptions. Prior to well field operations, a licensee collects baseline groundwater quality data in the planned production zone and in overlying and underlying aquifers, as appropriate, for a list of constituents approved by NRC. These groundwater data are used to determine (1) restoration standards to be met following the cessation of uranium recovery in the well field and (2) upper control limits for excusions monitoring in wells completed in the production zone and in the overlying and underlying aquifers, as appropriate. Licensees are required to monitor during well field operations for potential excursions and to take corrective actions in the case of a detected excursion. Following uranium recovery in the well field, the licensee commences aquifer restoration using a series of techniques (see Section 2.5) with the goal of meeting the restoration standards set prior to well field operations. NRC and the applicable state agency approve completed restoration based on data and information supplied by the licensee. As this information is provided in various sections of the GEIS, no further changes were made to the GEIS.*

**Comment: 006-002**
One commenter requested that the GEIS should not remove EPA from the process. The commenter requested the responsibilities of agencies should be explicit and provisions for enforcement should be ensured.

*Response: GEIS Chapter 1 includes discussions of the EPA roles and responsibilities including programs and permitting that apply to ISL facilities. These programs address underground injection, ambient air quality standards, emission standards for hazardous air pollutants, and protection of water resources. EPA and related programs play an important and substantial role in the regulation of ISL facilities. Regarding provisions for enforcement, each agency involved in regulating ISL facilities is responsible for enforcing its regulations. NRC ensures adequate resources are available to enforce its regulations including supporting regional offices and staff that conduct onsite inspections to verify compliance with NRC regulations. Additional discussion of enforcement is included in Section G5.9. Because the requested information is already discussed in the GEIS, no changes were made.*

**Comment: 1321-012**
The commenter encouraged deletion of any mention of dual regulation and delegation to the EPA's UIC program as a potential solution to the dual-regulation issue (e.g., as stated in GEIS Appendix B) due to the complexities involved. EPA noted that the purpose and scope of the GEIS is to evaluate impacts from ISL facilities and not to resolve regulatory issues. The commenter suggested a regulatory review as a more appropriate means to evaluate and address such issues.

*Response: NRC staff agrees that the purpose of the GEIS is to evaluate impacts from ISL facilities and not to resolve complex jurisdictional issues. In response to this comment, the text regarding dual regulation was removed from Appendix B.*

## G5.11.5 References

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

## G5.12 Cooperating Agencies and Consultations

**Comment: 1173-001; 1305-107; GR02-001; NE01-001**
These commenters requested clarification on the consultation process that would occur during site-specific environmental reviews. One commenter said that the split of jurisdictional responsibilities between agencies (BLM and NRC) was poorly defined in the GEIS, and requested cooperating agency status. Another commenter wanted to know if there was a public record of the government consultations. One commenter questioned whether consultations had been held with the Black Hills National Forest or U.S. Forest Service.

*Response: Consultations are described in the GEIS Chapter 9. Each site-specific review would include consultations with applicable federal and state agencies and affected tribes. This normally includes but is not limited to consultations with the U.S. Fish and Wildlife Service, state and Tribal Historic Preservation Offices, and affected tribes. Other consultations that are possible based on site-specific conditions include U.S. Forest Service (if proposal is on or near U.S. Forest Service land) and BLM (if proposal is on or near BLM land). In response to the comments raised, a new subsection within the GEIS Section 1.6.1 was added to clarify the role of BLM.*

**Comment: 1305-005; NE06-012**
These commenters wanted to know what consultations were done during development of the GEIS. One commenter wanted to know whether a prerequisite Section 7 consultation was conducted with the U.S. Fish and Wildlife Service and requested an explanation if this was not done. Another noted that the GEIS included no mention of consultations conducted with the U.S. Fish and Wildlife Service, BLM, or the U.S. Forest Service.

*Response: NRC did not conduct formal consultations with other state and federal agencies during the development of the GEIS. Such consultations are normally conducted during environmental reviews for site-specific licensing actions. WDEQ is a cooperating agency in the development of the GEIS as noted in the abstract of the GEIS. In addition, NRC communicated with and received comments from a variety of federal, tribal, and state agencies on the development of the GEIS. These agencies included the U.S Fish and Wildlife Service; EPA; BLM; DOE; Navajo Nation Department of Justice; South Dakota Department of Game, Fish, and Parks; New Mexico Environment Department; New Mexico Department of Game and Fish; and New Mexico State Land Office. Because the response addresses the comments, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 015-010; 019-002; 019-010; 036-037; 1321-024**
These commenters requested consultations during site-specific reviews. The National Park Service specifically identified projects that could be impacted if an ISL facility was sited nearby. One commenter (DOE) wanted DOE to be included as an interested stakeholder for ISL facility licensing actions for entities that could have a potential to change groundwater conditions at a nearby DOE-licensed or managed facility. Another commenter requested that NRC should express its intent in GEIS Chapter 1 to work with BLM to create a coordinated approach to ISL licensing. EPA requested to be notified when scoping is initiated for each tiered project and when copies of all tiered EAs are available for public review.

*Response: Each site-specific environmental review would include consultations with applicable federal, tribal, and state agencies. A new subsection within the GEIS Section 1.6.1 was added to clarify the role of BLM. Text was added to Section 1.6.1.5 to add the DOE Office of Legacy*

*Management as a potentially impacted adjacent landowner. Consistent with NRC's regulations in 10 CFR Part 51, EPA will be notified of scoping efforts for environmental reviews of new ISL license applications (51.28) and will receive copies of the draft and final SEIS prepared to support NRC's licensing decision for a new ISL facility (51.74, 51.93).*

## G5.13 GEIS Schedule

**Comment: 003-001; 004-001; 005-001; 012-001; 013-001; 016-004; 031-001; 033-010; 043-001; 1309-011; AL05-142; AL15-040; AL17-065; AL27-135; AL31-156; AL34-165; GA16-010; GI02-008; GR11-002; GR12-011; GR14-012; GR25-003; GR34-008; HC007-001; HC014-007; SP08-001; SP08-008; SP17-001**
Many commenters requested an extension to the public comment period. Most of these commenters requested a 180-day extension. Some commenters referred to the large size of the GEIS and the need for more time to read and collect referenced information. One commenter mentioned the comment period overlapped with seasonal activities (ranching, farming) in August and September that made it difficult for locals to participate. Another required more time due to lack of computer resources and internet access.

*Response: NRC received approximately similar numbers of comments requesting completion of the GEIS without delay or expediting the GEIS schedule as those requesting extension of the public comment period. NRC responded to the requests for extension of the public comment period by extending the period for 30 days. This provided more time for public review without substantially delaying the schedule for completion of the GEIS. As these comments pertained to the schedule for the GEIS and not the content of the document, no changes were made to the GEIS.*

**Comment: 007-002; 017-001; 017-015; 024-007; 028-002; 029-005; 030-001; AL10-020; AL12-023; AL26-127; CA02-009; CA04-004; CA04-006; CA05-001; CA07-014; CA08-003; CA08-008; CA10-002; CA10-004; CAG01-001; CAG01-003; CH-08-013; GA08-010; GA11-007; GR05-005; GR06-007; SP10-014; SP11-009; SP18-004**
Many commenters requested the GEIS be completed as soon as possible without delay. Some referred to the need for completion of the GEIS so NRC staff could focus on review of pending license applications. Others suggested delays in publication of the GEIS could negatively impact investment in ISL projects. Still others wanted the GEIS to be expedited and published on the original January 2009.

*Response: NRC received approximately similar numbers of comments requesting extension of the comment period as those requesting completion of the GEIS without delay or expediting the GEIS schedule. NRC responded to the requests for extension of the public comment period by extending the period for 30 days. This provided more time for public review without substantially delaying the schedule for completion of the GEIS. The extension in the final publication date for the GEIS from January to June 2009 reflects the considerable public interest in the GEIS from affected stakeholders and interested members of the public. As comments on the schedule do not call for changes to the GEIS, no changes to the GEIS were made.*

## G5.14 ISL Process Description

GEIS Chapter 2 describes the ISL process including the phases of an ISL facilities lifecycle (construction, operations, aquifer restoration, decommissioning), facilities and equipment, and historical operating experience. Most of the comments on material discussed in Chapter 2 are sorted below based on the applicable subsections of Chapter 2. Some comments that applied to various subsections of GEIS Chapter 2 but were similar in nature were grouped and discussed in Section G5.14.7 to avoid repetition in responses.

### G5.14.1 Overview (GEIS Sections 2.0 and 2.1)

**Comment: 050-063**
A commenter questioned whether NRC would license an ISL project if any of the four characteristics identified by Holen and Hatchell (1986), which make uranium deposits amenable to ISL extraction, are not present.

*Response: The characteristics that make uranium deposits amenable to ISL extraction are listed in the text box in Section 2.1 and are based on geologic and hydrologic features described by Holen and Hatchell (1986). These characteristics include deposit geometry, permeable host rock, confining layers, and saturated conditions. If any of these conditions are absent or minimally present, the applicant would have to demonstrate that production could occur and be protective of public health, safety, and the environment. The applicant must characterize the potential site to support an application for a license to construct and operate a new ISL facility (see Section 2.2). The applicant needs to provide enough information for the NRC staff to determine whether uranium production can be conducted in a manner that is protective of public health and safety and therefore, to issue a license. To make this determination, staff will require adequate hydrologic information, such as pumping tests, characterization and adequacy of confining layers, the location of fractures, and aquifer flow rates. After a license is issued, the licensee collects additional detailed well field characterization information primarily to pinpoint the exact location of uranium-bearing ore and to make sure that production wells are in hydraulic communication with horizontal monitoring wells located adjacent to the production zone and not in communication with monitoring wells above or below the production zone, as appropriate. The licensee will also collect background data specific to the well field to determine groundwater restoration standards to be met following the end of uranium recovery in the well field. In response to the comment, additional information was added to GEIS Section 2.2 to clarify that, if a license is granted, the licensee would collect more detailed geologic information and perform pump tests as each well field is developed to ensure that the well field possesses the physical characteristics to make it suitable for ISL extraction.*

**Comment: 1305-013**
A commenter questioned whether there are differences in the technology (e.g., drilling, underground infrastructure, and pumping) necessary to extract uranium from deposits at shallower depths {e.g., depths of 100 m [328 ft]} versus deeper depths {e.g., 560 m [1,840 ft]}.

*Response: The technology used to extract uranium at ISL sites in the uranium milling regions is described in GEIS Section 2.3 (Construction) and Section 2.4 (Operations). This technology does not generally differ with the depth of uranium mineralization. Wells drilled to deeper levels {i.e., greater than 300 m [1,000 ft]}, however, are more subject to collapse, and so steel or fiberglass casing is used in these situations. In response to the comment, additional information was added to GEIS Section 2.3.1.1 (Well Construction) to discuss the use of steel or fiberglass casing in deeper wells.*

**Comment: 050-064; 1305-012**
A commenter noted that roll-front and tabular uranium deposits have fundamentally different geometries and questioned if the ISL technology used and well field designs employed vary

between facilities extracting uranium from roll-front deposits versus tabular deposits. Another commenter asked what difference the deposit type has on potential impacts.

*Response: In Section 2.1.2, the GEIS states that, "strata bound deposits can take different physical forms and are typically described as either roll-front deposits or tabular deposits." Tabular uranium deposits are found in the Colorado Plateau, including northwestern New Mexico. Although tabular deposits hosted in sandstones in northwestern New Mexico have fundamentally different deposit geometries than roll-front deposits, they have geologic and hydrologic characteristics that make them suitable for uranium extraction by the same ISL technologies used for roll-front deposits. For example, tabular uranium deposits are typically horizontal, confined by low- or semi-permeable units such as claystone, mudstone, or shale, and have sufficient size and lateral continuity to economically extract uranium (see Figure 2.1-2). Regarding any differences in potential impacts from ore deposit geometry, the potential impacts from ISL operations are determined by a variety of factors that are discussed throughout the GEIS. Consideration of differences in the ore deposit geometry alone is not a sufficient basis for evaluating the potential for impacts from an ISL facility. In response to the public comment, additional information was added to Section 2.1.2 to clarify that tabular uranium deposits have geologic and hydrologic characteristics that make them suitable for uranium extraction by ISL techniques.*

**Comment: CA04-001**
A commenter noted that Platte County and especially Converse County have demonstrated considerable uranium reserves.

*Response: NRC acknowledges that Platte and Converse Counties in Wyoming have demonstrated uranium reserves. Most of Converse County and the northwestern part of Platte County are within the Wyoming East Uranium Milling Region defined in the GEIS (Figure 3.3-3). In this region, past, current, and potential uranium milling operations are generally found in the four-corner area of Campbell, Converse, Natrona, and Johnson counties (known as the Pumpkin Buttes District) and in the north-central part of Converse County (known as the Monument Hill District) (Table 5.2-1) (NRC, 2009a). One operating ISL site exists in Converse County (i.e., Smith Ranch) (Table 2.11-1). Because Platte and Converse Counties are included in the Wyoming East Uranium Milling Region in the GEIS, no changes to the GEIS were made in addition to this response.*

**Comment: GR08-001**
A commenter noted that the drawings (schematic illustrations) of roll-front ore bodies are in most instances not representative of actual ore bodies in the underground. He commented that some ore bodies are up and down (stacked).

*Response: Ideal crescent- or C-shaped cross-sectional views of sandstone-hosted uranium roll-front deposits are generally presented in drawings to illustrate the zoning, alteration, and mineralogical changes associated with their formation (Figure 2.1-1). In the actual subsurface, sandstone-hosted uranium roll-front deposits can take many forms depending on the site-specific environmental conditions (Figure 2.1-2). As described in Section 3.5.3, roll-front uranium deposits can be discordant, asymmetrical, irregularly-shaped, and can cut across sedimentary structures. In response to the public comment, information on the physical characteristics of roll-front deposits was added to Section 2.1.2.*

**Comment: 036-043**
A commenter wanted NRC to clarify that the color of yellowcake varies with dryer temperature. The commenter noted that the color of yellowcake is dependent on the temperature at which it is dried with higher temperatures resulting in darker colors and that yellowcake produced by modern vacuum dryers is indeed yellow.

*Response: NRC acknowledges that the color of yellowcake is dependent on the temperature at which it is dried. Colors can range from yellow to green to brown to black with darker colors resulting from drying at higher temperatures. Yellowcake produced using modern low-temperature vacuum dryers is yellow. In response to the public comment, additional information was added to the text box in Section 2.1.3 and the glossary in Chapter 12 to clarify that yellowcake color can be yellow, green, brown, or black with darker colors resulting from drying at higher temperatures.*

**Comment: 036-044**
A commenter wanted NRC to clarify that some ISL sites outside the uranium milling regions considered in the GEIS (e.g., Agreement States such as Texas) typically do not bury pipelines.

*Response: NRC acknowledges that pipelines at ISL facilities in south Texas run along the surface and are not required by their Agreement State license to be buried. The south Texas region is rarely exposed to freezing conditions, which could affect exposed pipes and result in leaks and ruptures. Installing pipelines above ground at ISL facilities that are generally not exposed to freezing conditions has the advantages of being less costly, reducing impacts to soils from trenching and backfilling, and being easier to service in the event of leaks and ruptures. In response to the public comment, additional information was added to Section 2.1.3 to clarify that ISL sites in the uranium milling regions considered in the GEIS are commonly exposed to freezing conditions during winter months and, therefore, pipelines are typically buried to avoid freezing.*

**Comment: 036-046; 1305-023**
A commenter noted that NRC should provide more examples of well field patterns at potential ISL sites. Another commenter asked NRC to amplify its discussion of well fields to clarify (1) why five-spot and seven-spot patterns are commonly used; (2) which pattern is more efficient in production and are there differences in how the varying patterns work in different types of geology; (3) which is more efficient in restoration, has one pattern had more incidences of excursions, and when and for what reason would one pattern be used over the other; and (4) what role does the NRC play in deciding and regulating well field design and provide specific sites that have employed various five-spot, seven-spot, and irregular designs.

*Response: Well field designs at ISL sites are discussed in Section 2.3.1.1. Well field arrangements using five- and seven-spot patterns are common at ISL sites and are illustrated in Figure 2.3-1. As discussed in Section 2.3.1.1, well patterns are developed on a site-specific basis and are based on the subsurface geometry of the ore body. Because roll-front deposits normally have irregular shapes, well patterns in a given field may also be irregular. The licensee generally alters well patterns to fit the size, shape, and boundaries of individual ore bodies. The five- and seven-spot patterns are typically used at ISL sites where the sandstone ore bodies are broad and laterally continuous. The five- and seven-spot patterns consist of regularly spaced injection wells around a centrally located recovery well are effective and efficient for both ISL operations and aquifer restoration activities (see Figure 2.3-1). For individual well fields, NRC reviews detailed site-specific information on the subsurface geometry of the ore body to verify that the well field design proposed by the licensee is appropriate for ISL* *extraction at the well field. A discussion of specific ISL sites in the uranium milling regions that have employed various five-spot, seven-spot, and irregular designs is beyond the detail intended for the GEIS. Because common well field patterns at ISL sites are illustrated in the GEIS (see Figure 2.3-1) and because the GEIS states that well patterns can be irregular based on the size and shape of the ore body, no changes to the GEIS were made in addition to this response.*

### G5.14.2 Preconstruction and Construction (GEIS Sections 2.2 and 2.3)

**Comment: 1314-032**
A commenter noted that the GEIS's preconstruction requirements for ISL operations regarding characterization of baseline water quality do not reflect actual practice. The commenter noted that NRC staff has permitted averaging of production zone water with nonproduction zones water within mine areas to allow for artificially high baseline contaminant levels for the purposes of granting a license.

*Response: NUREG–1569 (NRC, 2003) establishes procedures for determining preoperational baseline water quality conditions at ISL facilities. NUREG–1569 (NRC, 2003) specifies that baseline water quality should be determined for the mineralized aquifer (i.e., the production zone) and for adjacent nonmineralized aquifers (see NUREG–1569, Section 2.7). In GEIS Section 2.2, NRC references NUREG–1569 (NRC, 2003) and states explicitly that applicants are to determine baseline water quality for both the production zone and the adjacent unmineralized zones. NUREG–1569 (NRC, 2003) does not specify nor does NRC allow averaging of production zone water with water from surrounding nonmineralized aquifers for the purpose of establishing baseline water quality conditions at ISL facilities. Data outside the production (mineralized) zone is used to calculate upper control limits (UCLs) and are not mixed with mineralized data. UCLs are either calculated on an individual well basis or by average for a specific well field. Data inside the mineralized zone is used to calculate the restoration standards on an individual well basis or by well field average. UCL data and restoration data are collected after license issuance, but before operations in a well field. In response to the public comment, additional information was added to Section 2.2 to clarify how UCLs outside the mineralized zone and restoration standards within the mineralized zone are calculated.*

**Comment: 050-068**
A commenter asked NRC to provide details on well spacing, number of wells, and number of well fields at a typical ISL site.

*Response: Well field design at ISL facilities is discussed in Section 2.3.1.1. Well spacing in common well patterns (e.g., the five-spot or seven-spot pattern) at ISL sites are typically between 40 feet and 150 feet apart depending on ore body geometry and surface topography (NRC, 1998a; Energy Metals Corporation, U.S., 2007; Lost Creek ISR, LLC, 2007). The size, shape, and boundaries of individual ore bodies determine the number of well fields and the number of wells in a well field at an ISL site. Typically, individual well fields at ISL sites contain hundreds of wells. The GEIS cites information from the Crow Butte ISL facilities in Dawes County, Nebraska where the number of injection and production wells in individual well fields varies from about 190 to 900 (NRC, 1998a). In response to the public comment, information on typical well spacing for common well patterns at ISL sites was added to Section 2.3.1.1.*

**Comment: 050-070; 1305-037**
A commenter asked NRC to discuss how often a licensee must conduct a mechanical integrity test (MIT) on production and recovery wells and if there are situations when NRC requires more

frequent retesting than the once every 5 or less years specified in the GEIS. Another commenter asked several questions about MITs including: why a pressure drop of 10 percent is not considered significant to identify a MIT failure; why MITs are conducted every 5 years or less; is it possible for a well casing to fail and go undetected between MITs; when a well fails an MIT what corrective steps are taken; and is there a documented history of the success or failure rates for MITs at ISL mining sites.

*Response: NUREG–1569 (NRC, 2003) establishes acceptable guidelines for mechanical integrity testing of production and recovery wells. These guidelines are summarized in a text box in GEIS Section 2.3.1.1. State regulators may also include testing requirements as part of their UIC permitting process. Under NRC guidelines, a pressure drop of no more than 10 percent in a period of 10 to 20 minutes during the MIT indicates that the casing and grout are sound (i.e., do not leak) and the well is fit for service. NRC recommends that each well should be retested once each 5 years or less to ensure the integrity of the well construction. Well integrity tests should also be performed if a well has been damaged by surface or subsurface activity or has been serviced with equipment or procedures that could damage the well casing, such as insertion of a drill bit or cutting tool. It is possible for a well casing to fail and go undetected between MITs. Licensees maintain groundwater monitoring programs (see Chapter 8) to detect excursions resulting from poor well integrity and have operating procedures to analyze an excursion and determine how to remediate it. If a well casing fails an MIT, the well is taken out of service, repaired, and retested. If an acceptable test cannot be obtained after repairs, the well is plugged and abandoned. Results of MITs are maintained onsite and are available for inspection by NRC and the state agency regulating this activity. In addition, reports of MITs are submitted to the NRC and state agencies on a regular basis. For example, lists of wells receiving an MIT, the dates of those MITs, and the designation of whether a well passed or failed are reported on a quarterly basis to the Wyoming Department of Environmental Quality and a semiannual basis to the NRC. In response to the public comment, information on situations that would require an MIT to be performed and on procedures followed when a well casing fails an MIT were added to the text box on MIT in Section 2.3.1.1.*

**Comment: NE05-002**
A commenter asked whether wells are properly cased.

*Response: Well construction and integrity testing are described in Section 2.3.1.1. Geologic units above the aquifer of interest at ISL facilities are typically sealed with steel, fiberglass, or PVC casing grouted in place to prevent groundwater leakage from and to overlying aquifers. After completion and periodically after being brought into service, wells undergo mechanical integrity testing to verify that the well casing is sound (i.e., does not leak). Because the GEIS discusses the sealing of wells with casing and mechanical integrity testing to ensure that the well casing does not leak, no changes to the GEIS were made in addition to this response.*

**Comment: 1305-024; 1305-025; 1305-028; 1305-030; 1305-031; 1305-032; 1305-033 1305-036**
One commenter requested detailed information in GEIS Section 2.3.1.1 (well fields) on various types of well field equipment used at ISL facilities with historical information on performance. The information requested includes the following:

- Acknowledge variation in manifold design and performance and provide performance history of each design used

- Provide lists of well fields that have/have not implemented computerized monitoring systems

- Provide additional information on geophysical tools including logging methods and tools. Include a table with each tool used, when it is used, what is measured, and when it is not used

- Provide additional information on grouts and casing materials including what grouts and casings used based on lixiviant; depth of well; pressure; pH of groundwater; lists of grouts and casing materials in use; conditions of use; explanation of why used for specific conditions

- Describe how properly graded sand or gravel pack is determined and provide a table indicating all instances of wells filled with sand, gravel, and wells allowed to collapse around screen; explain substantive differences in production/reclamation performance

- Describe the variety of protective enclosures used to protect well heads; list circumstances each type is used and discuss substantive differences between types; discuss any cases of well heads exposed to elements; discuss what current and prior facilities did not use and explain why

- Describe the advantages and disadvantages of well screen liners and explain why they are optional; discuss substantive differences in wells that use screen liners and those that do not; discuss advantages and disadvantages of an under ream zone and why this is optional; discuss differences between wells with and without screen liners.

- Describe the air lift method and other pumping methods used in well development and under what circumstances each is used

*Response: Section 2.3.1.1 provides a summary of well field designs, drilling methods, well construction, development, and integrity testing commonly used at ISL facilities during the construction phase. As discussed in GEIS Section 1.7.5, state agencies also regulate wells as part of UIC permitting programs. The intent of the GEIS is to provide a general discussion to reasonably bound available well construction activities at NRC-licensed ISL facilities within the geographical regions examined in the GEIS. Details regarding specific technologies employed for a particular site would be provided in license applications and would be reviewed for adequacy with respect to operational safety and potential environmental impacts based on the specific proposal and the conditions that exist at the site.*

*Because the integrity and performance of wells can impact safety as well as the environment, the conclusions of an NRC safety review with regards to well design and construction would inform the NRC environmental review. The NRC regulates the safety of ISL facilities based on a risk informed, performance-based approach to regulation. This approach provides applicants flexibility to propose the technology and methods of their choosing provided they can demonstrate NRC safety requirements would be met.*

*Detailed review methods for the safety review (including well construction and integrity testing) are provided in NUREG–1569 (NRC, 2003). This guidance along with other supporting documents is referenced in the GEIS. Because NRC guidance is informed by decades of experience regulating ISL facilities, a detailed analysis of the performance of all aspects of ISL technology at the individual component level of detail is not necessary in the GEIS for* *evaluating potential impacts. Information on past operational experience at ISL facilities is included in GEIS Section 2.11.*

*While NRC guidance discusses methods that are considered acceptable to staff, NRC does not prescribe technology or methods that must be used by an applicant nor is it necessary for NRC to proactively evaluate all available options in the GEIS or elsewhere before applications are received. Past experience suggests that ISL facilities use similar technology and by focusing on what is common, the GEIS provides a reasonable basis for supporting future ISL license application reviews. If an applicant submits an application that includes unproven technology or methods that are important to safety, the NRC review may require additional details and performance data to verify that safety would be maintained. Based on the discussion already presented in the GEIS, and because the focus of these comments is at a level of detail that goes beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL20-072; AL20-075**
A commenter noted that hydrologic characterization methods are too vague and goals are not adequately described. This commenter also noted that groundwater sampling methodology is not described adequately.

*Response: The goal of hydrologic characterization during preconstruction of an ISL facility is to determine the preoperational nonradiological and radiological groundwater quality baseline so that NRC staff has enough information to properly analyze the site and make conclusions that groundwater has been adequately characterized (see Section 2.2). The methods used to accomplish this goal including groundwater sampling methodology are described in detail in NUREG-1569 (NRC, 2003). Section 2.2 summarizes the sampling methods used to establish baseline water quality conditions and provides a reference to NUREG–1569. A detailed discussion of groundwater sampling and monitoring and the methods used to establish baseline water quality conditions is presented in Section 8.3.1. NRC staff will evaluate the methodologies the licensee will use to sample and establish baseline water quality to determine that they are protective of health, safety, and the environment prior to issuing a license. Establishment of well field water quality baselines, monitoring well water quality baselines, restoration standards, and UCLs are determined just prior to a well field becoming operational, as described in Section 2.5.4. During operations, licenses must maintain groundwater monitoring programs to detect both vertical and horizontal excursions. Excursions and methods used in excursion monitoring are described in Sections 2.4.1.3 and 2.4.1.4. Because the goals and methods of preoperational hydraulic characterization and operational ground water monitoring are specified and summarized in the GEIS, no changes to the GEIS were made in addition to this response.*

**Comment: AL20-073**
A commenter noted that the description of well construction in the GEIS is antiquated because it describes only the use of PVC and steel casing and does not discuss the potential adsorption of contaminants on steel casing.

*Response: NRC acknowledges that casing materials other than PVC and steel are used in well construction at ISL facilities and that steel-cased wells will adsorb trace and heavy metals dissolved in the groundwater (NRC, 2003). For example, PVC, fiberglass, or acrylonitrile butadiene styrene casings are generally used in wells less than 300-m [1,000-ft] deep. Wells deeper than 300-m [1,000-ft] are subject to collapse and steel or fiberglass casing is generally necessary. Iron-oxide in steel-cased wells will adsorb trace and heavy metals dissolved in* *groundwater. For monitoring wells, the applicant should use casing that is inert to these metals, such as PVC or fiberglass. In response to the public comment, additional information on the types of casing used to construct wells and the adsorption of trace and heavy metals on steel cased wells was added to Section 2.3.1.1.*

**Comment: AL20-074; 1305-027**
A commenter stated that mud rotary is not an acceptable drilling technology and that the muds used in rotary drilling adsorbs contaminants. Another commenter noted that insufficient information is presented on drilling techniques including: techniques used other than mud rotary; any drilling with significant water consumption; special drilling fluids used and potential harm to environment, and what depths are applicable to different drilling techniques.

*Response: Rotary drilling using native mud and a small amount of drilling fluid additive for viscosity control is the standard drilling technique used to develop monitor, production, and injection wells at ISL facilities (Energy Metals Corporation, U.S., 2007; Lost Creek ISR, LLC, 2007). Other drilling techniques, such as air drilling, are cost prohibitive considering that individual well fields generally contain hundreds of wells (NRC, 1998a). Mud rotary drilling and the disposition of residual drilling muds at ISL facilities are discussed in Section 2.3.1.1. Residual drilling muds, which may contain contaminants adsorbed to the mud, are captured in a temporary mud pit excavated in the ground next to the drill site. Depending on state and local regulations, mud pits are backfilled and graded or are alternatively emptied and cleaned, and residual solids and liquids are transported and disposed of offsite (NRC, 2006). A discussion of the types of drilling fluids used and what depths are applicable to different drilling techniques is beyond the level of detail and scope intended for the GEIS. Because mud rotary drilling is a standard drilling technique used at ISL sites and the disposition of residual drilling muds, which may contain adsorbed contaminants, is discussed in the GEIS, no changes to the GEIS were made in addition to this response.*

**Comment: 036-045**
A commenter wanted NRC to clarify that more site-specific data must be obtained after issuance of a license in order to properly conduct ISL operations.

*Response: The NRC agrees that after granting a license much more site-specific data would be obtained as each well field is developed and brought into production (see Section 2.2). In response to the public comment, additional information was added to Section 2.2 to clarify that after issuance of a license more site-specific data is collected during the operation phase of an ISL facility.*

**Comment: 1305-014**
A commenter asked how NRC verifies the accuracy of site background groundwater quality data supplied by the applicant. The commenter also asked that if the application is for expanded operations at or near an existing licensed site, how does NRC ensure that baseline data are not contaminated by conditions arising from the existing operations.

*Response: NRC conducts independent verification of the information submitted in ISL license applications in accordance with procedures in NUREG–1569 (NRC, 2003). With respect to site background groundwater quality, NRC verifies that procedures for establishing background groundwater quality include acceptable sample collection methods, a set of sampled parameters that is appropriate for the site and in situ leach extraction method, and collection of sample sets that are sufficient to represent any natural spatial and temporal variations in water quality. As stated in NRC (2003, Section 2.7.3), the applicant must show that water samples* *were collected by acceptable industry sampling procedures. Additionally, applicants and licensees must have an acceptable quality assurance/quality control program consistent with NRC guidance (see discussion in NRC, 2003, Section 5.7.9). For license amendments to expand operations at or near an existing licensed site, NRC examines the record of site operations, including groundwater quality monitoring, to determine if baseline data collected for the expanded operations area have been affected by existing operations. In response to the public comment, additional information on NRC verification of baseline water quality information submitted by the licensee was added to Section 2.2.*

**Comment: 1305-017**
A commenter asked whether the NRC-accepted list of baseline water quality constituents in Table 2.2-1 is a minimum requirement for license applications. The commenter noted that if a state agency or federal agency either proposes or specifies a list containing constituents not included in the NRC-accepted list, will the applicant be held accountable for restoring these constituents to the measured baseline levels.

*Response: The NRC-accepted list of constituents in Table 2.2-1 includes constituents and water quality parameters that can increase in concentration as a result of in-situ leach activities (NRC, 2003). As discussed in Section 2.2, the applicant can propose a list of constituents that is tailored to a particular location. In such cases, sufficient technical bases must be provided for the selected constituent list. State and other federal agencies with jurisdiction over groundwater could conceivably specify a list of constituents not included in the NRC-approved list. In this case, the applicant would be accountable to the subject state and federal agency for restoring these constituents to measured baseline levels. The NRC staff typically considers the review of groundwater activities conducted by state and other federal agencies to identify areas, such as baseline water quality conditions, where dual reviews can be eliminated. In response to the public comment, information on the basis for the NRC-accepted list of constituents, requirements for an applicant proposed list, and constituent lists specified by state and other federal agencies were added to Section 2.2.*

**Comment: 1305-018; 1305-019; 1305-020**
A commenter asked how frequently baseline samples are collected over the "period of at least one year." The same commenter asked NRC to clarify what is considered "distribution that is sufficient to characterize the different aquifers and surface water bodies" and if there is no specific distribution, what accounts for the variation between sites.

*Response: NUREG–1569 (NRC, 2003) specifies that for assessing site background groundwater quality, at least four sets of samples, spaced sufficiently in time to indicate seasonal variability, should be collected and analyzed for each listed constituent for determining water quality conditions. In response to the public comment, text in Section 2.2 was revised to specify the frequency and seasonal distribution of baseline water quality sample collection.*

**Comment: 1305-021**
A commenter asked if baseline water quality data gathering included degradation of the aquifer from environmental impacts caused by past or current operating resource extraction techniques and past land use including exploratory drilling.

*Response: If other resource extraction techniques and exploratory drilling were conducted at or in the vicinity of a new ISL facility site, then degradation of the aquifer resulting from these activities would be captured in the baseline water quality data gathering. The historical record of exploratory drilling and resource extraction activities, including groundwater quality* *monitoring, provides a source of information for evaluating ISL licensing actions at the site. Because the environmental impacts caused by past activities would be captured in baseline water quality data gathering, no changes to the GEIS were made in addition to this response.*

**Comment: 1305-022**
A commenter asked if ISL sites have listed other baseline water quality parameters than the typical baseline water quality parameters listed in Table 2.2-1 and if so provide examples.

*Response: Typical baseline waster quality parameters accepted by NRC for establishing baseline water quality are listed in Table 2.2-1. Baseline water quality parameters measured at the COGEMA Irigaray ISL facility in Campbell County, Wyoming and at the Q-Sand Pilot Well Field at the Smith Ranch Uranium Project in Converse County, Wyoming are listed in Tables 2.11-4 and 2.11-5, respectively (Energy Metals Corporation, 2007; NRC, 2006). Comparison of the parameters in these tables indicates that, except of aluminum at the Irigaray ISL facility, all parameters listed at the Irigaray ISL facility (Table 2.11-4) and the Q-Sand Pilot Well Field (Table 2.11-5) are included in NRC-accepted list of constituents in Table 2.2-1. Because the GEIS includes examples of lists of baseline water quality parameters measured at ISL sites, no changes to the GEIS were made in addition to this response.*

**Comment: 1305-026**
A commenter asked how post-license well field changes, such as adjustment of the locations and boundaries of well fields as detailed data is collected, impact the license status. The commenter asked how a license can be issued prior to sufficient information being gathered, how is information on the characteristics of the aquifer and geology presented to the public and the regulator and are there differences in the level of information available to the public and the regulator, and does the information provide confidence that excursions will not occur and, if so, what types of information comprise the factual and technical basis for this confidence.

*Response: As discussed in Section 2.2, during the initial licensing review for a new ISL facility, NRC does not require a comprehensive discussion of all aspects of the site and of planned operations (NRC, 2003). Prior to issuance of a license, the applicant needs to provide enough information to generally locate the uranium mineralization, understand the natural systems involved, and establish baseline conditions prior to operation. If a license is granted, the licensee would collect more detailed data on the subsurface stratigraphy and uranium mineralization distribution as each well field is developed to ensure that the well field possesses the physical characteristic to make it suitable for ISL extraction. For individual well fields, NRC reviews the detailed information on the subsurface stratigraphy and geometry of the ore body to verify that the well field and the well field design proposed by the licensee is suitable for ISL extraction. In a performance-based license that would be issued by NRC, the licensee may make minor adjustments to well field locations and the production zone based on subsequent data after licensing; however, the licensee is not permitted to adjust the site-licensed boundary once it is established without applying for an amendment to its license. Because the GEIS includes information to address the commenter's questions concerning adjustment of the locations of boundaries of well fields, no changes to the GEIS were made in addition to this response.*

**Comment: 1305-029**
A commenter asked NRC to supply additional information on disposal of drilling fluids including: the localities where cutting and mud pits are backfilled and graded and emptied and cleaned; potential impacts to surface waters from each method; and a list of well fields that have been or are currently developed and which mud pit remediation used.

*Response: Disposal of drilling fluids resulting from mud rotary drilling at ISL facilities is discussed in Section 2.3.1.1. Residual cuttings and drilling fluids are contained and held in temporary mud pits excavated in the ground next to the drill site. After drilling activities are complete, such mud pits are backfilled and graded or are alternatively emptied and cleaned and the residual solids and liquids are transported and disposed of offsite. Whether mud pits are backfilled and graded or emptied and cleaned depends on regulations at the state and local level. A discussion of state and local regulations with respect to disposal of drilling fluids at ISL sites in the uranium milling regions considered in the GEIS is beyond the scope of the GEIS and would best be included at the site-specific environmental review level. Likewise, a list of developed well fields and the mud pit remediation method at ISL sites in the uranium milling regions considered in the GEIS is beyond the level of detail intended for the GEIS. Because mud pits are temporary and are remediated after drilling activities, impacts to surface water would be expected to be temporary and small for both remediation methods (i.e., backfilling and grading or emptying, cleaning, and disposal offsite). Because the questions raised by the commenter are site-specific in nature and would best be discussed or described at the site-specific environmental review level, no changes to the GEIS were made in addition to this response.*

**Comment: 1305-038**
A commenter had several questions concerning pipelines including: are trenches for pipelines unlined in all instances; have there been any instances when a pipeline has leaked; and are pipelines subject to mechanical integrity tests.

*Response: Construction of pipelines is discussed in Section 2.3.1.2. Pipelines used to convey water, lixiviant, resin, and wastewater at ISL facilities are placed in unlined trenches that are excavated as deep as 2 m [6 ft] below the ground surface to avoid potential freezing problems. Pipelines are not subject to mechanical integrity tests at ISL facilities; however, pipeline pressures are instrumented and recorded to monitor for potential leaks and spills that might result from pipeline failures (Section 8.3.2). Historical information on spills and leaks resulting from pipeline rupture and failures are described in Section 2.11.2. This information includes the ISL facility where the leak occurred, date, type and amount of fluid released, and cause of leak. Because the GEIS includes information to address the commenter's questions concerning pipelines, no changes to the GEIS were made in addition to this response.*

### G5.14.3 Operations (GEIS Section 2.4)

**Comment: 004-003**
A commenter was concerned that fracking chemicals would find their way to potable water.

*Response: Fracking is a process employed in oil, gas, and coal bed methane production that involves pumping a fluid into a well at high pressure to create fractures in the producing rock formation. In most cases, an additive, normally sand, is injected with the fluid to prop open the fractures to allow more complete production of the oil or gas. Because the host formations for uranium at ISL sites are permeable sandstones, fracking is not a technique that is used in the ISL extraction process. Leaching solutions referred to as lixiviants are used to mobilize and recover uranium within the permeable sandstone host formations. Licensees must maintain groundwater monitoring programs (see Chapter 8) to detect vertical and horizontal excursions of lixiviant and must have operating procedures to analyze an excursion and determine how to remediate it. Because fracking is not a process that is used in the ISL extraction process, no changes to the GEIS were made in addition to this response.*

**Comment: 028-006; AL06-109; 1305-040; 1305-041; 036-047**
Several commenters had concerns about the lixiviant used for uranium recovery operations. One commenter noted that the option to use nonconventional lixiviants must remain available at *in-situ* uranium recovery sites. Another commenter wanted the GEIS to clarify what leaching solutions are acceptable for uranium recovery operations. Another commenter was concerned about aquifer restoration and asked the GEIS to provide a specific history and documentation on results of different lixiviant chemistries and impacts on restoration results including acid-, ammonia-, and alkaline-based lixiviants. This same commenter asked why the GEIS assumes that alkaline-based lixiviants will be used for the purposes of the analyses presented in the GEIS and how this assumption might conflict with use of this GEIS in projects using other lixiviants. Another commenter noted that the GEIS should include a clarification as to the "chemicals" that are added to groundwater to produce the lixiviants used at ISL facilities in the United States.

*Response: Lixiviant chemistry at ISL sites is discussed in Section 2.4.1. During ISL operations, chemicals (e.g., sodium carbonate/bicarbonate, ammonia, or sulfuric acid) are added to the groundwater to produce a lixiviant. The use of alkaline-, acid-, and ammonia-based lixiviants at ISL facilities is discussed in Section 2.4.1.1 and in the text box "Lixiviant Selection" in Section 2.4.1.2. Specific histories and documentation on results of using different lixiviant chemistries and their impacts on aquifer restoration are beyond the level of detail intended for the GEIS. However, the GEIS provides literature references for detailed information on the impacts on aquifer restoration from using different types of lixiviants (e.g., International Atomic Energy Agency, 2001; Energy Information Administration, 1995; Davis and Curtis, 2007; Mudd, 2001). Although licensees may decide to use different lixiviants (i.e., acid- or alkaline-based leachates) for a given deposit (see text box "Lixiviant Selection" in Section 2.4.1.2), typical ISL uranium recovery operations in the United States use an alkaline sodium bicarbonate system to remove uranium from ore-bearing aquifers. In the United States, acid-based lixiviants have not been used in commercial ISL operations because aquifers subjected to acid-based ISL extraction have been more difficult to restore than aquifers subjected to alkaline-based ISL operations (Mudd, 2001). The GEIS assumes that alkaline-based lixiviants will be used in uranium recovery operations because alkaline lixiviants are used in all currently active and proposed ISL facilities in Wyoming, Nebraska, and New Mexico (NRC, 2006, 2004, 1998b, 1997; Energy Metals Corporation, U.S., 2007). In response to the public comment, additional information was added to Section 2.4.1 to clarify the chemicals added to groundwater to produce the lixiviants used for ISL operations. Additional information was also added to Section 2.4.1.1 to clarify that all currently active and proposed ISL facilities in Wyoming, Nebraska, and Mexico use alkaline lixiviants and, therefore, analyses presented in the GEIS assume that alkaline lixiviants will be used in uranium recovery operations.*

**Comment: 050-088**
A commenter asked whether well fields will be fenced to allow safe livestock and wildlife grazing and whether well fields will be open to hunting and other recreation during construction and operations.

*Response: Land use impacts at ISL facilities are discussed in Sections 4.2.1, 4.3.1, 4.4.1, and 4.5.1, and ecological impacts are discussed in GEIS Sections 4.2.5, 4.3.5, 4.4.5, and 4.5.5. As described in the GEIS land use impacts sections and in Section 2.11.1, fencing to limit both human and wildlife access is normally limited to restricted areas (e.g., processing plant, evaporation ponds) but depends on site-specific operational and land use conditions. The Smith-Ranch Highland site, for example, has used fencing around well fields to limit access. Well fields that are not fenced would remain more open to wildlife and potentially some human* *activities. Well fields at NRC-licensed facilities are mostly underground structures that are not expected to present a significant threat to wildlife populations. Spills must be reported to NRC and, as necessary, licensees take corrective actions to limit potential impacts. Details of specific proposals including placement and operation of surface facilities and well fields would be evaluated by NRC to assess the potential for safety and environmental impact. Because the concerns and questions raised by the commenter are included in the discussion of land use and ecological impacts in the GEIS, no changes to the GEIS were made in addition to this response.*

**Comment: NE04-002**
A commenter asked about the duration of an average ISL operation.

*Response: NRC licenses ISL facilities for a period of 10 years. The licensee can apply for license renewal prior to the end of each 10-year period and, if approved, may continue to operate for the duration of the extended licensed period. During the 10-year license period, a licensed facility may apply for amendments to their license to expand and add well fields. License renewals and amendment requests follow the NRC licensing process discussed in GEIS Section 1.7.1. Some of the currently licensed ISL facilities began as demonstration projects in the late 1970s and so those facilities have been in existence for the longest period (about 30 years) while other sites have been licensed for about 20 years. Because fluctuations in the uranium market price over time, facilities that are granted an NRC license might not be fully operational during the entire period of a license. No changes were made to the GEIS in addition to the information provided in this response.*

**Comment: 036-008**
A commenter noted that the GEIS should clarify the phased, iterative nature of the development of *in-situ* recovery project sites.

*Response: The phased nature in the licensing and development of an ISL facility is discussed in Section 2.2. The development and initial licensing of an ISL facility is not based on comprehensive information of all aspects of the site and of planned operations (NRC, 2003). During the prelicensing or preconstruction period, the applicant provides enough information to generally locate the ore body and understand the natural systems involved. The applicant must provide enough information to the NRC so that NRC staff can conclude that the ISL facility can be operated safely and be protective of the environment to provide a basis for granting a license. More detailed geologic and hydrologic information is developed as each area of the site is brought into production. In response to the public comment, additional information was added to front matter of Chapter 2 to clarify the phased, iterative nature of the development of an ISL facility.*

**Comment: 1305-044; CH06-012; NE06-002; NE04-005; GI01-009; GR31-008**
Several commenters had concerns about the mobilization of metals resulting from the ISL extraction and recovery process. One commenter asked about the common and uncommon metals that enrich groundwater during the uranium recovery process. Several commenters were concerned about the mobilization of hazardous constituents such as arsenic, selenium, cadmium, and lead. Another commenter asked if barium was a product of the ISL recovery process.

*Response: In addition to uranium, elements such as iron, manganese, selenium, arsenic, molybdenum, and vanadium, are also precipitated in the vicinity of roll-front deposits because of the low solubility of their reduced forms (see Section 3.1.2). During the uranium recovery process, groundwater in the production zone becomes progressively enriched in uranium and* *other hazardous metals in the deposit (Section 2.4.1.2). The typical chemistry of an alkaline-based sodium carbonate/bicarbonate lixiviant produced during the uranium recovery process is shown in Table 2.4-1. In addition to the metals listed in Table 2.4-1, hazardous metals such as arsenic, selenium, radium, and molybdenum are commonly mobilized by the lixiviant. Barium may also be mobilized in the uranium recovery process if it is present in the producing aquifer. These hazardous metals and other constituents such as chloride, which is introduced by the ion exchange resin system, are removed or precipitated from the groundwater during aquifer restoration after uranium recovery is completed (Section 2.5). Because mobilization of metals during the uranium recovery process is described in the GEIS along with the actions taken to stabilize and reduce metals concentrations in the producing aquifer during aquifer restoration (see Section 2.5.4), no changes to the GEIS were made in addition to this response.*

**Comment: 1305-045**
A commenter noted that the GEIS discussion of the use of buried pipelines to prevent freezing based on seasonal temperatures (Section 2.4.1.2) fails to effectively account for significant climatic differences in seasonal variation between the four framework regions.

*Response: Meteorology and climatology in each of the four uranium milling regions considered in the GEIS is discussed in Sections 3.2.6.1, 3.3.6.1, 3.4.6.1, and 3.5.6.1. These sections include descriptions of seasonal variations in temperature, rainfall, and snowfall. The use of buried pipelines to prevent freezing discussed in GEIS Section 2.4.1.2 is common at NRC-licensed ISL facilities in the four milling regions evaluated. Because seasonal variations in climate such as temperature and rainfall are described for each uranium milling region considered in the GEIS, no changes to the GEIS were made in addition to this response.*

**Comment: CH11-002; 036-048; 036-049; 050-071; 1305-051**
A commenter asked how excursions are contained at ISL sites. Another commenter noted that the definition of excursion in the glossary should be revised to reflect the definition in Chapter 2 and that ISL sites have different requirements for detecting excursions, such as two indicators exceeding their UCLs and/or one indicator exceeding its UCL by a certain percentage. This commenter also noted that it is the licensee's safety and environmental review panel (SERP) that approves final UCL values for monitor wells and that UCLs can be well or well field based. Another commenter asked NRC to provide details on detection of excursion, excursion indicators, and NRC policy requirements for protecting against excursions. One requested, table of excursion indicators, steps used to notify NRC in event of excursion, sampling frequencies, response rates required by NRC of operators, and discussion of how excursion reports are written and filed.

*Response: Excursions resulting from ISL operations are discussed in Section 2.4.1.3. In this section, an excursion is defined as the movement of lixiviant beyond the production zone. To protect against excursions, NRC license and underground injection control (UIC) permit conditions require that licenses conduct periodic tests. These tests include: conducting pump tests for each well field prior to operations to evaluate the confinement of the production horizon; continued well field characterization for identify geologic features that might result in excursions; and mechanical integrity testing of each well to check for leaks and cracks in the casing. Excursion monitoring at ISL sites is discussed in Section 2.4.1.4. Licensees maintain groundwater monitoring programs (see Chapter 8) to detect both vertical and horizontal excursions and must have operating procedures to analyze an excursion and determine remediation steps. GEIS Section 8.3.1.2 already includes a discussion that licensees are required to notify NRC, submit a written report, and take corrective actions in the event an excursion is identified. Additional information on excursion response is provided in*

*NUREG–1569 (NRC, 2003), which is referenced in Section 8.3.1.2. Geochemical excursion indicators are identified based on the well field's preoperational baseline water quality (see text box "Identifying Excursion Indicators and UCLs" in Section 2.4.1.4) and therefore are well field-specific parameters. An excursion is defined to occur when two or more excursion indicators in a monitoring well exceed their UCLs (NRC, 2003). Alternatively, since the advent of performance-based licensing, procedures to address excursions can be imposed through site-specific license conditions. Some ISL facilities have requirements where an excursion is identified to occur when an excursion indicator is exceeded in a monitor well by a certain percentage. For example, at the Crow Butte uranium recovery facility in Dawes County, Nebraska, a lixiviant excursion is assumed to occur when two UCLs in any monitoring well are exceeded or if a single UCL in a monitoring well is exceeded by 20 percent (NRC, 1998a). The NRC acknowledges that the licensee's SERP approves final UCL values for monitor well and that UCLs can be well or well field based. The SERP-approved UCL values are subject to NRC review and oversight. In response to the public comment, the definition of excursion in the glossary (Chapter 12) was revised to reflect the definition in Section 2.4.1.3, additional information was added to Section 2.4.1.4 to clarify the requirements for detecting excursions, and additional information was added to the text box "Identifying Excursion Indicators and UCLs" in Section 2.4.1.4 to clarify that the licensee's SERP approves final UCL values and that based on the level of homogeneity in the well field baseline water quality data, UCL values can be set the same for all monitor wells within a particular hydrogeologic unit or determined separately for each monitor in the hydrogeologic unit.*

**Comment: 036-050; CH13-003; CH13-004; 1305-049; 1305-050**
A commenter noted that the discussion of well field spacing in the GEIS only includes spacing between wells and not the distances of perimeter monitor wells from the well field itself. Another commenter also asked how far out from the well field are monitor wells placed and if there is any monitoring of wells that are miles away from ISL operations. One commenter asked what site-specific considerations and hydrogeologic characteristics are addressed to determine the location and spacing of monitor wells. Another comment requested clarification of the circumstances when underlying aquifer monitoring wells would not be required and the rationale for spacing of wells. They also requested the basis for the 2 week monitoring interval and why continuous monitoring with digital remote technology is not used.

*Response: The spacing of monitoring wells is discussed in Section 2.4.1.4. NRC acknowledges that this section does not specify the distances of perimeter monitor wells from the well field itself. Typically, the distance between monitoring wells and the distance of monitoring wells from the well field are similar. Section 8.3.1.2 provides examples of monitoring well spacing at the Smith Ranch ISL uranium facility in Wyoming and the proposed ISL facility at Crownpoint, New Mexico (NRC, 1997, 2006). At Smith Ranch the monitoring wells are located approximately 150 m [500 ft] beyond the well field, with a maximum spacing of 150 m [500 ft] between wells. At Crownpoint the proposed monitoring wells are at a distance of 140 m [460 ft] from the well field perimeter, with a distance of 140 m [460 ft] between each monitoring well. 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, aquifer transmissivity, and well abandonment procedures in the region (see Section 8.3.1.2). That section also discusses placement of monitoring wells to detect vertical excursions with spacing ranging 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). An example was provided where an underlying aquifer did not need to be monitored based on a thick confining layer of over 300 m [1,000 ft]. The monitoring frequency is also discussed in GEIS Section 8.3.1.2 as being based on hydraulic conductivity which would be determined on a site-specific basis considering guidance in NUREG–1549, Section 5.7.8 (NRC, 2003). With* *regard to digital remote technology, a specific type of monitoring technology or method is not required as long as the technology or method used adequately performs the intended function. Regarding the monitoring of groundwater quality in wells miles away or outside the permitted area of a new or proposed ISL facility, the NRC environmental monitoring guidance referenced in GEIS Section 8.2 includes monitoring of all privately owned wells within 3.3 km [2 mi] downgradient of the proposed ISL facility (NRC, 2003, 1980). In response to the public comment, additional information was added to Section 2.4.1.4 to clarify the distance of monitoring wells from the well field perimeter and to address the hydrogeologic characteristics used to determine the location and spacing of monitor wells.*

**Comment: 036-051**
A commenter noted that the purpose of the sodium carbonate or bicarbonate rinse during the elution step of uranium processing is not to keep stripped uranium from precipitating in the elution vessel but is to place loaded resins in a bicarbonate state instead of a chloride state.

*Response: The elution step of the uranium process circuit is described in Section 2.4.2.2. NRC agrees that the purpose of the sodium carbonate or bicarbonate rinse during the elution stage of uranium processing is to convert the resin to a bicarbonate form. In response to the public comment, the description of the elution step in Section 2.4.2.2 was revised to indicate that the purpose of the sodium carbonate or bicarbonate rinse is to remove the high chloride eluant entrained in the resin and convert the resin to bicarbonate form.*

**Comment: 1305-054**
One commenter asked for additional details on ion exchange circuits in GEIS Section 2.4.2.1. They requested details on the substantive differences between ion exchange circuits including why some are downflow and others upflow; the influence of facility design on the size and number of circuits; advantages of small versus large; reasons for licensees using fewer larger vessels rather than a larger number of smaller units for processing the same amount of lixiviant.

*Response: Section 2.4.2.1 provides a summary of ion exchange processing methods commonly used at ISL facilities. The intent of the GEIS is to provide a general discussion of ion exchange processing activities at NRC-licensed ISL facilities. Details regarding specific configurations of ion exchange equipment employed for a particular site would be provided in license applications and would be reviewed for adequacy with respect to operational safety and potential environmental impacts based on the specific proposal and the conditions that exist at the site. Variations in processing equipment configurations at ISL facilities can be influenced by a number of factors including available technology at the time the proposal was developed as well as equipment and processing efficiencies and costs. NRC reviews each proposed configuration to ensure safety requirements are met and potential environmental impacts are assessed. Because the additional detail requested by the commenter was considered to be not necessary to support the evaluation of environmental impacts in the GEIS, no changes to the GEIS were made in response to the comment.*

**Comment: 1305-060; NE06-001**
A commenter asked if the net inward flow of groundwater into well fields resulting from production wells extracting slightly more water than is reinjected into the host aquifer (production bleed) can be offset by groundwater extraction in other areas, including nearby production sites, cities, and water supplies. If so, the commenter asked that scenarios under which this may occur or has occurred in the past be provided in the GEIS. Another commenter noted that the GEIS mentions that the production bleed is about 1 to 3 percent for a typical mine, which is about 20 to 35 gallons per minute per well based on reviewed documents.

*Response: Management of excess water resulting from uranium mobilization and processing is discussed in Section 2.4.3. Production wells extract slightly more water than is reinjected into the host aquifer. This extracted "excess" water is called "production bleed," and it ensures that there is net inflow of groundwater into the well field to minimize the potential movement of lixiviant and associated contaminants out of the well field (see Section 2.4.1.2). As discussed in Section 2.4.3, production bleed is about 1 to 3 percent of the circulation rate, which can amount to an excess production of several tens to a hundred liters per minute (several tens of gallons per minute). Well fields at ISL facilities are designed so that production bleed is not affected by groundwater extraction from nearby production sites or water supplies. A discussion of scenarios under which production bleed may be offset by groundwater extraction in other areas, such as nearby production sites, cities, and water supplies, is beyond the scope of the GEIS but would be considered during the site-specific licensing review if they were identified. Because the GEIS includes a discussion of production bleed and its purpose and typical production bleed volumes (several tens of gallons per minute), no changes to the GEIS were made in addition to this response.*

**Comment: GR04-002**
A commenter asked what percentage of uranium in the lixiviant is actually extracted, and how much remains.

*Response: Uranium mobilization during ISL operations is discussed in Section 2.4.1. Pregnant lixiviant can contain up to 500 mg/L $U_3O_8$ (see Table 2.4-1); however, uranium concentrations averaging 40 to 50 mg/L $U_3O_8$ [120 to 150 mg/L of uranium] are expected in production fluids (Lost Creek ISR, LCC, 2007). The pregnant lixiviant is passed through ion exchange columns during uranium processing where the uranium is adsorbed onto resin beads. The barren lixiviants leaving the ion exchange columns normally contain less than 5 mg/L of uranium (Energy Metals Corporation, U.S., 2007; Lost Creek ISR, LCC, 2007). Therefore, greater than 95 percent of the uranium in the lixiviant is extracted during the ion exchange process. In response to the public comment, additional information was added to Section 2.4.2.1 to indicate that barren lixiviant leaving the ion exchange units normally contain less than 5 mg/L of uranium and based on average uranium concentrations in pregnant lixiviants greater than 95 percent of the uranium is extracted during the ion exchange process.*

**Comment: 036-021**
A commenter noted that the statement that consumptive use of groundwater during restoration has been less than consumptive use during operations is incorrect. This statement occurs in the GEIS in the Groundwater Impacts section of the Executive Summary.

*Response: NRC acknowledges that consumptive use of groundwater during aquifer restoration is generally greater than groundwater consumption during ISL operations (see Section 4.2.4.2.3). A primary reason for increased consumptive use during restoration is that no water is reinjected during groundwater sweep. In response to the public comment, the statement concerning consumptive use of groundwater during restoration in the Groundwater Impacts section of the Executive Summary was revised to state that consumptive use of groundwater during aquifer restoration is generally greater than groundwater consumptive use during ISL operations.*

**Comment: 1305-055**
A commenter asked several questions about the resin beads used in the ion exchange columns including: do all plants use the same resin beads; are all resin beads chemically identical; who

are the primary producers of the resin beads used in currently operating facilities; and are resin beads environmentally benign.

*Response: Ion exchange of uranium onto resin beads is described in Section 2.4.2.1. The ion exchange resins used for uranium processing at ISL facilities are generally comprised of small polymer or plastic beads, which are charged particles having an affinity for uranium. Since uranium in the lixiviant solution exists as a negatively charged ion (anion), the columns at the recover plant hold anion resin beads. There are literally millions of these small resin beads in an ion exchange column, which can adsorb low concentrations of uranium in solution.*
*A description and discussion of the types of resin beads, their chemistry, and the primary producers of resin beads used in currently operating facilities is beyond the level of detail intended for the GEIS. In response to the public comment, additional information was added to Section 2.4.2.1 to indicate that ion exchange columns contain ion exchange resin composed of negatively charged polymer or plastic beads.*

**Comment: 1305-047**
A commenter asked how often are periodic tests to protect against excursion required and if there is no set period, explain why and provide a table with permitted periods or each operating monitor well.

*Response: Excursion monitoring is discussed in Section 2.4.1.4. No details on monitoring frequency for detection of excursions are provided in this section. Details on groundwater monitoring requirements at ISL facilities including monitoring frequency are provided in Chapter 8. NUREG–1569 (NRC, 2003) provides basic guidelines for monitoring frequency and response to an excursion detection. Monitoring frequency is determined on a site-specific basis and depends on the hydrologic characteristics of the producing aquifer, such as hydraulic conductivity. The NRC guidance (NRC, 2003) indicates the monitoring frequency for all wells for excursion indicators should be at least every 2 weeks during operations. In response to the public comment, information on the frequency of sampling of monitoring wells was added to Section 2.4.1.4.*

**Comment: 1305-052**
A commenter asked why the statistical methods used to establish to establish UCLs is dependent on water quality. This commenter also asked whether the same statistical method could be used to improve consistency in determining excursions and whether NRC has ever taken enforcement actions for failure to properly monitor for excursions and if so provide details and documentation.

*Response: Statistical methods used to establish UCLs are described in the text box "Identifying Excursion Indicators and UCLs" in Section 2.4.1.4. Because the chemistry of groundwater in producing aquifers at ISL sites in the four uranium milling regions considered in the GEIS can be highly variable, the NRC has identified several statistical methods that can be used to establish UCLs (NRC, 2003). The statistical methods are selected based on site-specific groundwater conditions and are intended to improve the detection of an excursion. Using the same statistical method for every site could lead to situations where the method poorly describes the hydrologic data, thereby diminishing the ability to detect excursions, especially in aquifers that have highly variable water quality. A detailed discussion and description of enforcement actions taken by NRC for failure to properly monitor for excursions is beyond the scope of the GEIS. Because the statistical methods described in the GEIS to establish UCLs are intended to improve detection of excursions, no changes to the GEIS were made beyond this response.*

**Comment: 1305-057**
A commenter asked other than eliminating transportation from a remote location, if there are any advantages/disadvantages to elute the resin directly in the ion exchange column.

*Response: Satellite facilities at ISL sites contain remote ion exchange columns. When the resins in those columns are fully loaded with uranium, the resins are removed from the columns and transported to a central processing facility for resin processing. Satellite facilities do not have the equipment and infrastructure necessary to process resin. After arrival at the central processing facility, the resin may be eluted in an ion exchange column or it can be transferred to a separate elution tank for processing. Whether the resin is eluted in the ion exchange column or in a separate elution tank depends on the design of the processing plant. An advantage of eluting the resin directly in the ion exchange column at the central processing facility is that a separate elution tank is not required, which eliminates a processing step. An advantage of transferring resin to an elution tank is that the central processing plant's ion exchange columns do not have to be taken "offline" to load the satellite facilities' resin and therefore can remain available for continued uranium recovery. A discussion of the advantages and disadvantages of eluting the resin directly in the ion exchange column at the central processing facility is beyond the level of detail intended for the GEIS and, therefore, no changes to the GEIS were made in addition to this response.*

**Comment: 036-138**
A commenter suggested that the definition of yellowcake in the glossary be revised to reflect that yellowcake is not a sludge.

*Response: NRC has revised the definition of yellowcake in the text box in GEIS Section 2.1.3 and in GEIS Chapter 12 to refer to its composition (a mixture of uranium oxides) and color (related to the drying temperature achieved), rather than to its consistency.*

**Comment: 036-131**
A commenter suggested that the definition of lixiviant in the glossary be revised to match the definition in Chapter 2.

*Response: The production and use of lixiviant in the ISL process is described in Section 2.4.1. In response to the public comment, the definition of lixiviant in the glossary (Chapter 12) was revised to match the description in Section 2.4.1.*

**Comment: 036-132**
A commenter suggested that mechanical integrity test be added to the glossary and that the types of wells that apply to mechanical integrity tests be included in the definition.

*Response: A definition for mechanical integrity is included in the GEIS glossary (Chapter 12) and includes a description of mechanical integrity tests and the types of wells that apply to mechanical integrity tests. Because a definition for mechanical integrity is included in the GEIS glossary, no changes to the GEIS were made in addition to this response.*

**Comment: 036-136**
A commenter suggested that the definition of satellite facility in the glossary be revised to reflect that they may be connected to the central processing facility by pipeline.

*Response: Satellite facilities are used for remote ion exchange operations to produce uranium from uranium deposits located away from the central processing facility [see remote ion* *exchange (RIX) definition in the glossary in Chapter 12]. At the satellite facility the uranium is stripped from the lixiviant by loading onto ion exchange resins and then transported by tanker trucks to a large central processing facility for additional processing and uranium recovery. Because satellite facilities are far removed from the central processing facility, they are typically not connected by pipeline to the central processing facility. Because satellite facilities are for remote ion exchange operations and are typically not connected to the central processing facility by pipeline, no changes to the GEIS were made in addition to this response.*

### G5.14.4 Aquifer Restoration (GEIS Section 2.5)

**Comment: 036-053; 1305-061; 1305-064; CH14-001**
One commenter asked for a general clarification of the definition of groundwater restoration. Another commenter requested that the discussion of aquifer restoration in Section 2.5 of the GEIS include a discussion of the development and use of site-specific restoration action plans to describe aquifer restoration activities for an individual ISL facility. Another commenter requested additional detailed site-specific historical information on past and ongoing aquifer restoration efforts

*Response: In response to the comment, the definition of restoration in the glossary of the GEIS (Chapter 12) was reviewed and revised to be consistent with current NRC practice as "Returning each constituent in affected groundwater to its Commission-approved background concentration or an alternate standard as approved by the NRC." In addition, GEIS Section 2.5 provides more detailed description and discussion of the purpose of aquifer restoration and the steps used to implement aquifer restoration programs. Because of the inherent site-specific nature of hydrology in the different geographic regions considered in the GEIS, it is not practical to establish general criteria that can be implemented at all ISL sites. The purpose of the GEIS is, instead, to provide a foundation for site-specific environmental reviews of individual ISL facilities. For this purpose, historical information on aquifer restoration at NRC-licensed facilities is summarized in GEIS Section 2.11.5, including references to more detailed studies. Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

*Restoration action plans (RAP) were identified during ongoing litigation associated with the licensing action for the Crownpoint facility in New Mexico as a means to provide adequate assurance of the protection of underground sources of drinking water adjacent to the exempted uranium production zones. The NRC guidance in NUREG–1569 (NRC, 2003, Section 6.1) includes a discussion of review methods and acceptance criteria that the NRC staff use to review plans and schedules submitted by the license prior to beginning aquifer restoration activities. On a case-by-case basis, the NRC staff will review any plans and schedules submitted by licensees as part of the site-specific safety and environmental reviews for individual facilities. The introduction to GEIS Section 2.5 has been revised for clarification, and references to the additional detailed information in NUREG–1569, Section 6.1 have been added.*

**Comments: 019-011; 019-012; 019-013; 036-056; 036-057; 036-058; 036-059; 036-060; 036-061; 036-062; 036-063; 036-064**
Two commenters submitted a number of specific comments requesting clarification and additional discussion of the separate steps in the aquifer restoration process. These include clarification on groundwater transfer, groundwater sweep, ion exchange, and stabilization. One of the commenters also requested clarification with respect to the definitions for "pore volume"

and "flare" provided in the text box in Page 2-27, asking that they be made consistent with the definitions provided in the glossary in GEIS Section 12.

*Response: As described in the introduction to GEIS Section 2.5, the intent is to provide a general discussion of steps that have been used previously in aquifer restoration. The text in GEIS Section 2.5 makes clear that these are examples, and does not imply that NRC requires that all of these steps be used in every aquifer restoration program. The aquifer restoration plans and schedules submitted by a licensee or applicant for a specific site would be reviewed by the NRC staff on a case-by-case basis, using review methods and acceptance criteria described in NUREG–1569 (NRC, 2003, Section 6.1). Consistent with the level of detail that is appropriate in the GEIS, the text in Section 2.5 has been revised to provide clarification, consistency, and additional information, as appropriate. The text box discussing "pore volume" and "flair" in GEIS Section 2.5.2 was reviewed and revised for consistency with glossary definitions of the terms, as appropriate.*

**Comment: 1305-071**
One commenter requested clarification of why stabilization monitoring is conducted on a quarterly basis. The commenter also asked if there was a minimum or maximum time a well field could be in stabilization; how many samples were required to establish a statistically significant trend in stability time series data; and what confidence does NRC base statistical significance. The commenter requested clarification on which metric is used to determine aquifer restoration is complete: stability averages, stability trends, final stability readings, or some combination of the above.

*Response: As discussed in NRC guidance in NUREG–1569 (NRC, 2003), the purpose of a stability monitoring program is to ensure that chemical species of concern do not increase in concentration subsequent to restoration. The applicant specifies the length of time that stability monitoring would be conducted, the number of wells to be monitored, the chemical indicators to be monitored, and the monitoring frequency in its license application, which is reviewed and, if found acceptable, approved by NRC. These requirements will vary based on site-specific postextraction water quality and geohydrologic and geochemical characteristics. Well fields may be decommissioned when all constituent concentrations meet the approved restoration standards, are found to be stable, and no post-restoration degradation in groundwater quality occurs, or is expected to occur, outside the aquifer exemption boundary. As discussed in Section 2.5, the aquifer restoration standards and specific methods for demonstrating compliance are determined on a site-specific and well field-by-well field basis based on site specific conditions. In response to this comment, a reference to the guidance in NUREG–1569 (NRC, 2003) was included in Section 2.5.*

**Comment: 1305-069**
One commenter asked if all reverse osmosis systems used at ISL facilities are designed the same and whether any substantive difference in performance across systems has been seen at ISL facilities, and if so, what is the basis for the performance differences.

*Response: GEIS Section 2.5.3 summarizes how reverse osmosis is used at ISL facilities during the aquifer restoration phase. Details regarding specific reverse osmosis systems employed at a particular site would be provided in license applications and would be reviewed for adequacy with respect to operational safety and potential environmental impacts based on the specific proposal. Because water treatment systems can impact safety as well as the environment, the conclusions of an NRC safety review with regards to water treatment would inform the NRC environmental review. The NRC regulates the safety of ISL facilities based on a risk informed,* *performance-based approach to regulation. This approach provides applicants flexibility to propose the technology and methods of their choosing provided they can demonstrate NRC safety requirements would be met. Reverse osmosis equipment proposed by an applicant would include performance specifications that would need to be sufficient for the intended use of the equipment. Performance of water treatment systems at ISL facilities is also verified during operations by the monitoring programs discussed in GEIS Section 2.9. As a result, an analysis of all reverse osmosis systems is not needed in the GEIS to support an evaluation of potential environmental impacts, therefore, no changes were made to the GEIS in response to the comment.*

**Comment: 017-013; 036-54**
One commenter indicated that GEIS Section 2.5 should describe that the goals of aquifer restoration are to protect adjacent underground drinking water sources, and requested that the GEIS include a discussion of past restoration projects. Another commenter requested that the text in Section 2.5 be revised to clarify that the purpose of restoration is to minimize, not eliminate altogether, the potential for contamination of adjacent aquifers.

*Response: The purpose of groundwater restoration is to return the production zone to water quality conditions that existed prior to operations to the extent possible and to ensure that the water quality and groundwater use in surrounding sources of drinking water will not be adversely affected by the uranium recovery. The aquifer restoration program for a specific site is reviewed to ensure that it complies with NRC requirements and license conditions. Specific information on historical aquifer restoration efforts at NRC-licensed sites is provided in GEIS Section 2.11.5, and more detailed information is available in the cited references. The introduction to GEIS Section 2.5 has been revised to provide a more clear statement to this effect.*

### G5.14.5 Gaseous or Airborne Particulate Emissions (GEIS Section 2.7.1)

**Comment: NE03-002**
One commenter asked what types of effluents are released to the air from ISL facilities and what is done to address the potential impacts from these emissions.

*Response: GEIS Section 2.7.1 discusses airborne effluents from ISL facilities. The primary airborne effluent is radon gas that can be released from well fields and processing equipment. Radon is generated from natural radioactive decay in the ore deposit. Pregnant lixiviant that is pumped to the surface contains radon gas in solution and the radon can be released when the solution is transferred and processed. Radon readily disperses in air and as discussed in GEIS Chapter 8 and Section 2.9, is monitored within the processing facilities and at various locations onsite to ensure concentrations are within NRC limits for protection of worker and public safety. Operational monitoring of yellowcake drying operations discussed in GEIS Section 2.9 is also conducted to ensure equipment is operating as intended and is in compliance with NRC limits for protection of worker and public safety. Environmental monitoring discussed in GEIS Chapter 8 verifies that releases are within NRC limits for protection of worker and public health and safety. As this information is already discussed in the GEIS, no changes were made in response to the comment.*

**Comment: 036-069; 1321-008**
A few commenters requested the GEIS include additional information on radon releases from ISL facilities including historical data on emissions and dose estimates for workers and the public.

*Response: GEIS Section 4.2.11.2.1 already included historical in-plant radon montoring results for an ISL facility and dose modeling results for a number of ISL facilties. In response to the comments, the existing text of GEIS Section 4.2.11.2.1 was clarified to indicate which dose modeling results included radon releases. Historical radon monitoring results from an ISL facility's environmental monitoring program were also added to that section.*

**Comment: 1173-022**
Regarding the off gas scrubber efficiency of 95–99 percent mentioned in GEIS Section 2.4.2.3, one commenter asked what volume of U particulates is released in a typical plant.

*Response: Many ISL facilities use vacuum dryer technology that is expected to significantly reduce uranium emissions. For facilities that decide to use thermal drying, stack releases have been estimated on the basis of information provided by a number of operating ISL facilities (and assumptions regarding variability in efficiency of control over time) to be about 0.1percent of the production (NRC, 2003, 1980). Actual values for a specific site would vary depending on the control technology used and operational parameters. Monitoring programs discussed in GEIS Chapter 8 and Section 2.9 would verify environmental concentrations of uranium comply with NRC safety requirements. As the comment was a clarifying question that was answered by this response, no changes were made to the GEIS.*

**Comment: 036-071**
One commenter suggested NRC check the units on the Y axis of Figure 2.7-1. The units in that figure are listed as s/m3 and the commenter suggests they might be Sv/m3.

*Response: The relative air concentration the commenter refers to is in units of seconds per cubic meter. These values are commonly discussed in air pollution modeling terminology as chi over Q values (the estimated downwind air concentration over the release rate, which, in this case would be Curie-seconds per cubic meter per Curie released). These units were simplified by the authors in the original reference as seconds per cubic meter. As the units match the source documentation, no changes were made to the GEIS in response to this comment.*

### G5.14.6 Operational History (GEIS Section 2.11)

#### G5.14.6.1 General Information on Operational History is Not Complete

**Comment: 1314-052; 1314-058; AL14-034; AL20-078**
Several commenters raised general concerns with the completeness of the operational history presented in the GEIS.

*Response: General information based on historical experience at NRC-licensed ISL facilities in Wyoming and Nebraska is presented throughout the GEIS to provide a basic understanding of the types and magnitudes of operational impacts. In particular, GEIS Chapter 2 includes summaries of waste management operations (Section 2.7), typical areas involved in ISL facilities (Section 2.11.1), spills and leaks (Section 2.11.2), groundwater use (Section 2.11.3), excursions (Section 2.11.4), aquifer restoration (Section 2.11.5), and socioeconomic information (Section 2.11.6). The impacts analyses presented in GEIS Chapter 4 rely on this information as appropriate. In addition, typical best management practices, management actions, and mitigation measures are described in GEIS Chapter 7, and Chapter 8 includes a description of the types of monitoring activities and reporting requirements that have been implemented at NRC-licensed facilities. Because the discussion already presented is consistent with the* *intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

**G5.14.6.2 Historic Operational Experience: Area of Facilities (Section 2.11.1)**

**Comment: 1602-004; AL02-004; NE04-008; NE09-001**
One commenter stated that the GEIS does not include specific information on how large ISL sites are, how many wells are necessary, or how much supporting infrastructure (e.g., roads, electricity) is needed. Another commenter asked how large ISL facilities are and requested clarification on whether the property is owned by the government or privately held. Other commenters wanted to know the size of the ISL facilities in comparison to typical coal bed methane operations.

*Response: GEIS Section 2.11.1 includes a summary table with historical information on the permitted area for 7 different NRC-licensed ISL facilities, ranging from about 1,000 to 6,500 ha [2,500 to 16,000 acres]. As described in the text for Section 2.11.1, not all of the permitted area is developed for uranium recovery. For example, the well fields have occupied between 40 to 2,500 ha [100 to 6,000 acres]. The processing facilities and satellite plants have a smaller footprint that have typically ranged from about 1 to 6 ha [2.5 to 15 acres]. Historical information on transportation needs during the lifecycle of a typical ISL facility is presented in GEIS Section 2.8. Land ownership for ISL facilities varies depending on site location and local conditions. NRC is not involved in regulating land ownership; rather, license applicants submit proposals that NRC reviews for potential environmental impacts that include impacts to land uses (addressed in GEIS Sections 3.2.1, 3.3.1, 3.4.1, 3.5.1, 4.2.2, 4.3.2, 4.4.2, and 4.5.2). Both surface and subsurface ownership can be private or public. Complex land ownership and use situations can result in conflicts between subsurface lessors and surface owners. A new section (3.1.2.2) was added to the GEIS to provide additional information on complex (e.g., split estate) land use issues. Because the discussion already presented is consistent with the intended scope of the GEIS, and no additional changes were made to the GEIS beyond the information provided in this response.*

**G5.14.6.3 Historic Operational Experience: Spills and Leaks (Section 2.11.2)**

**Comment: 036-082; 1305-081; 1305-083; 1314-053; 1314-055; 1601-002; CH06-005**
Several commenters, noting that the uranium ISL industry has a history of spills and leaks, made general requests for NRC to disclose information on operational experience with respect to spills and leaks. One commenter provided specific comments with respect to the operational history of an ISL facility in Converse County, Wyoming. Several commenters raised specific questions on text changes including a request for clarification on why a 2007 spill was listed when the GEIS indicated the time period considered was 2001 to 2005 and requesting an update to Table 2.11-2 of the GEIS with respect to include sodium hydroxide (NaOH) as a 50/50 mix of dry and bulk solids. Finally, one commenter requested additional detail on the reporting requirements for NRC and state agencies, and a comparative evaluation of the environmental impacts associated with the different reporting times.

*Response: GEIS Section 2.11.2 provides a summary discussion of historical spills reported at NRC-licensed facilities. The general types of potential impacts associated with the identification and recovery of these spills is described in GEIS Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2. Historical best management practices, management actions, and mitigation measures used to reduce the potential impacts associated with spills and leaks are presented in GEIS Chapter 7. The information summarized in GEIS Section 2.11.2 is consistent with the cited references;*

*however, based on the comment received, the text was edited to clarify that the recent spill history from 2001 to 2005 reported by the licensee was for a different time period and reference than the spills reported by the WDEQ .*

*During the site-specific safety and environmental reviews for an individual ISL facility, the NRC staff will independently evaluate the specific spill prevention and response measures proposed by the licensee. Previous licensee performance will also be considered, as appropriate. All licensee semi-annual effluent reports as well as NRC inspection reports for individual ISL facilities, including notices of violation, progress with respect to spill response and cleanup measures, are publicly available through the Agencywide Documents Access and Management System (ADAMS) on the NRC website (http://www.nrc.gov/reading-rm/adams.html). The NRC has provided a brief summary of state and federal permitting requirements in GEIS Section 1.7. It is, however, beyond the intended scope of the GEIS to monitor and assess the compliance of individual facilities with respect to the terms and conditions of these permits. Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

### G5.14.6.4 Historic Operational Experience: Groundwater Use (Section 2.11.3)

**Comment: 036-083**
One commenter requested clarification of the difference between groundwater consumption rate and total production rate.

*Response: As described in GEIS Section 2.11.3, the total production rate represents the amount of water that is pumped from the uranium production zone. Based on historical water management at NRC-licensed ISL facilities, following treatment to remove uranium, between 97 and 99 percent of this water is recharged to produce lixiviant and reinjected into the production zone to extract additional uranium. As described in GEIS Sections 2.4.1.2 and 2.11.3, a production bleed of 1 to 3 percent of the total production rate is removed from the circuit to ensure that there is a net inflow of groundwater into the well field to minimize the potential movement of lixiviant and its associated contaminants out of the well field. This production bleed, plus other smaller water uses for purposes such as sanitation and dust suppression, represent the amount of groundwater that is consumed (i.e., the groundwater consumption rate) during construction and operations at an ISL facility. Additionally, as discussed in GEIS Sections 4.2.4.2.3, 4.3.4.2.3, 4.4.4.2.3, and 4.5.4.2.3, a still larger volume of water can be consumed during well field aquifer restoration. As this information is already discussed in the GEIS, no changes were made in response to the comment.*

### G5.14.6.5 Historic Operational Experience: Excursions (Section 2.11.4)

**Comment: 031-012; 036-084; 036-085; 050-032; 057-001; 1305-087; 1321-001; CA03-001; GR12-007; GR12-010**
A number of commenters requested additional information with respect to the likelihood, frequency, causes, and potential impacts of excursions from the uranium production zone into other adjacent aquifers. Commenters requested additional information based on historical operations information from both Non-Agreement (Wyoming and Nebraska) and Agreement States such as Texas. Several commenters noted that because of the heterogeneous nature of uranium ore deposits, lixiviants are difficult to control, leading to the possibility of excursions. One commenter wanted additional information on the NRC requirements for reporting excursions. One commenter raised specific suggestions related to the use of well integrity

testing to safeguard against excursions, and clarification as to how excursions are identified, measured, and corrected.

*Response: GEIS Section 2.11.4 recognizes the potential for both horizontal and vertical excursions, and provides historical overview of excursions at NRC-licensed ISL facilities in Wyoming and Nebraska. Although NRC has licensed the Crownpoint facility in New Mexico, there has been no production using ISL techniques to date. NRC has not granted any licenses for ISL facilities in South Dakota. The listing of potential causes and likelihood of excursions presented in GEIS Section 2.11.4 (and the references therein) is intended to be representative of the types of causes that have been determined for specific excursions, and is not intended to be exhaustive. As stated in Section 1.5.4, matters regulated by NRC Agreement States such as Texas are outside of the intended scope of the GEIS. General ore deposit geometries that are and are not favorable to ISL production are described in Sections 2.1 and 2.4, as well as the introduction of Chapter 3. More specific information on the geology and hydrology of the four uranium milling regions considered in the GEIS are contained in Chapter 3, and the potential effects that these features may have on excursions are described in Chapter 4. Monitoring is described in general terms in GEIS Section 2.4.1.4, and general NRC reporting requirements are described in GEIS Section 8.3.1. These sections of the GEIS also contain references to the more detailed reporting requirements identified in NRC guidance (NRC, 2003, Section 5.7.8). The purpose of mechanical integrity testing is described in GEIS Section 2.3.1.1; additional details are incorporated by reference to NRC guidance (NRC, 2003, Section 3.1.3).*

*The intent of the GEIS is not to present an exhaustive listing of site-specific information on excursions, but rather to represent the range of impacts, such as excursions, that have been encountered at NRC-licensed facilities. During the site-specific safety and environmental reviews for an individual ISL facility, the NRC staff will independently evaluate the excursion history for a given site as applicable (i.e., for license amendment or license renewal requests). The NRC staff will determine the details of monitoring and reporting requirements for individual facilities, such as excursion indicator species, well spacing, and reporting frequencies on a case-by-case basis during the site-specific safety and environmental reviews. These requirements are established by license condition and subject to NRC oversight and inspection (see GEIS, Section 8.3.1.2). Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

### G5.14.6.6 Historic Operational Experience: Aquifer Restoration (Section 2.11.5)

**Comment: 018-003; 027-005; 032-023; 050-033; 1305-086; 1305-088; 1309-005; 1317-009; AL25-122; CH01-003; GA23-007**

A number of commenters questioned the completeness of the historical record for aquifer restoration efforts that is summarized in GEIS Section 2.11.5. Many commenters noted that no uranium production zones have been restored to baseline conditions, and that many well fields have been in restoration for years. One commenter requested very detailed information with respect to historic baseline water quality, pore volumes, flare factors, surety analyses, and data presented to obtain state UIC permits. One commenter noted that the list of sites identified and discussed in Section 2.11.5 is incomplete and should be expanded.

*Response: The information on aquifer restoration at NRC-licensed ISL facilities presented in GEIS Section 2.11.5 includes activities at ISL research and development sites in Wyoming (Ruth, Bison Basin, Reno Creek, and the Leuenberger Project) and at commercial ISL facilities* *in Wyoming and Nebraska (Smith Ranch-Highlands, Irigaray, Crow Butte). The number of pore volumes and the length of time involved in restoration is also summarized in GEIS Section 2.11.5. Financial surety is discussed in GEIS Section 2.10, and more detailed information is available in the cited regulations (10 CFR Part 40, Appendix A) reference to NRC guidance in NUREG–1569 (NRC, 2003, Appendix C). The intent of the GEIS is to provide a general discussion to bound available historical aquifer restoration activities at NRC-licensed ISL facilities for the broad geographical regions examined in the GEIS. Specific aquifer restoration objectives for groundwater quality, baseline conditions, pore volumes, and financial sureties are determined on a site-specific basis and established as license conditions for individual ISL facilities (see GEIS Section 1.7.1). References to specific studies where additional detail is available are provided in the GEIS. Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

**Comment: 031-013; 032-021; 033-007; 1321-002**
Several commenters requested information on the use of ACLs during aquifer restoration.

*Response: The intent of the GEIS is to provide a general discussion to bound available historical aquifer restoration activities at NRC-licensed ISL facilities for the broad geographical regions examined in the GEIS. Specific aquifer restoration objectives for groundwater quality, baseline conditions, pore volumes, and financial sureties are determined on a site-specific basis and established as license conditions for individual ISL facilities (GEIS Section 1.7.1). As described in NUREG–1569, Section 6.1.3 (NRC, 2003), if a given groundwater constituent cannot technically or economically be restored to the established objectives, an applicant must demonstrate that leaving the constituent at the higher concentration would not be a threat to public health and safety or the environment or produce an unacceptable degradation to the water use of adjacent groundwater resources. The NRC staff independently review these amendment requests on a case-by-case basis to determine the acceptability of the information presented by the licensee. To date, there are no examples for NRC-licensed ISL facilities where ACLs have been used during aquifer restoration. For new license applications and license expansions, NRC will require that restoration be completed to the requirements listed in 10 CFR Part 40, Appendix A, Criterion 5B(5), which may result in future ACL applications to NRC. Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL06-011; AL16-060; GA15-003; GR12-008**
Several commenters requested that NRC include information on aquifer restoration activities at conventional mining and milling sites, as well as information from NRC Agreement States such as Texas.

*Response: As described in GEIS Appendix A and Section 1.5.4, issues related to conventional mining and milling operations and matters regulated by Agreement States are beyond the scope of the GEIS. As past and present conventional mining and milling may relate to an individual ISL facility, they could be considered as part of a site-specific cumulative impact assessment. Because the issues raised in these comments are beyond the scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1305-090; CH03-003**
Two commenters questioned the adequacy of the summary of aquifer restoration activities presented in GEIS Section 2.11.5, and one requested clarification on how the GEIS will be used with respect to aquifer restoration.

*Response: The intent of the GEIS is to provide a general discussion to bound available historical aquifer restoration activities at NRC-licensed ISL facilities for the broad geographical regions examined in the GEIS. As described in GEIS Section 1.8, site-specific environmental reviews for individual ISL facilities will be tiered from the GEIS. Specific aquifer restoration objectives for groundwater quality, baseline conditions, and financial sureties are determined on a site-specific basis and established as license conditions for individual ISL facilities (GEIS Section 1.7.1). Relevant portions of the GEIS that are applicable can then be incorporated by reference into the NRC's site-specific environmental review, with impact conclusions adopted as applicable. As stated previously in this appendix, NRC will be preparing a site-specific SEIS to document the results of the staff's environmental reviews for new ISL license applications (see Sections G5.4.3 and G5.5.5 ). Based on the discussion already presented in the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

**Comment: 019-016; 032-022; 1173-027; 1305-089**
Several commenters requested specific clarification on information presented in GEIS Section 2.11.5. One noted the section does not discuss exceedances for manganese and TDS reported in Table 2.11-4. Another requested checking the reported baseline uranium concentration of 18.8 mg/L, suggested that it seemed high, and requested including the mean value. One commenter wanted the section to list site-specific hydrological and geochemical characteristics that complicate aquifer restoration. Another requested clarification of whether postoperation water quality values contained in Table 2.11-4 are pre- or postsweep/restoration. The commenter noted that if the reported values applied to postrestoration, then an explanation was needed for the constituents that are elevated from baseline.

*Response: In response to the comments received on the data presented in Table 2.11-4, NRC conducted an additional review of available restoration data and updated the table with data that addresses the concerns raised by commenters. The revised table includes both baseline and postrestoration water quality data. These data show both the range of constituent concentrations (i.e., minimums and maximums) as well as mean values. The revised table also more clearly shows which constituents exceeded baseline concentration values and provides the number of samples that exceeded baseline values. As appropriate, the text in GEIS Section 2.11.5 has been revised and clarified to discuss the additional information in the table, the constituents that exceeded baseline levels, and the factors that complicate restoration efforts such as preoperational baseline water quality, lixiviant chemistry, aquitard thickness and continuity, aquifer mineralogy, porosity, and permeability.*

### G5.14.6.7 Historic Operational Experience: Socioeconomics (Section 2.11.6)

**Comment: GA12-002; GA15-002; GR01-001**
Two commenters at public meetings requested information on how many jobs would be created for an ISL facility, with one of these commenters indicating that renewable energy would create more. Another commenter stated that ISL facilities are not large employers.

*Response: GEIS Section 2.11.6 presents a summary of the total number of full-time jobs that have historically been associated with ISL facilities. The total number of full-time, permanent employees and local contractors depends on the size and production rate of a given ISL facility,* *but has typically ranged from about 20 to 200 during an operational lifecycle (including construction, operations, aquifer restoration, and decontamination/decommissioning) that may span several decades. As described in GEIS Section 4.2.10.2, it is anticipated that the construction and decommissioning phases of the ISL lifecycle will require the largest workforce, with fewer employees required for operations and aquifer restoration. At the same time, however, the NRC staff recognizes that more than one of these phases may overlap in time, with perhaps simultaneous construction, operation, and aquifer restoration activities occurring at individual well fields. Specific employment requirements and the potential impacts on the local economy will be evaluated as part of the site-specific environmental review. Based on the discussion already presented in the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

### G5.14.7 Requests for Detailed Information About All ISL Facilities

**Comment: 1305-039; 1305-042; 1305-043; 1305-046; 1305-048; 1305-053; 1305-056; 1305-058; 1305-059; 1305-062; 1305-063; 1305-065; 1305-066; 1305-067; 1305-068; 1305-070; 1305-073; 1305-074; 1305-076; 1305-077; 1305-080; 1305-082**
One commenter provided a number of comments requesting detailed information about various aspects of ISL operations and licensing for all past and present ISL facilities. The specific information requested included the following:

- Discuss what is considered sufficient freeboard for evaporation ponds and whether is it same for all ISL facilities, if it is not then explain why not; and discuss how evaporation rate, wave action, and volume of wastewater impact freeboard; provide cases where requirements were exceeded, and if so, when where and what impact.

- Discuss the mean and standard deviation of typical lixiviant chemistry; how many solutions are used to derive the ranges in Table 2.4-1; discuss the lixiviant chemistry for each current and past ISL facility including performance differences at each site, are the sites comparable, and if not, explain why not.

- Provide full documentation and comparative evaluation of the history of alkaline based ISL operations and acid-based mine sites including restoration success and any restoration difficulties.

- Provide a list of all excursions reported to NRC with basis for excursion and regulatory response and basis for response.

- Revise Section 2.4.1.3 to summarize corrective actions taken to remediate vertical excursions, list all instances of vertical excursions, licensee rationale, and remediation action taken.

- Describe what considerations allow NRC staff to determine an excursion cannot be recovered; the length of time a licensee must attempt to recover an excursion prior to this determination; list all instances of vertical and horizontal excursions, duration, whether an injection stop was ordered; provide more specific guidelines used by NRC to determine agency response to excursions.

- Discuss whether facilities that can process resin have a substantively different impact on environment. List the facilities (central and satellite); their ability to process resin; and differences in license or permit stipulations regarding impacts of resin processing.

- Discuss whether all operating and proposed processing plants use Yellowcake dryers and provide a list of all currently operating and proposed new processing plants with dryer technology that is used or planned.

- Discuss whether all plants have bag house dust collection systems and which plants do not; whether all are designed the same; if not, then explain the differences among systems and how effective each is at containing dust.

- Provide a full listing of every Safe Drinking Water Act (SDWA) aquifer exemption provided to ISL facilities with authorizing agency and date of exemption.

- Modify GEIS Section 2.5 to include for each ISL well field in the US: the name and location; start prod year; stop prod year; year aquifer restoration began; year when aquifer restoration completed; whether the aquifer was returned to preoperational baseline; whether NRC required an MCL/ACL; the number and date of each excursion; the number of wells in excursion status; and the status of resolution of each excursion.

- Provide examples of when, where, and why aquifer restoration did not commence after ISL operations ended.

- List all past and present ISL facilities by restoration method including: groundwater transfer, groundwater sweep, reverse osmosis with permeate injection, recirculation, stabilization monitoring, or other. Explain differences in effectiveness in methods for completed restorations.

- Explain whether there is a correlation between the size of a well field and number of pore volumes used for groundwater sweep. For commercial well fields, explain what is the magnitude and slope of any correlation and for any significant correlations explain the relationship (e.g., linear, exponential, quadratic, other).

- Provide in Section 2.5.2 a comparison of pore volume estimates documented in surety estimates with actual pore volumes used; discuss any extensions for additional pore volumes with the stated need, and associated license amendments.

- Clarify whether all past, present, and proposed ISL facilities used or proposed brine concentrators. If they did not provide a list of all past, present, and proposed facilities by use of brine concentrators or not; clarify whether brine concentration salts have other uses or whether they are they hazardous waste.

- Provide the volumes of decontamination and decommissioning wastes for all current and past ISL facilities; what is mean and standard deviation of wastes per facility from all current and past facilities (noting Table 2.6-1 waste volumes estimates are for the Smith-Ranch facility).

- Provide documentation of disposal path for all past, present, and proposed ISL facilities regarding 11e2 byproduct wastes.

- Provide documentation on all areas where treated water was land applied and provide follow-up monitoring results for uranium and radium; clarify whether decommissioning surveys been conducted for all affected land areas in the past.

- Provide details on any NPDES permits obtained by ISL facilities and whether there have been any past violations. If violations occurred, provide description of violations and a list of penalties levied.

- Clarify whether NRC and state agencies have required RAPs only for HRI facilities or for others, and if this is not the case, then discuss why not. If NRC or states have required RAPs provide links for public access to RAPs in their entirety; provide comparative analysis of RAPs and whether they were adequate to meet original cost estimates for restoration and decontamination and decommissioning.

- Provide (if possible) a quantitative listing of spills and leaks at each past and present ISL facility. Identify if there is a threshold reportable quantity of spill; clarify and provide basis; provide cause of each leak and spill and the resulting environmental analysis of impacts (commenter noted that Section 2.11.2 single example of spills and leaks is inadequate).

*Response: GEIS Chapter 2 provides a detailed description of the ISL process applicable to the evaluation of potential impacts from proposed ISL facilities. That Chapter addresses all phases of the ISL facility lifecycle and provides information on the historical operating experience at ISL facilities with respect to topics of safety significance and of public concern including spills, leaks, excursions, and aquifer restoration. The intent of GEIS Chapter 2 is to provide a discussion of the key aspects of the ISL process that are common to NRC-licensed ISL facilities as a foundation for GEIS impact analyses. The discussion is intended to be focused on issues that are significant to ISL proposals and their potential environmental impacts rather than provide a detailed description of all aspects of every facility that NRC has licensed.*

*Detailed information regarding the specific technologies, equipment, and operational practices and parameters applicable to specific ISL proposals would be provided in each license application and would be reviewed for adequacy with respect to operational safety and potential environmental impacts based on the proposal and the conditions that exist at the site. This includes many of the topics raised in the comments including the proposed yellowcake dryer technology, air pollution controls, water treatment systems, lixiviant chemistry, well field size, waste disposal methods, agreements, effluent and waste volume estimates, and surety estimates with projections for aquifer restoration and decommissioning activities.*
*Because many of the facility design and operational aspects of ISL facilities can impact safety as well as the environment, the conclusions of an NRC safety review with regards to facility design and operations would inform the NRC environmental review. The NRC regulates the safety of ISL facilities based on a risk informed, performance-based approach to regulation. This approach provides applicant's flexibility to propose the technology and methods of their choosing provided they can demonstrate NRC safety requirements would be met. Detailed review methods and criteria for the safety review (addressing, for example, radiological safety programs, monitoring programs, control of process solutions, excursion corrective actions and notification, aquifer restoration, decommissioning) are provided in NUREG–1569 (NRC, 2003). This guidance along with other supporting documents is referenced in the GEIS, therefore, and details need not be repeated in GEIS Chapter 2. Because NRC guidance is informed by decades of NRC experience regulating ISL facilities, a detailed analysis of the performance of all aspects of ISL technology is not necessary in the GEIS to support the evaluation of potential*

*impacts. Similarly, an assessment of the effectiveness of the applicable NRC regulatory programs (e.g., RAPs, corrective actions, excursion recovery, financial surety) is both not necessary and beyond the purpose and scope of the GEIS. An evaluation of other federal and state permitting programs of ISL facilities (e.g., aquifer exemption, NPDES) is also unnecessary and goes beyond the purpose and scope of the GEIS. Individuals wanting to explore the regulatory history of ISL facilities in greater detail can find substantial information on the public record at the NRC website (www.nrc.gov) in ADAMS and in public document rooms. This public information includes licensing documents, semi-annual effluent reports, inspection reports, and enforcement action notices.*

*While NRC guidance discusses methods that are considered acceptable to staff, NRC does not prescribe technology or methods that must be used by an applicant nor is it necessary for NRC to proactively evaluate all available options in the GEIS or elsewhere before applications are received. Past experience suggests that ISL facilities use similar technology and by focusing on what is common, the GEIS provides a reasonable basis for supporting future ISL license application reviews. If an applicant submits an application that includes unproven technology or methods, the NRC review may require additional details and performance data to verify that safety would be maintained. Based on the discussion already presented in the GEIS, and because the focus of these comments is at a level of detail and scope that goes beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

### G5.14.8 References

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

NRC. "Review of Power Resources, Inc.'s A-Well Field Ground Water Restoration Report for the Smith Ranch-Highland Uranium Project." ML041840470. Washington, DC: NRC. 2004.

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. 1998a.

NRC. "Environmental Assessment for Renewal of Source Material License No. SUA–1341, Cogema Mining, Inc. Irigaray and Christensen Ranch Projects, Campbell and Johnson Counties, Wyoming." Docket No. 40-8502. Washington, DC: NRC. June 1998b.

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.

NRC. NUREG–0706, "Final Generic Environmental Impact Statement on Uranium Milling Project M-25." Washington, DC: NRC. September 1980.

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

## G5.15 Financial Surety

**Comment: 963-001; 1300-012; 1601-010; 1602-013; CH03-001; CH06-015; CH11-003; CH11-004 GR03-003; SP05-002**
A number of commenters requested clarification on the bonding and surety arrangements. One commenter said the GEIS failed to acknowledge that there is nothing in NRC statute or regulation that requires the financial guarantee to be spent on decommissioning and reclamation of the site. Several commenters suggested the GEIS needed to address financial status of the mining companies. They also wanted to know how NRC would deal with a company that left and did not clean up the area. One commenter was concerned with what would happen if the contaminants leaked to another area and who would pay for that cleanup.

*Response: GEIS Section 2.10 discusses financial surety arrangements. NRC regulations (10 CFR Part 40, Appendix A) require that applicants or licensees set aside sufficient funds prior to operations to cover the costs for a third party, if necessary, to conduct decommissioning, reclamation of disturbed areas, waste disposal, and groundwater restoration. A surety arrangement is intended to cover these costs in the event of licensee default. To terminate an NRC license, an applicant is required to develop a site-specific decommissioning plan that must be reviewed and approved by NRC before decommissioning can begin. The NRC staff review* *of the proposed decommissioning plan includes both safety and environmental reviews. Financial surety would have to be addressed by the licensees as part of the site-specific review process of the decommissioning plan. NRC also annually reviews a licensee's financial surety to assess expansions in operations, changes in engineering design, completion of decommissioning activities, actual experience in aquifer restoration, and inflation. GEIS Section 2.10 also references specific NRC guidance documents (e.g., NUREG–1569) that specify how to estimate the costs. Because these comments involve information already contained in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-068; 036-079; 036-080; 036-081; 1305-080**
Two commenters recommended changes or corrections to the GEIS regarding surety arrangements. One commenter requested the section on decontamination, decommissioning, and reclamation should include a complete explanation of financial assurance mechanisms and financial instruments that demonstrate acceptable financial assurance will be available if necessary. This commenter also wanted more detail in the GEIS financial surety section. The commenter also suggested revising a statement on how cost estimates are determined, stating that the regulations do not require an independent contractor to prepare the financial assurance cost estimate. This commenter also requested that NRC retract a statement that surety calculations should exclude site personnel and equipment. Another commenter asked specific questions about whether past cost assessments in restoration actions plans have been adequate to cover costs of groundwater restoration, decommissioning, and reclamation.

*Response: In response to this comment text in GEIS Section 2.6 was changed from "a financial surety" to" financial surety arrangements" to be consistent with the language used in 10 CFR Part 40, Appendix A, Criterion 9. Additionally in Section 2.10, Lines 45 and 46 were modified to say, "The licensee must calculate cost estimates based on completion of all activities." The statement about not including licensee-owned equipment and staff in cost estimates is from the cited NRC guidance (NRC, 2003) and as such is not a requirement but a method that would be acceptable to staff. As the statement is consistent with existing guidance, no changes were needed. Regarding the final comment on the adequacy of cost estimates in past restoration action plans, an assessment of the effectiveness of the applicable NRC regulatory programs (including restoration action plans and cost or financial surety estimates) is beyond the purpose and scope of the GEIS. Therefore, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 032-020; 050-051; 1305-078; 1321-015; 1321-016; GI01-008; GI02-006; SP06-001**
A number of commenters requested that the GEIS should assess the sufficiency of surety practices. One commenter wanted more detail in the financial surety section of the GEIS and requested a full comparative accounting of all past sureties required by NRC. Another commenter wanted to know what financial documents were considered for financial assurance. One commenter said financial surety was a great concern because some aquifers had not been adequately restored at ISL mining sites. Another commenter thought the GEIS should be revised to include information to analyze the potential costs for site cleanups. One commenter inquired why such a large bond was required if the process was environmentally safe. Another expressed a concern about companies going bankrupt and leaving the problem to others. Another commenter spoke specifically about Smith Ranch and said the bond posted was not nearly enough to cover the amount needed to clean up the area.

*Response: NRC staff considers financial surety to be an important issue, and as such, it will need to be addressed by the applicant in any site-specific licenses. The GEIS Financial Surety arrangements section states that an applicant is required to have an NRC-approved financial surety in place prior to beginning uranium recovery operations and discusses the appropriate regulations to be used. As discussed in GEIS Section 1.5.2, the GEIS is based on existing regulations in effect at the time of writing. The purpose of the GEIS is to evaluate the potential impacts of ISL facilities and detailed evaluation of or changes to NRC regulations, programs, and practice regarding surety arrangements is beyond the scope of the GEIS. Other comments were focused on site-specific actions that do not need to be addressed in the GEIS. Because the GEIS is based on existing regulations and practices regarding surety arrangements, no changes were made to the GEIS in response to these comments.*

**Comment: 034-011; CH11-007**
These commenters recommended specific details to be considered in establishing the necessary financial surety. One commenter suggested financial bonding should include responses for long-term vertical excursions from improperly abandoned exploration holes to other aquifers. Another commenter expressed a concern whether surety estimates addressed catastrophic events that could happen, such as earthquakes.

*Response: As discussed in GEIS Section 2.10, the purpose of a surety arrangement is to provide funds that are intended to cover the costs of site decontamination and decommissioning. These funds provide confidence that sites will be cleaned up at the end of operations in the event of licensee default. The amount of the surety arrangement is based on consideration of site-specific factors that can influence aquifer restoration and decommissioning costs. The surety is evaluated by NRC as part of a site-specific safety review that is conducted in parallel with the environmental review and, therefore, is beyond the scope of the GEIS. The NRC safety review also addresses concerns about potential catastrophic events impacting safe operations by conducting detailed reviews of site conditions, as applicable, that could lead to accident conditions. This can include consideration of seismic events (e.g., earthquakes), extreme weather events, and industrial accidents. Because these comments were related to site-specific issues or information already discussed in the GEIS, no changes were made beyond these comments.*

## G5.15.1 References

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

## G5.16 Alternatives

**Comment: 018-008; 028-015; 1301-001; 1302-003; 1312-003; 1314-005; 1314-061; 1314-071; 1314-072; 1314-073; 1314-074; 1314-075; 1314-076; 1314-077; 1314-078; 1314-079; 1314-080; 1314-081; 1314-082; 1388-001; NE06-010; NE06-023**
Many comments were received stating the GEIS does not consider an adequate or reasonable range of alternatives. Commenters recommended additional alternatives be included in the GEIS, including alternatives to regional uranium development; evaluating global uranium reserves; evaluating renewable energy; evaluating energy efficiency; evaluating alternative sources of uranium; developing a new regulatory framework for ISL operations; enhancing NRC review capabilities and staffing; improving efficiency of NRC staff resources by improved procedures; and encouraging states to become agreement states to reduce the NRC workload.

One commenter agreed with the GEIS that discussing alternative milling methods is outside the scope of the GEIS. Another commenter noted the GEIS did not select a preferred alternative.

*Response: Note that many of the alternatives that were commented on do not meet the need for the proposed action expressed in GEIS Section 1.3 and are therefore not alternatives to the proposed action and are outside the scope of the GEIS. As discussed in the GEIS Section 2.12, NRC initially considered the no-action alternative and alternative methods for uranium recovery. As explained in Section 2.12, alternative methods of uranium recovery were not considered in detail, because the GEIS applies to the future licensing of ISL facilities and not the evaluation of available technologies for uranium extraction. Because the selection of reasonable alternatives is affected by site-specific conditions, alternatives may be considered in a site-specific environmental review. Other suggestions relating to evaluating NRC review capabilities, practices, and regulations go beyond the purpose and scope of the GEIS. NRC will not select a preferred alternative. As a licensing agency, NRC evaluates in its environmental reviews, the potential environmental impacts of the applicant's proposed action and reasonable alternatives. This environmental review and the NRC staff's safety review form the bases for NRC's final licensing decision. Because the evaluation of alternatives is a site-specific issue, no changes were made to the GEIS regarding consideration of alternatives in response to the comments.*

**Comment: 050-022**
A commenter suggested the GEIS list of alternatives was too limited and requested the GEIS assess advantages and disadvantages of the various aspects of ISL projects and perhaps require the best (e.g., safest) methods for milling be used by applicants.

*Response: Because NRC uses a risk-informed, performance-based approach to regulation of ISL facilities, NRC does not prescribe facility designs or technologies. Applicants have the flexibility to select and propose the ISL methods of their choosing in license applications submitted to NRC. NRC then evaluates the applications for safety and potential environmental impacts as discussed in Section 1.7.1 of the GEIS. Most ISL facilities use a standardized technology that was analyzed in the GEIS. However, if the applicant proposes to use a technology that was not analyzed in the GEIS, the NRC may not be able to adopt the impact conclusions described in the GEIS, unless NRC finds the proposed method would have the same or less impacts as the methods analyzed in the GEIS. The applications are reviewed by NRC staff for compliance with NRC requirements. GEIS Chapter 2 contains a description of the generally standardized ISL process. For these reasons, no additional changes were made to the GEIS in response to this comment.*

**Comment: 1305-008**
A commenter requested clarifying the description of the NRC site-specific environmental review process pertaining to the meaning of a reasonable range of alternatives in GEIS Chapter 1 and whether it includes well field designs not proposed by the applicant; additional environmental safeguards; or alternative ISL technologies. If so, the commenter further requested clarification of how this is possible if ISL technology is relatively standardized as discussed in the GEIS.

*Response: Alternatives to be considered in a site-specific environmental review depend on the specific proposal and site conditions. Well field designs, environmental protection measures, or alternative ISL technologies (such as the use of acid- or ammonia-based lixiviants) fall within the range of possibilities that could be considered, if these possibilities are valid alternatives to a particular site-specific proposal; some of these are discussed in the GEIS. As described in the GEIS Chapter 1, NRC staff uses NUREG–1748 (NRC, 2003) as guidance for conducting site-*

*specific environmental reviews of proposed ISL facilities, including consideration of reasonable alternatives. The range of reasonable alternatives is evaluated in the site-specific environmental reviews. The statement in the GEIS regarding the relative standardization of ISL technology is a reflection of the consistency in methods used in past NRC-licensed ISL facilities and anticipated to be proposed in new ISL license applications. For these reasons, additional changes to the GEIS were not needed.*

### G5.16.1 References

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

## G5.17 History and Legacy of Uranium Mining

**Comment: 002-001; 005-002; 008-003; 018-007; 021-002; 021-003; 021-004; 021-005; 035-007; 040-001; 046-001; 061-011; 061-014; 061-017; 061-020; 1309-015; 1311-018; 1314-006; 1314-024; 1314-040; 1314-040; 1317-008; 1317-011; 1318-002; 1318-010; 1320-001; 1322-002; 1482-002; 1539-002; 1547-002; AL01-130; AL05-010; AL05-146; AL06-110; AL13-027; AL13-029; AL13-030; AL15-047; AL16-062; AL17-063; AL23-090; AL24-094; AL24-106; AL31-154; AL34-164; GA01-005; GA04-009; GA07-004; GA10-006; GA12-001; GA12-003; GA14-003; GA23-001; GA23-003; GA23-012; GA24-001; GA25-001; GA27-001; GA28-001; GR01-006; GR08-004; GR12-001; GR12-002; GR14-007; GR16-002; GR22-003; GR22-004; GR23-001; GR24-001; GR24-003; GR26-001; GR28-001; GR28-002; GR31-004; HC008-002; HC020-003; SP08-003; SP08-004; SP08-007; SP09-002; SP13-002**
A number of commenters voiced concerns about longstanding impacts from past uranium mining activities in their region. Most of these comments were expressed at public meetings held in the communities of Grants and Gallup in New Mexico; however, similar comments were expressed at a meeting in Spearfish, South Dakota, and in submitted comment letters and e-mails. One commenter described how the tribes had a history of environmental, health, and cultural impacts from uranium mining. One suggested the NRC has not adequately recognized the past impacts of uranium mining on the Navajo people and Navajo land. Commenters mentioned abandoned uranium mines, abandoned exploratory wells, tailings, and abandoned uranium milling sites have contributed to local environmental contamination in surface water, soils, air, and groundwater. Some commenters suggested health impacts in their families and communities were caused by past mining activities. Commenters also suggested legacy contamination has led to contaminated livestock, sheep kills, high uranium and gamma radiation on haul roads, and high radium in Navajo backyards. One claimed that no measures were taken in early mining operations to protect water resources. A number of commenters referred to soil, air, and water contamination. Sites and areas mentioned include Church Rock, Homestake, Laguna, Paguate, Tuba City, and Navajo backyards. Another commenter was skeptical of contamination claims near Grants, New Mexico, and noted that local water flows through one of the largest uranium deposits in the United States. Many asked that NRC or the federal government help clean up these abandoned sites and provide support for medical studies and healthcare in affected areas. Some blamed NRC for not addressing the cleanup of legacy sites. Others noted the long time it has taken (i.e., 30 years) for the federal government to begin cleaning up sites. Others stated that the past legacy causes them to mistrust any new proposals for uranium milling. Some suggested new uranium facilities should not be approved until past mining sites are cleaned up. Others commented that the GEIS did not adequately discuss past uranium mining issues. One commenter suggested the New Mexico uranium

industry has acknowledged environmental and health legacy issues from past mining and noted that techniques and regulations for uranium extraction have changed in the last 50 years.

*Response: NRC understands and recognizes there are serious legacy issues resulting from the decades of mining activities from the 1940s through the 1970s when waste from uranium mines was not cleaned up after mines were shut down. Many of these abandoned sites are on or near Native American lands. NRC regulation of ISL facilities includes ensuring the necessary measures are taken by ISL operators to confine mobilized uranium and other constituents within the well field where the facility is operating, ensure monitoring programs are in place to provide early detection of any migration of process fluids away from the well field, and enforce necessary corrective actions to prevent uranium from contaminating adjacent water sources to ensure the public is protected.*

*While NRC regulates uranium recovery (i.e., milling) facilities, NRC does not regulate uranium mining or abandoned uranium mining sites. Mining involves the actual digging and excavating of uranium ore from the earth, whereas uranium recovery involves the processing and concentration of uranium from the ore or ore body into a compound commonly referred to as yellowcake.*

*As discussed in the GEIS Appendix A, because the GEIS addresses NRC licensing reviews for ISL facilities, topics related to conventional milling are not addressed in the GEIS. In response to comments, this statement was further clarified to refer to past mining as also being outside the scope. The legacy of past conventional milling activities was intended to be identified in terms of cumulative impacts in the GEIS (as stated in Appendix A) but was not explicitly mentioned in Chapter 5 of the document. Additional text has been added to the GEIS Chapter 5 to clarify that abandoned uranium mining and milling sites and related environmental contamination and/or underground workings may need to be considered in site-specific cumulative impact assessments to the degree they are found on or near proposed ISL sites and their region of influence on the environment overlaps with that of the proposed ISL facility.*

*Recently, several members of the U.S. Congress have expressed an interest in the uranium mining legacy issues and the current status of abandoned uranium mining sites. Beginning in October 2007, the Congressional Committee on Oversight and Government Reform, chaired by Representative Henry Waxman of California, held meetings with EPA, DOE, the Indian Health Service, Bureau of Indian Affairs, and NRC and requested multiyear action plans from all those agencies to address legacy cleanup efforts on Navajo lands. On June 9, 2008, these agencies completed a 5-year plan (EPA 2008), with specific milestones to address assessment and cleanup of affected structures, water sources, and land areas. The 5-year plan also included conducting one or more case control studies of health risks faced by individuals residing near mill sites or abandoned mill sites.*

**Comment: 1314-049**
The GEIS needs to discuss how the regional geochemistry has been impacted by past uranium mining.

*Response: As described in the GEIS, Appendix A, Chapter 1, legacy impacts are outside the scope of the GEIS but, as previously mentioned, abandoned uranium mining and milling sites and related environmental contamination and/or underground workings may need to be considered in site-specific cumulative impact assessments to the degree they are found on or near proposed ISL sites and their region of influence on the environment overlaps with that of the proposed ISL facility. Geochemical conditions in groundwater aquifers in the vicinity of a* *proposed ISL facility would be included in site characterization activities conducted by applicants in support of any license application for that facility. The types of conditions to be characterized and how the information is considered in NRC safety reviews of ISL facility license applications are described in detail in NUREG–1569 (NRC, 2003).*

### G5.17.1 References

EPA. "Health and Environmental Impacts of Uranium Contamination in the Navajo Nation—Five Year Plan." 2008. <http://www.epa.gov/region09/superfund/Navajo-nation/pdf/NN-5-Year-Plan-June-12.pdf> (10 February 2009).

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

## G5.18 Native American Interactions

### G5.18.1 Tribal Bans, Jurisdictional Issues, and Authority To Regulate Uranium Extraction

**Comments: 011-013; 017-018; 036-033; 036-038; 048-004; 1317-001; 1318-001; 1318-006; 1318-007; 1318-008; 1318-011; AL02-005; AL05-009; GA04-002; GA07-002; GA07-004; GA07-005; GR25-002; GR34-006; HC008-001**
Several commenters expressed concerns regarding the Navajo Nation ban on uranium mining on tribal trust lands (Dine Bikeyah) and requested clarification of tribal and NRC authority to regulate uranium mining within the current boundaries of tribal lands. One commenter referred to Sioux Nation reservations as nuclear-free zones and suggested that no uranium mining should occur in these areas. Another commenter asked, if an ISL is proposed on Navajo or Pueblo land, whether the tribes are involved in the decision. One commenter suggested NRC had preemptive authority regarding ISL licensing.

*Response: As discussed in the GEIS Section 1.7, beyond obtaining an NRC license, uranium ISL facilities also must obtain the necessary permits from the appropriate federal, tribal, and state agencies. GEIS Sections 1.7.4, 1.7.2.1, and 1.7.2.2 discuss the role of tribal agencies in permitting. Section 1.7.4 also includes a discussion of the Navajo ban on uranium milling and describes the related legal and policy issues that have been subject to litigation. This discussion should be generally applicable to other types of bans enacted by Native American tribes. The NRC approach to such jurisdictional issues has been to fulfill its statutory mandate to evaluate license applications and determine whether a particular application complies with the AEA and NRC regulations.*

*NRC recognizes the tribal sovereignty of the Navajo nation. NRC's statutory authority requires NRC to process license applications and issue licenses when applicants fulfill NRC's statutory and regulatory requirements. NRC also requires licensees to obtain all necessary permits and licenses from the appropriate regulatory authorities prior to operating their facility. Simply put, if a licensee cannot satisfy applicable federal, state, and tribal requirements that are lawfully enacted within the jurisdiction of each government entity, it cannot go forward with the project. NRC's licensing proceedings are not the appropriate venue to respond to issues of dispute regarding the jurisdictional limits of entities other than the NRC. For example, the Navajo ban on uranium mining and processing presents a number of complex legal and policy issues that* *are currently being litigated in the U.S. Court of Appeals for the 10th Circuit in a case brought against the EPA with respect to certain proposed uranium processing sites in New Mexico.*

*Other means by which tribal governments can play a role in ISL licensing is through the consultation process described in the GEIS Chapter 9. Consultations between NRC and affected Native American tribes would occur during the site-specific environmental review process when the details of specific proposals, including site location, are known. Because the GEIS already includes general discussions of the tribal agency role in ISL permitting, discussion of the Navajo ban in particular, and discussion of the consultation process, no changes were made to the GEIS in response to these comments.*

**Comment: 038-006**
One commenter noted that tribes have declared nuclear-free zones on reservations but was concerned about contamination generated off-reservation migrating onto reservations via groundwater and air (radon, dust) transport.

*Response: NRC regulations are designed to protect public health and safety and the environment from the activities conducted at ISL facilities. This includes protection of adjacent lands and residents from potentially harmful releases of radioactive materials from these facilities. NRC regulates ISL facilities in a manner that is consistent with its statutory authority and has no authority to implement tribal laws. This response is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

### G5.18.2 Treaty Rights and Aboriginal Land Claims

**Comment: 011-003; 011-011; 026-002; 036-033; 038-005; 061-005; 061-006; 061-007; 1314-065; 1388-004; 1388-012; GA07-001; GA07-003; GR34-003; GR34-004**
Several commenters expressed concerns regarding treaty rights and control of lands granted to the Navajo Nation, along with United Nations resolutions regarding aboriginal rights, that include "traditional" Navajo areas (Dinetah) that are no longer included as part of Navajo tribal trust lands (Dine Bikeyah). Other commenters noted that portions of the proposed ISL mining regions in Wyoming, South Dakota, and Nebraska are contained within the boundaries of the Great Sioux Nation recognized in the Treaty of 1868 and, therefore, tribal landownership rights and trust responsibilities relating to the larger Sioux Nation as defined in the Treaty of 1868 are being ignored. Another commenter referred to a 1980 Supreme Court decision regarding the Black Hills of South Dakota and the Great Sioux Nation. Other commenters indicated the GEIS lacks discussion of tribal land ownership issues and does not consider future treaty rights issues and access to sacred ceremonial grounds.

*Response: NRC is aware that longstanding treaty disputes exist between Native American tribes and the U.S. government. In its role as a regulatory agency, NRC lacks the authority to resolve these issues. During the site-specific environmental review, as discussed in the GEIS Chapter 9, NRC would conduct NHPA consultations with state and Tribal Historic Preservation Offices to take into account whether a proposed ISL facility could affect historic properties. NRC would also consult with affected tribal governments to consider topics of concern regarding specific ISL proposals including potentially affected places of cultural significance. As described in the historic and cultural resource sections of GEIS Chapter 3, places of cultural significance can include a variety of religious and cultural uses including ceremonial activities, shrines, burial grounds, hunting and gathering areas, caves and shelters, springs, trails, and archaeological sites. With regard to United Nations Resolution A/61/L.67, the United States did not sign this* *declaration and is not, therefore, bound by it. As the response is considered sufficient to address the comments, no changes were made to the GEIS.*

### G5.18.3 NRC Tribal Trust Obligations

**Comment: 1309-001; 1314-063; AL14-038; CH10-003**
A few comments addressed tribal trust issues. A few comments suggested the GEIS failed to mention or analyze the federal government trust relationship with tribes. One of these suggested the NRC is obligated to do more than conduct consultations and involve tribes in the licensing process in ways that are already available to the general public. Another mentioned the GEIS violated the trust responsibility with the Oglala Sioux and violated treaty rights. One noted the relationship between the Oglala Sioux and the federal government predates the States of South Dakota, North Dakota, Montana, Wyoming, and Nebraska and that should be respected.

*Response: Within the extent of its statutory authority, NRC executes its mission to protect public health and safety and the environment in a manner that protects all members of the public from licensed activities. This protection includes Native American tribes and their members that may live in the vicinity of NRC-licensed ISL facilities. NRC's interaction with tribal governments is guided by the provision contained in Executive Order 13175, Consultation and Coordination With Indian Tribal Governments, issued by President Clinton on November 6, 2000. As an independent regulatory agency, NRC is not bound by the provisions of the Executive Order but has adopted practices that are consistent with the fundamental principles contained in the Executive Order.*

*During the site-specific environmental review, as discussed in the GEIS Chapter 9, NRC would conduct NHPA consultations with state and tribal historic preservation offices to evaluate whether a proposed ISL facility would affect historic properties. NRC would also consult with affected tribal governments to consider topics of concern regarding specific ISL proposals, including potentially affected places of cultural significance, land disturbance, health, and groundwater use and restoration. NRC has also developed a strategy for outreach to Native American tribes to facilitate an open dialogue with tribes on topics of mutual interest regarding future uranium recovery licensing actions. This strategy is available on the NRC website (NRC, 2008). NRC also met with a number of potentially affected tribes to discuss the GEIS during the period when public comment meetings were held in each of the four milling regions. All these efforts demonstrate that NRC is committed to working with Native American tribes as NRC executes its statutory obligations to review future ISL license applications. This response is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

### G5.18.4 Adequacy of GEIS With Respect to Native American Concerns

**Comment: 011-009; 1321-020**
Some commenters provided specific comments on the adequacy of the GEIS with regard to Native American concerns. One suggested the GEIS did not do environmental justice, because the GEIS authors did not know the meaning of environmental justice in Indian country. Another wanted the GEIS environmental justice section to include more information on water supply, cultural, radiation health and safety, and other related impacts to Native Americans.

*Response: NRC developed the GEIS to address the potential environmental impacts of ISL facilities in a manner consistent with NRC requirements at 10 CFR Part 51 and NRC guidance in NUREG–1748 (NRC, 2003). The environmental justice section was developed consistent with the NRC environmental justice policy statement (NRC, 2004). Based on this policy, an environmental justice analysis evaluates potential disproportionately high and adverse impacts associated with physical, socioeconomic, health, and cultural resources to low-income and minority populations. The environmental justice analysis in the GEIS Chapter 6 discusses the potential for disproportionately high and adverse environmental and health impacts on minority and low-income populations from future ISL licensing in the four milling regions. In this analysis, three of the four milling regions had low-income and minority populations that could trigger a site-specific environmental justice analysis. For these milling regions, the GEIS concluded additional site-specific information would be needed to complete the environmental justice analysis on the topics requested by the commenter (e.g., water resources, cultural, health). Therefore, conclusions of the environmental justice analyses would be made during site-specific environmental reviews for specific ISL facility proposals in the aforementioned regions. This response was considered to address the concerns raised by the commenters; therefore, no changes were made to the GEIS in response to the comments.*

**Comment: 1314-064**
Some commenters provided specific comments on the adequacy of the GEIS with regard to Native American concerns. They suggested ISL operations would impede tribal hunting and livestock practices.

*Response: The GEIS addresses potential impacts to a variety of resource areas (e.g., land use, water resources, air quality, ecology, socioeconomics, and health) that apply to all people including Native Americans. Hunting and grazing activities, in particular, are discussed in land use sections of Chapter 3. In addition, traditional land use areas and hunting areas are included in the historic and cultural discussions in Chapter 3. The land use impact sections of GEIS Chapter 4 address impacts on hunting and livestock by considering potential changes in land uses, access restrictions, grazing and agricultural activities, and recreational activities. Concerns regarding potential impacts to tribal hunting and livestock practices would be evaluated, as appropriate, in site-specific reviews of ISL license applications in concert with appropriate consultation with tribal agencies. Because this information is already addressed in the GEIS, no changes were made.*

**Comment: 1388-011**
One commenter mentioned the GEIS is prejudiced against Native Americans because cultural and historic properties are not completely documented and instead slant toward mitigation. This level of detail was compared to the detail provided for wildlife migration patterns with no similar consideration toward Native Americans.

*Response: An important objective in developing the GEIS was to use the best available information. Nonetheless, the level of detail of information presented in the GEIS is not entirely consistent from one topic, or one region, to another. This is, in part, the result of the availability and accessibility of information on specific topics at particular locations rather than some inherent bias in the analysis. For example, the Chapter 3 sections on historic and cultural resources include more detailed information on archaeological and historic sites in the Northwestern New Mexico milling region relative to the other milling regions due, in part, to the high degree of interest in that area in identifying and researching sites. This response is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

**Comment: 1317-010**
One commenter mentioned the tribes' concerns with flaws in the GEIS were exacerbated by past interactions with the NRC. Examples were provided regarding the Navajo Ban and NRC administrative judges' interpretation of its significance as irrelevant to NRC licensing proceedings, and concerns about what was referred to as a "business as usual" approach by NRC regarding uranium extraction on Mount Taylor.

*Response: Mount Taylor is discussed in the GEIS Sections 3.5.1, 3.5.8, 3.5.8.3, and 4.5.8.1 as a significant cultural landscape that could be impacted by activities related to ISL facilities. The GEIS also mentions that the New Mexico Cultural Properties Review Committee has accepted an emergency listing of the Mount Taylor Traditional Cultural Properties to the State Register of Cultural Properties and the nominating group has 1 year to complete the final nomination to the state register. Under the authority granted to NRC by the AEA and NEPA, NRC would review any future ISL applications including those that may be proposed in the vicinity of Mount Taylor. These NRC reviews would be conducted in a manner consistent with NRC statutory authority and would include a site-specific environmental review that includes an assessment of potential historic and cultural impacts on significant cultural properties including Mount Taylor. In addition, NRC would undertake government-to-government consultations with affected Native American tribes, including consultation with the applicable Tribal Historic Preservation Office. In addition to the NRC licensing process, applicants would need to obtain and comply with all other applicable permits before they can proceed with operations.*

*As discussed in Section G5.18.1 with regard to the Navajo Ban on uranium mining, the NRC recognizes the sovereignty of the Navajo Nation but does not have authority to implement Navajo laws. GEIS Section 1.7 discusses the licensing and permitting process for an ISL facility. That section mentions that beyond obtaining an NRC license, uranium ISL facilities also must obtain the necessary permits from the appropriate federal, tribal, and state agencies. This response is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

## G5.18.5 Adequacy of Tribal and Government-to-Government Consultations

**Comment: 032-005; 032-034; 050-084; 1317-004; 1321-019; 1321-021; AL06-012; AL15-042; HC017-002; NE06-013**
Several commenters expressed concerns regarding the lack of government-to-government consultations between tribes and the NRC in the development of the GEIS. Commenters noted the list of tribes in the GEIS with which the NRC consulted on a non-government-to-government basis does not include other interested tribes in New Mexico, Montana, Wyoming, South Dakota, and Nebraska. Other commenters noted that government-to-government consultations with Native American tribes should be performed and the results of such consultations should be included in the GEIS. Commenters noted the GEIS discussion of consultations in Chapter 9 does not mention tribes other than Navajo and should be revised. Another commenter requested all documents tiered off GEIS should include results of consultations.

*Response: NRC has attempted to have discussions with tribal representatives whenever this was feasible for both parties. Unfortunately, direct meetings with all of the potentially affected tribes could not be completed during development of the GEIS and subsequent public comment meetings. Additional substantive consultations with affected Native American tribes and tribal organizations have been pursued and also will occur during the site-specific NRC environmental review process. The discussion in the GEIS of tribal consultation indicates that NRC consults* *with affected tribes as part of carrying out the intent behind Executive Order 13175 "Consultation and Coordination with Indian Tribal Governments" and requirements at 10 CFR 51.28(a)(5). The specific mention of consultations with the Navajo Nation through the Navajo Department of Justice is a commitment to the Navajo Nation based on prior discussions. The mention of that commitment in the GEIS Chapter 9 is not intended to suggest that NRC would consult only with the Navajo Nation on ISL projects. In response to the comments, the discussion in the GEIS Chapter 9 was revised to clarify this and mention other tribes that NRC has met with and would meet with to discuss the preparation of the GEIS.*

### G5.18.6 Local Community Outreach and Consultation

**Comment: 011-008; 011-010; 035-006**
Some commenters provided concerns on local outreach efforts. One mentioned NRC outreach to the Navajo Nation is ineffective and has not been taken to small towns such as Pinedale. Another suggested that before milling can take place, NRC must have consent from local indigenous peoples. One was concerned that NRC should not let religious beliefs affect private or public land, although the commenter indicated it was okay for Indian land.

*Response: As discussed at the beginning of this appendix, NRC conducted three scoping meetings and eight public comment meetings on the GEIS. NRC also extended the public comment period to provide more time for members of the public to submit comments on the GEIS. In addition to the formal public meetings, NRC staff met with representatives of federal, state, tribes and local agencies in the four uranium milling regions. NRC talked to members of the public and press before and after the formal public meetings. While NRC has made a reasonable effort to provide outreach to the local populations in the regions, the large geographic area considered by the GEIS presents practical challenges for outreach efforts. NRC will continue to provide opportunities for local input as part of the environmental review process for site-specific ISL license applications.*

*The NRC licensing process offers multiple opportunities for public involvement including provisions for public comment and requests for hearing on specific licensing actions. This process does not include provisions for local consent prior to NRC granting a license. NRC considers all views provided during opportunities for public involvement. All NRC actions are conducted in a manner that is consistent with NRC's statutory authority and regulations. This response is considered sufficient to respond to the comments; therefore, no changes were made to the GEIS.*

### G5.18.7 Uranium Legacy Concerns

See Section G5.17 for comments and responses related to the legacy of uranium mining.

### G5.18.8 References

NRC. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register.* Vol. 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. "U.S. Nuclear Regulatory Commission Strategy for Outreach and Communication With Indian Tribes Potentially Affected by Uranium Recovery Sites." 2008. <http://www.nrc.gov/materials/uranium-recovery.html> 16 February 2009.

## G5.19 Land Use

### G5.19.1 Minor Corrections to the GEIS

**Comment: 017-017; 017-019; 1173-029; 1173-030**
Commenters requested that NRC revise the GEIS to correct four items: (1) verify and correct, if appropriate, the statement on contamination caused by uranium milling in the Rio San Jose Basin; (2) change the February 2008 New Mexico cultural property review committee approval of Mount Taylor to June 2008; (3) change BLM land use for more than grazing; and (4) change "Land Ownership" in the title of a table change to "Land Surface Ownership."

*Response: These four corrections related to land use were addressed in GEIS Section 3.2.1, in Table 3.2-1, and in Section 3.5.1. The GEIS text was revised accordingly. For consistency, the title and header change from "Land Ownership" to "Land Surface Ownership" in Table 3.2-1 concerning the Wyoming West Uranium Milling Region was extended to three similar tables (3.3-1, 3.4-1 and 3.5-1) concerning the three other regions of interest.*

### G5.19.2 Ownership Issues, Surface, and Mineral Rights

**Comment: 036-092; 050-090; 1173-002; 1173-028; 1173-042; 1173-087; HC013-002**
A commenter asked that the checkerboard nature of land ownership and the related jurisdiction issues in New Mexico be taken into account and discussed. Other commenters from Wyoming requested that acknowledgments and discussions be included on surface rights versus mineral rights and on split estate (private, state, or local government surface ownership and federal subsurface mining claims) with the related consent issue with land surface owners. It also needs to be determined whether ISL companies were fulfilling their contracts with land owners.
*Response: In GEIS Section 3.5.1, NRC staff recognized and described in general terms the checkerboard mix of Navajo Tribal Trust land and privately held individual Navajo allotments land in the central part of McKinley County, New Mexico. Details on land ownership status and related jurisdiction issues are very specific to a particular proposed ISL facility site. Because the comments raised concerns on specific site land ownership and land use jurisdiction and legal issues beyond the scope of the GEIS, no changes to the GEIS were made beyond this response.*

*In responses to Wyoming commenters, a discussion on surface rights versus mineral rights and on split estate status was added to GEIS Section 3.2.1. In addition, similar but shorter remarks were added to GEIS Sections 3.3.1 and 4.3.1.1 to acknowledge the issues of surface rights versus mineral rights and split estate.*

*ISL operators need to not only lease mineral rights but also to to obtain the consent of surface owners to access the land; explore, construct, and operate their ISL facilities; and find appropriate mitigation, or compensation measures for impacts and losses of access, grazing, agricultural, recreational or other activities that would affect the surface owners. These impacts, mitigation and compensation are to be defined and implemented between surface owners and ISL operators, taking into account the size, sequencing, and duration of the identified land use impacts and losses. In Wyoming, for example, WDEQ, Land Quality Division enforces all* *statutes and regulations on land disturbances dealing with mining and reclamation. It issues permits to mine for noncoal resources and in-situ recovery operations. Permits identify site-specific requirements including establishing reclamation bonds based on estimated site-specific costs to ensure adequate funding would be available for reclamation. It is beyond the scope of the GEIS to attempt to provide details on the scope and requirements of consent agreements that are private and on specific contractual matters between surface owners and ISL companies. For the same reason, NRC staff has no public information on whether or how ISL companies are fulfilling their agreements with surface owners. Because the comments raised concerns on private agreements between land owners and ISL companies that are not public information, no changes to the GEIS were made beyond this response.*

### G5.19.3 Amount of Land Affected and Type; Degree and Duration of Potential Impacts

**Comment: 036-017; 036-125; 050-040; 050-043; 050-089; 050-091; 059-005; 1305-100; 1305-102; 1305-108; AL14-033; GI04-001; HC016-002; NE03-003**
Commenters indicated that potential impacts to ecological, historical, and cultural resources during the construction phase of an ISL facility were improperly included in the land use sections and were assigned too broad a range of potential impacts. Commenters from Wyoming asked how much land area is needed for an ISL facility, how land owners would be impacted, and whether the land could be returned for ranching, wildlife, or other uses after decommissioning. Others indicated that there was no discussion of land use impacts and mitigation, that merely a listing was presented, and that the "temporary" qualification of the construction seasons and impacts as well as the mitigation and reclamation measures needed more explanations. Other commenters from Wyoming requested that impacts on hunting, recreation, ranching, and farming activities be addressed; indicated that land use impacts are underestimated or are significant and should be more fully analyzed; and requested that impacts on federal lands should be adequately addressed. The last comment from Wyoming asked NRC to describe how ISL facility well fields could coexist with oil and gas or CBM sites within an ISL permitted area and how impacts to current or future nonuranium resources could be expected to be SMALL. A commenter from New Mexico indicated that the GEIS inaccurately stated that there were no ISL projects on tribal lands.

*Response: Prior to construction of an ISL facility in the four regions of interest, the land considered may be in the process of being used for any or several of the following general categories: agricultural, oil and gas and minerals production and transportation, recreational, ecological, wildlife, and cultural and historical uses. A new section has been added to the GEIS (Section 3.1.2.2) which discusses land ownership rights, responsibilities, and opportunities. Principal economic activities in agriculture, energy and minerals, and recreation would be well known and documented for any land where an ISL facility would be built. However, some ecological and wildlife resources and possibly some cultural or historical resources could be less conspicuous. Therefore, license applicants would conduct detailed site-specific studies and surveys to evaluate the presence of ecological, cultural, or historical resources. Despite such surveys, it is possible that unknown or undiscovered resources may still be present. All of these resources, known and undiscovered, are integral parts of the preconstruction land attributes. Accordingly, NRC staff determined it to be appropriate to state that some of these less known or undiscovered ecological, historical, and cultural resources could be initially impacted during the disturbances of the construction phase. It is fairly common that buried, previously unknown archaeological or cultural resources are evidenced during road construction, grading, trenching, and other excavation activities. Greater details and analyses* *are presented in sections of the GEIS addressing ecological, historical, and cultural resources (Sections 3.2.5 and 3.2.8, 3.3.5 and 3.3.8, 3.4.5 and 3.4.8, 3.5.5 and 3.5.8) and their potential impacts (Sections 4.2.5 and 4.2.8, 4.3.5 and 4.3.8, 4.4.5 and 4.4.8, 4.5.5 and 4.5.8). In sum, the nature and extent of these ecological, historical, and cultural resources may be only partially known or even undiscovered, until fully assessed in detail by site-specific assessments as part of an ISL facility license application. For these reasons, NRC indicated that the potential for those resources to be altered or destroyed during construction can only be evaluated from potentially SMALL to LARGE impacts in the GEIS to account for uncertainties. Site-specific studies and assessments would generate the appropriate detailed site data needed to more finely evaluate those potential impacts for each license application for an ISL facility.*

*The ranges of land area that existing and future ISL facilities utilize are described in GEIS Sections 2.1.3, 2.11.1, and 4.2.1. The descriptions include information on the total permitted areas, the well field areas, and the surface facility areas of ISL facilities. The potential land use impacts that would affect different land owners at and around a specific ISL facility would be detailed in the plans of the site-specific license application to the NRC. NRC presented and analyzed the types and range of impacts to land use in GEIS Sections 4.2.1, 4.3.1, 4.4.1, and 4.5.1 for each of the four regions of interest. These analyses comprise potential impacts on ranching, farming, and recreational activities, including hunting, which is a popular recreational activity along with off-road touring. These potential impacts would affect public lands in a way similar to how they would affect privately owned lands. These impacts are analyzed for the four phases of an ISL facility: (1) construction, (2) operations, (3) aquifer restoration, and (4) decontamination, decommissioning, and reclamation. Impacts on land use are also summarized in the Executive Summary (Pages xxxiii and xxxiv) and in Table 10-1. Mitigations measures as they pertain to land use impacts are described in Chapter 7.*

*The degrees of land use impacts are deemed SMALL to MODERATE because of the small percentage of land that would be disturbed or restricted (typically less than 10 percent) compared to the whole permitted area of an ISL facility. Land use changes and disturbances due to drilling, trenching, excavating, grading, and surface facilities development would be most intense during the construction period. These disturbances are deemed temporary because of the relatively short one to three construction seasons involved and because postconstruction mitigation measures, such as recontouring and restoring surface cover, well sites, staging areas, trenches, and parts of dirt access roads would minimize loss of pasture land, grazing rights, cultivated land, or recreational areas (GEIS Sections 4.2.1, 4.3.1, 4.4.,1 and 4.5.1). NRC staff recognizes that in terms of duration, the land use impacts during an average operation phase of 20 years could be deemed larger compared to the shorter construction phase of 1 to 3 years. However, potential impacts remain SMALL in terms of the overall percentage of the land of the permitted area and, often, the impacted areas may not remain impacted for the entire operations phase. For example, prior land uses at a particular well field area where uranium extraction activities have stopped can be partly or totally restored, while uranium extraction activities are being shifted to an other well field (GEIS Sections 4.2.1, 4.3.1, 4.4.1, and 4.5.1). Appropriate compensation measures for the loss of grazing, agricultural, recreational, or other activities are to be defined and implemented between surface owners and ISL operators, taking into account the size, sequencing, and duration of the identified land use losses. NRC indicated that, after decommissioning operations of an ISL facility, the land is to be restored to its original condition to reestablish the prior land uses such as ranching or wildlife spaces or to redevelop the land for other uses (GEIS, Sections 4.2.1, 4.3.1, 4.4.1, and 4.5.1). Restoring the land surface to premining conditions after decommissioning is one of the important requirements of the license NRC would grant to the licensee of a new ISL facility.*

*If an ISL operator secures a lease for uranium extraction on a permitted area, it would likely take precedent over future mineral rights for oil and gas, CBM, or other mineral resources in the same area. These potential future mineral rights could be either delayed for the duration of an ISL project or, if feasible, intermixed within the overall permit area of an ISL facility depending on agreements surface owners and different mineral rights leases would put in effect in accordance with appropriate federal and state regulations. The GEIS can only acknowledge in general terms that surface owners and mineral rights lease holders need to reach agreements—the details of which can only be developed on a site-specific basis. Such impacts would be evaluated as cumulative impacts in site-specific environmental reviews.*

*Because the comments addressed here, represent concerns of general nature on land use impacts, changes to the GEIS were limited to the clarifications provided.*

*In response to the comment on ISL sites located on tribal lands in New Mexico, it should be noted that GEIS Section 3.5.1 indicated that the Crownpoint and Church Rock Chapters of the Navajo Nation are in an area known as the checkerboard, characterized by mixed private tribal and government property rights. The text did not refer to the Crownpoint and Church Rock sites. GEIS Section 3.5.1 was amended to indicate that these two sites are partly located on Navajo Tribal Trust land or on allotted land.*

### G5.19.4 Grazing Rights and Farming Compensation and Other Values of Livestock Grazing

**Comment: 050-041; GI03-004; HC009-003; HC009-007**
Commenters from Wyoming asked whether there would be compensation or other mitigation measures for ranchers and farmers due to the interruption of grazing rights or the loss of cultivated lands on an ISL facility. Related to the interruption of open rangeland grazing, a commenter requested that the loss of other environmental, historic, and social values related to livestock grazing be considered.

*Response: In GEIS Section 4.2.1.1, NRC staff indicated that use of the land as rangeland, pasture land, or cultivated fields would likely be excluded or lost in fenced areas and along dirt roads, well fields, and surface facility buildings for the life duration of an ISL facility. Although these land use impacts were deemed SMALL in relation to the small percentage of land use losses compared to the whole permitted land area, no mitigation measures were discussed. Therefore, NRC staff amended the GEIS to more clearly indicate that mitigation and compensation measures would need to be identified and agreed upon between surface owners, grazing rights permit holders, and ISL facility companies to take into account the loss of grazing land or cultivated land due to the restricted access or fenced portions of an ISL facility on its permitted area. Amendments to the GEIS were made in Section 4.2.1.1.*

### G5.19.5 Mitigation and Reclamation Issues

**Comment: 050-092; 1173-061**
Commenters from Wyoming asked whether moving operations sequentially from one well field to the next would be required as a mitigation measure. Another commenter noted the GEIS stated the impact to land use would be SMALL and that reclamation would be coordinated with BLM, and wanted to know how this would happen.

*Response: Changing ISL operations from one well field to another is part of the normal operations phase of an ISL facility. There is no NRC requirement for sequencing of well field operations, and it does not constitute a mitigation measure for potential land use impacts. When a well field is no longer productive (e.g., uranium yields diminish to levels that are no longer profitable), a licensee ends the production phase of well field operations and begins the aquifer restoration phase. While aquifer restoration can take years to complete, NRC requires ISL licensees to comply with the timely decommissioning requirements at 10 CFR 40.42 (NRC, 2008) that require notification of NRC within 60 days following the decision to permanently cease injection of lixiviant into a well field (an action that signifies intent to cease production and begin aquifer restoration and subsequent ground surface decommissioning of the well field). A licensee then has 24 months to complete restoration and decommissioning or notify NRC and request an alternate schedule. This process ensures that aquifer restoration and surface decommissioning is completed as soon as practicable, the health and safety of workers and the public are protected, and reclaimed land can be made available for other uses.*

*Prior to surface decommissioning and reclamation, as discussed in GEIS Section 2.6, licensees submit a decommissioning plan for NRC review and approval. Other federal and state agencies responsible for UIC permitting and land management (e.g., WDEQ, BLM, and others), as applicable, are expected to have additional permit requirements that affect, for example, well abandonment and surface reclamation that a licensee would have to meet during ISL decommissioning. NRC expects to consult with the applicable federal and state agencies (including BLM) to exchange information on proposed decommissioning plans and associated regulatory activities. It is beyond the scope of the GEIS to indicate the procedures and scope of communication and coordination between NRC and other applicable agencies involved in regulating ISL facilities. Because the comments pertain to details of regulatory process issues that are summarized in the GEIS, no changes to the GEIS were made in response to the comment.*

### G5.19.6 References

NRC. "Compliance With 10 CFR 40.42's Timely Decommissioning Requirements." Letter (July 7) from K.I. McConnell to S. Collings, Power Resources, Inc. Washington, DC: NRC. 2008.

## G5.20 Transportation

**Comment: 050-042; 1173-007; GR31-005; HC009-008**
A commenter noted the transportation sections of the GEIS address larger roads where there could be more human impacts but did not address resource damage and hazards of smaller feeder roads. Other commenters suggested the GEIS address the impacts of roads and traffic on farming and grazing, loss of forage palatability from road dust, open gates, interference with livestock herding, and livestock crashes as potential safety issues.

*Response: Consistent with the regional scope of the GEIS, the transportation information and analyses are primarily based on the regional transportation infrastructure and roads where state agencies provide information on traffic counts. The existence of unpaved access roads is noted in GEIS Chapter 3 transportation sections. GEIS Chapter 4 transportation sections include potential impacts from noise, dust, and incidental wildlife and livestock kills. These impact conclusions implicitly apply to the local (some unpaved) access roadways discussed in Chapter 3 that would be used by an ISL facility; however, text was added to GEIS Sections*

*4.2.2, 4.3.2, 4.4.2, and 4.5.2 to clarify this more explicitly in the final GEIS. While the commenter did not provide examples of the types of additional resource damage and hazards there was concern about, based on this and the other comments received, the aforementioned transportation impacts sections were modified to include a note that significant unique local conditions and potential hazards and resource impacts would be considered in an NRC site-specific environmental review. Dust impacts to forage palatability and interference with livestock herding were added as potential local impacts. These effects would not be significant enough to change the air quality impacts assessment. Unique local and site-specific transportation information would be provided by license applicants in their environmental reports that are provided with license applications. NRC also expects that any unique local conditions that may need to be considered with regard to potential environmental impacts would be identified during interactions and consultations with other federal and state agencies as part of the NRC site-specific environmental review process.*

**Comment: 059-006**
A commenter suggested the GEIS underestimated the "transportation" impacts, which they claimed should be high due to dust and wildlife impacts. The commenter noted that most of the area roads are unpaved, which would contribute to dust generation. Concerns included health impacts of dust and incidental wildlife kills from vehicle traffic.

*Response: GEIS Chapter 4 describes the assessment of potential impacts and the classification of impact significance as SMALL, MODERATE, and LARGE based on existing NRC guidance (NRC, 2003). Large impacts are defined as clearly noticeable and sufficient to destabilize important attributes of the resource considered. The transportation impacts for three of the four ISL phases are classified as SMALL to MODERATE instead of SMALL to LARGE based on consideration of the low magnitude of expected traffic from an ISL facility, the intermittent nature of that traffic (e.g., commuting workers), and the proximity of roads to sensitive areas such as occupied structures, wildlife, and grazing areas. While it is expected dust generated from this traffic could produce noticeable impacts, these were not considered sufficient to destabilize the resource. For example, the intermittent dust generation from traffic would not be expected to be of sufficient duration to cause health impacts, and incidental wildlife kills would not be expected to destabilize local populations of terrestrial species. As a result, no changes were made to the impact conclusions in the GEIS based on review of this comment. If review of additional local, site-specific information for a proposed facility suggests a unique combination of local conditions exist such that dust or wildlife kills from transportation could have LARGE impacts, the GEIS conclusions would not limit such a conclusion from being made in a site-specific environmental review.*

**Comment: 032-024; 1173-026**
A commenter noted that the GEIS addresses ion-exchange resin transportation for each region but believes the GEIS should address the shipment of ion-exchange resins for processing from one region to another. Another commenter noted that transportation would be more complicated if remote ion exchange was used at an ISL facility.

*Response: The commenters are correct in noting that remote ion-exchange activities can result in shipment of uranium-loaded ion-exchange resins from remote well fields to processing facilities as discussed in GEIS Chapters 2 and 4. GEIS Chapter 4 notes that the potential radiological impacts from ion-exchange resin shipments are bounded by the analysis of impacts from yellowcake shipments based on the lower concentration of uranium in the ion exchange resins and the chemically bound nature of uranium making it more difficult to disperse when released in an accident. The comments imply that the longer distance, remote ion-exchange* *shipments may have a greater impact that was not considered in the GEIS; however, the transportation risks are proportional to the total miles traveled which would still be less for long distance, remote ion-exchange when compared to yellowcake shipments. For example, based on information provided in GEIS Chapter 2, if the expected annual 365 ion exchange shipments were assumed to travel a distance of 200 miles, that would result in 73,000 total annual miles traveled. By comparison, a midpoint of 62 yellowcake shipments (GEIS Table 2.8-1) shipped approximately 1,300 miles per shipment (GEIS Table 3.3-3) to the conversion facility in Illinois would generate 80,600 total annual miles. Given the other factors mentioned in the GEIS that limit the hazard level of the uranium-loaded ion-exchange material compared to yellowcake, the additional distance of these remote ion exchange shipments is not expected to exceed the estimated radiological risks from yellowcake transportation already discussed in the GEIS. Nonradiological risks are addressed in GEIS Section 4.2.2.2 for Wyoming West, and the overall risk of a high consequence accident is considered to be SMALL. Because the transportation impact sections in GEIS Chapter 4 did not include this discussion of the effect of distance on the risk from ion-exchange resin shipments, this information was added to those sections in response to this comment. GEIS Chapter 2 was also edited to convey that the distance traveled by remote ion exchange shipments can vary. If a single facility was to do most of the processing for multiple ISL sites in an area, there is a potential for additive impacts on traffic and roads in the vicinity of the processing facility. Such proposals would depend on site-specific conditions that would need to be evaluated when individual proposals are submitted to NRC for review.*

**Comment: AL25-118; NE07-003**
Commenters expressed concerns about transportation accidents including the potential health and environmental impacts. One commenter noted that accidents have happened in the past.

*Response: Transportation sections in the GEIS Chapter 4 address the potential impacts of transportation accidents from ISL facility transportation activities. This includes consideration of the potential impacts of accidents during transportation of yellowcake uranium, uranium-loaded ion-exchange resin transportation, radioactive waste transportation, and hazardous chemical transportation. Overall, ISL-facility-related transportation activities, as discussed in GEIS Chapter 3 transportation sections, involve low numbers of truck shipments per day (about two trucks per day or less). All these materials must be shipped in accordance with applicable NRC and U.S. Department of Transportation regulations. These regulations address various aspects important to maintaining safety throughout transportation activities including specifying and certifying appropriate packaging, securing loads, labeling and placarding, and providing dose rate limits for packages and conveyances containing radioactive materials. For transportation, yellowcake uranium is classified as low specific activity (LSA) material (meaning low radioactivity per unit mass). The nature of this material requires safety precautions, but these precautions are not extraordinary. The GEIS includes an estimation of risk from transportation of yellowcake from an ISL facility to a conversion facility in Metropolis, Illinois. This analysis considers the consequences of accidental release of package contents, airborne dispersion of yellowcake material, and inhalation dose to a local population. Estimated impacts show low radiological risk to the exposed population. The commenter is correct in noting that accidents have happened, and past accidents involving release of yellowcake material (as much as 30 percent of shipment contents) are discussed in GEIS Chapter 4 transportation sections. These prior accidents involved spilled yellowcake material that was cleaned up without significant impacts to public safety or the environment. Uranium-loaded ion-exchange resin shipments and ISL radioactive waste shipments are expected to present a lower risk than yellowcake transportation due mostly to the less concentrated nature of the material, lower dispersion potential (for resins), and shorter shipment distances. Chemical supply shipments* *are commonly safely executed by complying with regulations and established safety practices but do present a SMALL risk. A high catastrophic consequence chemical release event is plausible but unlikely based on past experience. As the comments expressed general concerns, because transportation accidents are already addressed in the GEIS, no further changes to the GEIS were made in response.*

**Comment: 028-007; 050-057; 1173-016; 1321-017**
Some commenters provided comments on the national transportation impact analysis included in the GEIS. One commenter concurred that yellowcake transportation risks have already been addressed in the prior analyses. A few other commenters questioned whether the prior studies, which were conducted in 1977 and 1980, were still relevant or timely. One commenter also suggested that terrorism should be included in the transportation analysis.

*Response: As noted by one commenter, and as described in GEIS Chapter 1 and in Chapter 4 transportation sections, the NRC has previously analyzed the risks for national transportation of all radioactive materials, including yellowcake shipments, in NUREG–0170 (NRC, 1977). That analysis considered risks from both normal (incident-free) transportation and from accidents. An additional analysis of yellowcake transportation impacts was conducted in 1980 by the NRC in a prior GEIS for uranium milling (NRC, 1980). Release and dose estimates from the 1980 analysis were incorporated into an updated analysis in Mackin, et al. (2001), which used more current factors to convert dose to latent cancer fatalities. All these analyses of yellowcake transportation show that risks from yellowcake shipments are expected to be SMALL. While the calculations are dated, and methods have evolved over time, the risk assessment approaches for accident calculations used during that timeframe (late 1970 to early 1980) tended to be conservative and therefore overestimate risks. This overestimation of accident risks in NUREG–0170 (NRC, 1977) calculations was demonstrated when spent fuel transportation risk calculations were recalculated [Sprung, et al. (2000) used more modern risk assessment methods and data and compared with NUREG–0170 results]. In addition to the generally conservative nature of the past calculations, there remain a number of variables in the transportation scenarios analyzed in the past that are still either comparable or conservative with regard to yellowcake transportation in the present time period. For example, as noted in GEIS Chapter 4 transportation sections, the same conversion facility exists in Metropolis, Illinois, so shipment distances assumed in the prior analyses are consistent with those considered in the GEIS risk estimates. The amount of yellowcake shipped and number of shipments from the prior accident analysis are also comparable with information in GEIS Chapter 2. National average truck accident rates used in both NUREG–0170 and the 1980 GEIS accident calculations are also higher than more recent state-specific estimates for New Mexico, Wyoming, Nebraska, and South Dakota (Saricks and Tompkins, 1999). These considerations suggest the past estimates remain a sufficient basis for making impact conclusions regarding potential yellowcake transportation risks and that any NRC update of yellowcake transportation risk estimates would be unlikely to change the impact conclusions from the prior analyses. In response to these comments, additional text was added to GEIS Chapters 1 and 4 to convey the applicability of these prior analyses to current yellowcake transportation.*

*As stated in the Commission's Memorandum and Order CLI–02–24 (NRC, 2002), although the NRC has determined that issues of terrorism in the context of NEPA should not be addressed, the NRC is devoting substantial time and attention to terrorism-related matters. For example, as part of fulfilling its mission to protect public health and safety and common defense and security pursuant to the AEA, the NRC staff is conducting security assessments of commercial uses of radioactive material. NRC does not consider NEPA to require the NRC to consider the* *environmental consequences of a hypothetical terrorist attack on an NRC-licensed facility because the "environmental" effect caused by third-party miscreants is simply too far removed from the natural or expected consequences of agency action to require a study under NEPA [CLI–07–08, 65 NRC 124] (NRC, 2007).*

**Comment: 050-045**
One commenter was concerned about new ISL projects impacting community roads and highways and leading to related socioeconomic consequences. An example was provided by the Powder River Basin Resource Council that the State of Wyoming expects State Route 59 between Gillette and Douglas to require expansion due to coal and CBM development-related traffic. The commenter suggested that ISL-related traffic would exacerbate such problems, asked who would bear the burden of such impacts on community resources from ISL development, and asked about cumulative impacts of new projects in close proximity to ISL facilities within a geographic area.

*Response: As discussed in GEIS Chapter 4, the estimated low magnitude of road transportation from all phases of the ISL facility life cycle (GEIS Section 2.8), when compared with local traffic volumes in the uranium milling regions (GEIS Sections 3.2.2, 3.3.2, 3.4.2, and 3.5.2), would not be expected to significantly change the amount of traffic or accident rates. Any related infrastructure wear and tear is expected to be proportional to the traffic, and therefore the contribution from ISL-related activities would not be expected to be significant in light of the high volume associated with the other activities mentioned by the commenter. The Chapter 4 transportation sections further note that wear and tear introduced by ISL-related traffic on lower traffic roads may be more pronounced (this is because the proportion of all traffic that is contributed by ISL activities would be far greater on the small, low traffic, roads and therefore would contribute proportionally more to the wear and tear of these roads). Regarding the question of "who bears the burden" for infrastructure impacts, it would be the applicable federal, state, or local agencies responsible for maintaining the roads that are within their jurisdictions. Cumulative impacts of multiple projects are discussed in GEIS Chapter 5. Tables showing other concurrent actions occurring in the uranium milling regions show the potential for impacts of these actions on various resource areas including transportation. The cumulative impact analysis for a particular ISL proposal would be conducted during the NRC environmental review for that proposal. The cumulative impact analysis would address unique site-specific circumstances and would make site-specific impact conclusions on cumulative impacts.
No changes to the GEIS were made beyond the information provided in this response.*

**Comment: 050-094**
The commenter requested clarification of what roads are included in the statement in GEIS Section 4.2.2.2 that "most of the roads assessed for average annual daily traffic counts in the Wyoming West Uranium Milling Region have sufficiently high [traffic] counts."

*Response: The statement in question refers to the roads and traffic counts provided in Chapter 3 transportation section for Wyoming West Uranium Milling Region (Table 3.2-2) that was used as the basis for the impact analysis. As noted in Section 4.2.2.2, the expected ISL-generated traffic is compared with the existing traffic counts and, in most cases, the expected ISL-generated traffic is a small proportion of the existing traffic and, therefore, would not be likely to contribute a noticeable impact on existing traffic. As noted in the GEIS, only for the few roads with very low traffic counts would the added traffic from ISL produce a noticeable increase in traffic. In response to this question, more explicit references to the tables in Chapter 3 transportation sections were added to all Chapter 4 transportation sections to clarify the discussion.*

**Comment: 1173-043; NE07-002**
One commenter requested clarification on the transportation routes that would be used by ISL facilities to ship the yellowcake uranium product. Another commenter asked why a particular representative route (traveling through the Denver area) was selected for GEIS Table 3.3-3 versus what was believed to be a more direct route.

*Response: As discussed in GEIS Chapter 3 transportation sections, many routing options are available to ISL facilities for shipping yellowcake product to the conversion facility in Metropolis, Illinois, where the material would be processed further. It is not practical or necessary to identify all the possible routes these shipments could take. To support evaluating potential transportation accident impacts in the GEIS, representative routes are provided in Chapter 3 transportation sections. Including the representative routes in the GEIS provides insights into potential route selections that might be used by future ISL licensees and also provides information on possible shipment distances for comparison with values used in the transportation risk calculations described in GEIS Chapter 4 transportation sections (risk is proportional to distance traveled). The representative routes were selected by reviewing road networks from estimated origin locations (i.e., areas within the milling regions where past, present, or future ISL interest is known) to the conversion facility using direct routes from local and state roads to the interstate highway system. A variety of other routes are possible. However, the representative routes are expected to provide a reasonable estimate of the shipment distances from the areas of milling interest within each uranium milling region considered in the GEIS. In response to the comment, additional text was added to the descriptions of representative routes in GEIS Chapter 3 transportation sections to clarify that actual routes can vary, but representative routes are used to provide estimates of shipment distances to support the evaluation of impacts in Chapter 4.*

**Comment: 1173-056**
The commenter asked about the GEIS including information about truck transportation but asked whether yellowcake could be transported by rail.

*Response: LSA material (which includes yellowcake) could be shipped by rail provided those shipments comply with the applicable NRC and the Department of Transportation requirements. Shipment of yellowcake by rail is not common at ISL facilities and therefore is not addressed in the GEIS. The GEIS focuses on common practices of ISL facilities. If an ISL facility proposed using rail transport, that proposal would be evaluated for potential environmental impacts in the NRC site-specific environmental review.*

**Comment: HC010-008**
The commenter asked about the proportion of existing traffic counts (e.g., 800, 900, and 400 vehicles per day) included in traffic count tables in the GEIS Chapter 3 to which an ISL facility would contribute.

*Response: GEIS Chapter 4 transportation sections address the contribution of expected ISL facility traffic to local traffic counts represented in the Chapter 3 tables. The discussion in Chapter 4 references the estimated ISL-related vehicle trips in Chapter 2 (Section 2.8) where ISL facility activities are described. The information in Chapter 2 refers to annual vehicle trips but translates to approximately 2 trucks per day or less, and 20 to 200 commuting workers per day during the various phases of the ISL facility life cycle. As discussed in Chapter 4 impact sections, the overall magnitude of traffic generated by an ISL facility is low relative to existing traffic counts. This is true for most of the roads analyzed; however, this level of added traffic may be more noticeable on those roads within each milling region with the lowest traffic counts.*

*As this evaluation of the information is already discussed in Chapter 4 of the GEIS, no changes were made in response to this comment.*

**Comment: 036-086; NE07-001**
One commenter requested a description of the drums used for transportation of yellowcake. Another commenter suggested the yellowcake drum weights reported in GEIS Chapter 1 (Section 1.7.3) and in GEIS Chapter 4 transportation impact sections are not consistent with current DOT requirements at 49 CFR 178.504(b)(9), which limit the drum shipment weight to 400 kg [881.8 lbs].

*Response: Yellowcake is defined as LSA material in NRC and U.S. Department of Transportation regulations. Packages used to ship LSA material must meet the requirements of the U.S. Department of Transportation at 49 CFR 173.427(b). This requirement provides options for packaging and does not limit to the nonbulk quantity of 400 kg [881.8 lbs], although some of the available options would be so limited. As discussed in GEIS Section 2.4.2.3, packages commonly used at ISL facilities to ship yellowcake are 55-gallon steel drums as shown in GEIS Figure 2.4-6. Regarding the discussion of drum weight in GEIS Chapter 4, this statement is presented in the context of describing the assumptions of the accident analysis in the prior GEIS for uranium milling (NRC, 1980). Therefore, the statement is an accurate reflection of the assumptions in that analysis which are expected to be based on regulations and practices in effect at the time of the analysis. Text in Chapter 4 was revised to more clearly link the number to the analysis. The Chapter 1 reference was not changed as it is presented as an example average that implies some variability in actual practice.*

**Comment: 1173-025**
A commenter requested adding in GEIS Section 2.7.2 a discussion of transportation of 11e.(2) byproduct wastes to a licensed facility and the risks involved and also requested that the locations of the 11e.(2) facilities be identified.

*Response: GEIS Chapter 2 is focused on describing the ISL process and the types of activities that normally take place at an ISL facility. The discussions of impacts of transporting waste materials are located in the Chapter 4 transportation impact sections. These sections include a discussion of the potential impacts of transporting 11e.(2) waste materials during the applicable phases of the ISL facility life cycle. Decommissioning byproduct wastes referred to by the commenter are expected to present lower risks than operational yellowcake shipments because of the concentrated nature of yellowcake, the longer distance traveled for yellowcake shipments, and the greater frequency of yellowcake shipments relative to decommissioning shipments of 11e.(2) byproduct wastes.*

*11e.(2) disposal facilities are often located at existing mill sites that have tailings disposal areas that are licensed to accept 11e.(2) byproduct wastes. The existing facilities that are licensed by NRC to accept 11e.(2) byproduct waste for disposal are the Pathfinder-Shirley Basin uranium mill tailings impoundment in Mills, Wyoming, and the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Additionally, three sites are licensed by NRC Agreement States to accept 11e.(2) byproduct material for disposal (i.e., the EnergySolutions site in Clive, Utah; the White Mesa uranium mill site in Blanding, Utah; and the Waste Controls Specialists site in Andrews, Texas). These facilities are not described in detail in the GEIS, because the potential environmental impacts from these facilities are evaluated separately from ISL facility reviews. As discussed in the waste management impacts sections in GEIS Chapter 4, NRC requires ISL licensees to have agreements for byproduct waste disposal in place before operations can begin, thereby ensuring adequate disposal capacity is available* *throughout the life of the ISL facility. In response to this comment, additional links were made between Section 2.7 (Effluents and Waste Management), Section 2.8 (Transportation), and applicable Chapter 4 impact sections.*

**Comment: 028-008; 036-099**
Some commenters requested the GEIS include information and analysis related to use of municipal water treatment ion-exchange resins at ISL sites.

*Response: As noted in the GEIS scoping report (Appendix A) and in GEIS Section 1.5.4, consideration of alternative feed materials for ISL facilities is outside the scope of the GEIS and related information is not needed to support existing GEIS analyses. 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 U.S. demand for uranium or what sources of uranium should be used. As a result, no changes were made to the GEIS in response to these comments.*

**Comment: 036-100**
A commenter questioned why chemical shipments during aquifer restoration would lead to SMALL to MODERATE aquifer restoration transportation impacts in GEIS Section 4.2.2.3 when other potential impacts from transportation are SMALL. It was noted no chemical shipments are solely associated with aquifer restoration.

*Response: As noted in Section 4.2.2.3, the impact conclusions include not only chemical and/or supply shipments but also include employee commuting, which, as with the transportation impact conclusions for the other ISL facility phases discussed in Section 4.2.2, are SMALL to MODERATE (the MODERATE conclusion is based on commuting on low traffic roads as stated). Therefore, the impact is not based on chemical shipments as the commenter asserted. Because the information is already included in the section, no changes were made to the GEIS in response to this comment.*

**Comment: 061-008; 061-009; GR31-006; NE007-005; NE07-004**
Some commenters expressed concerns about small towns and rural communities along yellowcake transportation routes not being adequately trained or equipped in emergency response and hazardous material handling. Another mentioned that emergency response would be slow due to long distances. One requested that accidents must be announced to the public and any spilled material cleaned up.

*Response: NRC has a policy statement regarding response to transportation accidents involving radioactive materials. This policy statement is in NRC Inspection Manual Chapter 1330 and can be located on the NRC public website at www.nrc.gov. The statement clarifies that accidents involving fire, breakage, spillage, or suspected radioactive contamination are required to be reported to the U.S. Department of Transportation in accordance with 49 CFR 171.15 and §171.16. While such reporting is required, the U.S. Department of Transportation rarely responds to the scene. Police departments are usually the first to respond to transportation accidents and know by shipping papers and/or vehicle placarding that radioactive material is involved. If fire is involved, police will notify fire departments. States will also be notified by police and state representatives in almost all cases respond. In most cases, the consigner of the shipment also responds. The state government is responsible for assuring control of the accident scene to protect the health and safety of the public. Additional comments were received on emergency response during accidents, and these were addressed in the Public and Occupational Health section (G5.31). Because carriers* *are exempt from NRC regulations in most cases, there is no obligation for the NRC regional offices to respond and assist in the aspects of radioactive materials control following transportation accidents that occur in transit. Exceptions include notification, providing information and technical assistance if requested by the state, and accident investigation for incidents involving packages of radioactive materials regulated by NRC. If any material is spilled in an accident, the area affected by the spill is cleaned up by the applicable state emergency response authority. Because the GEIS Chapter 4 transportation sections already provide examples of transportation accidents and mention shipper and state involvement in response and cleanup, no changes were made in response to this comment.*

### G5.20.1 References

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## G5.21 Geology and Soils

### G5.21.1 Black Hills Geology

**Comment: 025-004; 1173-057**
One commenter noted that the Nebraska-South Dakota-Wyoming Uranium Milling Region runs under the Black Hills National Forest; with one of the world's largest cave systems, and because of that movement in the foundation rock could cause instability. Another commenter suggested

adding a sentence stating that the igneous intrusions in the northwestern Black Hills, such as Devils Tower, Bear Butte, the Bear Lodge Mountains, and Terry Peak, result from alkalic volcanism in the late Paleocene to early Eocene. This commenter also suggested deleting the reference to Paleocene rocks in the stratigraphic description of the Black Hills (Section 3.4.3.1).

*Response: The NRC staff acknowledges that large cave systems are present within the Black Hills National Forest and that igneous intrusions of late Paleocene to early Eocene age are present in the northwestern Black Hills. Cave systems, such as Jewel Cave, Wind Cave, Rushmore Cave, and Black Hills Caverns, within the Black Hills National Forest are developed in carbonate rocks at distances far removed from potential sandstone-hosted uranium deposits. These caves are located within exposures of Inyan Kara strata, which crop out in a roughly oval pattern around the flanks of the Black Hills (see Figure 3.4-4). Sandstone-hosted uranium deposits occur from 2 to 8 km [1 to 5 mi] outside the exposed Inyan Kara strata (Section 3.4.3.1). Because cave systems in the Black Hills are not in the proximity of potential uranium deposits, they will not affect the stability of rocks and sediments at potential ISL sites. Likewise, igneous intrusions in the northwestern Black Hills are not in the proximity of potential or existing sandstone-hosted uranium deposits and will not affect potential ISL mining operations. In addition, igneous intrusions resulting from alkalic volcanism in the late Paleocene to early Eocene are not referenced in the literature as sources of uranium for the sandstone-hosted uranium deposits in the Black Hills. Upon review of Black Hills stratigraphy described in Harshman (1968), the NRC staff agrees that the reference to "Paleocene" rocks should be deleted and replaced with "Pliocene" rocks in Section 3.4.3.1. In response to the comment concerning rock ages in the Black Hills, the reference to "Paleocene" rocks was deleted and replaced with "Pliocene" rocks in Section 3.4.3.1.*

### G5.21.2 Soil Impacts of Waste Disposal

**Comment: 050-047; 050-098; 050-099; 1173-069; 1173-070**
Several commenters expressed concern about the soil impacts of waste disposal at ISL sites, specifically, evaporation pond liner leaks and land application of treated process water. One commenter noted that soils, grasses, and surface water could be impacted if evaporation pond liners fail or water is discharged from evaporation ponds. The commenter noted that if projects use land application for water disposal, this could negatively impact soils and vegetation. Another commenter questioned the significance of soil impacts from evaporation pond liner failures and whether NRC could implement additional mitigation measures to prevent or reduce the likelihood of such impacts. This commenter also questioned the significance of land application on soil impacts, especially given the presence of selenium and other heavy metals and radionuclides in the waste, and the disposal of contaminated soil during decommissioning. Another commenter noted that land application could degrade soil productivity and site potential and questioned whether it would be helpful to monitor for loss of soil productivity and changes in vegetative composition and production.

*Response: Potential soil impacts resulting from evaporation pond liner failures and land application of treated wastewater in the uranium milling regions are discussed in Sections 4.2.3, 4.3.3, 4.4.3, and 4.5.3. Past leaks resulting from evaporation pond liner failures at ISL facilities and the corrective actions taken are discussed in Section 2.11.2. The significance of soil impacts resulting from evaporation pond liner failures and land application were determined based on required routine inspections, monitoring programs, and decommissioning activities. To mitigate soil contamination resulting from evaporation pond liner failures, NRC-licensed ISL facilities are designed with leak detection systems and pond embankments are monitored and* *inspected in accordance with NRC-approved inspection programs. Licensees are required to maintain sufficient reserve capacity in the evaporation pond system to enable transferring the contents of a pond to other ponds in the event of a leak and subsequent corrective action and liner repair. The licensee uses its environmental monitoring program (Chapter 8) to identify soil impacts caused by land application. The requirements for monitoring soils and sediments for radiological contamination at ISL facilities, typically on an annual basis, are included in licenses issued by NRC (Section 8.2.2). Monitoring includes analyzing water before it is applied to the land and soil sampling to ensure that concentrations of radionuclides and other metals are within allowable limits. States regulate land application of wastewater and impose release limits on nonradiological constituents. Although soil productivity and site potential can be affected by land application of treated wastewater, state and federal regulations do not require ISL licensees to monitor for loss of soil productivity and changes in vegetative composition and production resulting from land application. Land application areas are included in decommissioning surveys. The primary steps in decommissioning of ISL facilities, including the cleanup and disposal of contaminated soils, are described in Section 2.6. In response to the public comments, additional information was added to Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2 to clarify the potential effects of land application on site potential and to clarify that land application of nonradiological constituents is regulated by the state.*

### G5.21.3 Soil Disturbance Concerns

**Comment: 050-048; 1173-063; 1173-064**
A number of commenters expressed concerns about soil disturbance at ISL facilities. One commenter was concerned about topsoil protection and the measures implemented to mitigate loss of topsoil. Another commenter suggested that the nature of soil disturbance (e.g., erosion, runoff, compaction, and sedimentation) and the reasonable and foreseeable acres of disturbance be disclosed. This commenter also suggested that a predictive estimate of erosion, runoff, and sedimentation should be included in the GEIS. Another commenter suggested that NRC clarify that topsoil and subsoil should be segregated when excavating trenches for pipelines and cables so that the general soil profile can be reestablished during backfilling.

*Response: Potential soil impacts resulting from construction activities at ISL facilities are discussed in Sections 4.2.3.1, 4.3.3.1, 4.4.3.1, and 4.5.3.1. These sections include a discussion of Earth-moving activities that will result in soil disturbance. Impacts to topsoil are commonly mitigated using best management practices. The GEIS refers to Chapter 7, where best management practices related to protection of geology and soils are described in Table 7.4-1. Based on information from historical operation of ISL milling facilities, much of the permitted area of a site is undisturbed and surface operations (wells, processing facilities) affect only a small portion of the permitted area (Sections 2.11.1 and 4.2.1). Predictive estimates of erosion, runoff, and sedimentation would require detailed site-specific information such as soil characteristics, planned waste disposal methods, and estimated areas affected by construction of surface facilities, evaporation ponds, and well fields. These types of predictive estimates are beyond the scope of the GEIS and would be best evaluated, if necessary, at the site-specific environmental review level. NRC agrees that the GEIS should clarify that operators should segregate topsoil and subsoil during trenching so that the general soil profile can be restored during backfilling. In response to the public comments, Sections 4.2.3.1, 4.3.3.1, 4.4.3.1, and 4.5.3.1 were revised to include (1) a description of the nature of soil disturbance resulting from construction activities; (2) additional information on the mitigation measures used to protect* *topsoils; and (3) additional text to clarify that topsoil and subsoil should be segregated during trenching so that the general soil profile can be restored when backfilling.*

### G5.21.4 Subsidence Risks

**Comment: 050-095**
A commenter wanted NRC to explain how depth of uranium source formations would decrease subsidence risk.

*Response: The risk of subsidence at ISL facilities resulting from ISL operations is discussed in Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2. In these sections, impacts to geology from ground subsidence were expected to be SMALL because the uranium mobilization and recovery process does not result in removal of rock matrix or structure from the target sandstones and because uranium mineralization occurs at hundreds to thousands of feet below the ground surface (Section 2.1.2). In addition, the thickness of individual mineralization fronts in sandstone-hosted uranium deposits is typically 0.6 to 7.5 m [2 to 25 ft] (Section 3.1.2). At the depths and thicknesses of mineralized zones and considering that rock matrix is not removed in the uranium mobilization and recovery process, it is unlikely that any collapse in the target sandstones resulting from ISL operations would be translated to the ground surface. In response to the public comment, additional information was added to Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2 to clarify how the depth and thickness of uranium mineralization in sandstone-hosted uranium deposits would decrease subsidence risks.*

### G5.21.5 Reactivation of Faults

**Comment: 050-096**
A commenter wanted clarification of the reactivation of faults statement in Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2. Specifically, the commenter suggested rewording the reactivation of faults statement to read, "Based on historical ISL operations, reactivation of faults [is not anticipated] in the ... Region."

*Response: Reactivation of faults resulting from ISL operations is discussed in Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2. In each of these sections, the GEIS states that "Based on historical ISL operations, reactivation of faults has not been observed in the ...Region." Upon review, the NRC staff agrees with the commenter that this statement should read, "Based on historical ISL operations, reactivation of faults is not anticipated in the ...Region," and has revised text accordingly in these sections.*

### G5.21.6 Soil Impacts From Surface Spills

**Comment: 050-097; 1173-065; 1173-067; CH07-004**
Several commenters expressed concerns about soil impacts resulting from surface spills and the detection and remediation of surface spills. One commenter was concerned about the detection of surface spills. Another commenter was concerned about the significance of surface spills and the effectiveness of spill responses. Another commenter suggested that NRC cite data to support assertions that spills are caught and remediated promptly and that spill response plans are mandatory (required) rather than expected as indicated in the GEIS. Another commenter asked about the evidence leading to the conclusion that soil impacts from spills would be temporary and SMALL.

*Response: Spills and leaks resulting from pipeline ruptures or the failure of pipeline and wellhead fittings and valves are discussed in Section 2.11.2. Impacts to soil resulting from spills are discussed in Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2. In these sections, NRC does not assert that spills are caught promptly. Licensees typically instrument and record pipeline pressures to detect unexpected loss of pressure and potential spills resulting from ruptured piping or the failure of fittings and valves (Sections 2.3.1.2 and 8.2.5). As part of the monitoring requirements at ISL facilities, licensees are required to report spills to the NRC within 24 hours of detection and establish immediate spill responses through onsite operating procedures (NRC, 2003). Best management practices for preventing releases of contaminants to the environment are discussed in Chapter 7 and include collecting and monitoring soils and sediments for potential contamination. NRC typically requires licensees to implement spill prevention and response plans described in the license application. As discussed in Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2, in the short term, impacts to soils from spills could range from SMALL to LARGE depending on the volume of soil affected by the spill. Based on licensee requirements including immediate spill responses following detection, spill recovery actions (e.g., recovering as much of the spilled fluids as possible), and monitoring programs (collecting samples of affected soil to determine level of contamination), the overall long-term soil impacts from spills are expected to be SMALL. In response to the public comments, Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2 were revised to indicate that "upon detection" licensees are "required" (rather than expected) to establish immediate spill responses through onsite standard operation procedures (NRC, 2003).*

### G5.21.7 Underestimation of Soil Impacts

**Comment: 059-007**
A commenter was concerned that the GEIS underestimates soil impacts. For all phases of ISL activities, the commenter noted that most of the soil impacts in the GEIS are understated as SMALL.

*Response: Potential soil impacts for all phases of ISL activities (construction, operation, aquifer restoration, and decommissioning) are discussed in Sections 4.2.3, 4.3.3, 4.4.3, and 4.5.3. The significance of potential soil impacts resulting from ISL activities was determined based on an analysis of best management and construction practices (Chapter 7 and Section 2.7.2), estimated area of soil disturbance resulting from construction activities (Section 4.2.1), required routine inspection and monitoring programs (Chapter 8), spill response and recovery actions (Sections 4.2.3, 4.3.3, 4.4.3, and 4.5.3), and decommissioning activities (Section 2.6). The NRC staff believes that the licensee's required spill response and recovery procedures will maintain SMALL impacts to soil resources. Because information used to determine the significance of potential soil impacts is included in the GEIS, no changes to the GEIS were made beyond this response.*

### G5.21.8 Earthquake Assessment

**Comment: 061-010; CH11-007**
A commenter was concerned about earthquakes in the uranium milling regions and suggested that individual site-specific studies are needed to assess earthquake activity in the uranium milling regions because of earthquakes' potential impacts on underground pipes and aquifers at ISL sites. Another commenter was concerned about how earthquakes are addressed in the GEIS.

*Response: The NRC staff acknowledges that earthquakes in the uranium milling regions have the potential to damage well casings and produce faulting and fracturing in confining units that could potentially cause cross-contamination of aquifers. The NRC staff also agrees with the commenter that the assessment of earthquake activity in the regions is best evaluated by site-specific studies. To estimate the potential of earthquake activity at new and existing ISL facilities, NRC requires licensees to submit an assessment of historical and recent seismic activity (NRC, 2003). The review of potential seismic activity impacts on ISL operations is part of an NRC safety review that is conducted in parallel with and informs the NRC environmental review. Because the comments represent a concern that is assessed at the site-specific safety review level, no changes in the GEIS were made beyond this response.*

## G5.21.9 Characterization of Producing and Confining Units

**Comment: 1173-013; 1305-095; AL15-050**
Several commenters were concerned about the characterization of producing and confining units. One commenter noted that the GEIS does not explain the degree to which confining layers may transmit water and the areal extent of confining layers. Another commenter suggested that the GEIS provide more information on the relevance of different confining layers, how this impacts potential for excursions, and what past experience has shown. Another commenter noted that the geology and hydrology characterization in the GEIS was inadequate (i.e., did not account for local unconformities and heterogeneities of confining units).

*Response: Uranium-bearing sandstone aquifers in the uranium milling regions are described in Sections 3.2.4.3.3, 3.3.4.3.3, 3.4.4.3.3, and 3.5.4.3.3. The description of the uranium-bearing sandstone aquifers includes a discussion of the hydrogeologic characteristics of the sandstone aquifers and available information on the level of confinement (i.e., the thickness, continuity, and permeability of confining units) and occurrence of unconformities (e.g., faults and fractures) in confining units. Assessment of the degree of confinement is an important part of the site-specific review. The potential impacts to groundwater resulting from ISL operations, including excursions from production zones, are described in Sections 4.2.4.2, 4.3.4.2, 4.4.3.2, and 4.5.3.2. Excursions and excursion monitoring during ISL operations are discussed in Section 2.4.1.3. Historical information on excursions and recovery actions from historical operation of ISL uranium milling facilities are discussed in Section 2.11.4. Because the GEIS includes a discussion and evaluation of the hydrogeologic characteristics of producing and confining units in the four uranium milling regions, no changes to the GEIS were made beyond the response.*

## G5.21.10 Age of Precambrian

**Comment: 1173-031**
A commenter noted that Precambrian is older than approximately 540 million years, not 453 million years as stated in the GEIS.

*Response: The NRC staff agrees that Precambrian is older than 540 million years, not older than 453 million years. In response to the public comment, the age of the Precambrian stated in Sections 3.2.3 and 3.3.3 was changed from 453 to 540 million years.*

### G5.21.11 Powder River Basin Geology

**Comment: 1173-GS-044; 1173-GS-045; 1173-GS-046; 1173-GS-047; 1173-GS-048; 1173-GS-049**
A commenter noted the following concerning geologic aspects of the Powder River Basin:

1. The Powder River Basin did not exist prior to the Laramide orogeny (Late Cretaceous time; 65 to 99 million years ago), and development and deposition in the basin began during Paleocene time (55 to 65 million years ago).

2. The Pumpkin Buttes in the Powder River Basin are capped by the Oligocene White River formation. Although erosion has removed much of the Miocene/Oligocene units, the Pumpkin Buttes remain.

3. The Wasatch formation in the Powder River Basin also contains thick coal beds.

4. The Moonstone, Spilt Rock, Wagon Bed, and Arikaree formations do not exist in the Powder River Basin.

5. The Fort Union formation in the Powder River Basin also contains thick, continuous coal beds.
6. The Lance formation is underlain by the Fox Hills formation. Below the Fox Hills formation is thick, marine Pierre Shale.

*Response: After reviewing geologic history and stratigraphy of the Powder River Basin, the NRC staff agrees with these comments. In response to the public comments, information was added to Section 3.3.3 and Figure 3.3-5 was revised. Because stratigraphic descriptions presented in the GEIS were limited to formations involved in potential milling operations or that have environmental significance, information on the Fox Hills Formation and the Pierre Shale was not included in the Section 3.3.3 and Figure 3.3-5 revisions.*

### G5.21.12 Fractures and Faults

**Comment: 1309-013; AL15-051**
Two commenters expressed concerns about faults and fractures as pathways for groundwater and surface water contamination. One commenter noted that the GEIS fails to analyze local faults and fractures as migration pathways between the mined aquifers and other nearby aquifer. Another commenter noted that faults and fractures render the confined aquifer concept moot and that characterization of faults and fractures needs consideration at the site-specific review level.

*Response: The NRC staff recognizes that faults and fractures that crosscut confining layers may lead to migration pathways between mineralized aquifers and overlying and underlying nonmineralized aquifers. Faults and fractures are evaluated at the site-specific environmental review level (Section 2.2). NRC license and UIC permit conditions require that licensees conduct periodic tests to detect and protect against the movement of lixiviant from production zones and beyond the boundaries of the well field (Section 2.4.1.3). These tests include conducting pump tests in each well field prior to operations to evaluate the confinement of the production horizon and well field characterization to identify geologic features (e.g., thinning* *confining layers, fractures, high flow zones) that might result in excursions. Licensees are required to maintain groundwater monitoring programs (see Chapter 8) to detect both vertical and horizontal excursions and must have operating procedures to analyze an excursion and determine how to remediate it (Section 2.4.1.4). Because characterization and the potential impacts of faults and fractures are addressed in the GEIS, no changes to the GEIS were made beyond this response.*

## G5.21.13 Uranium Geochemistry

**Comment: 1314-048**
A commenter noted that the GEIS does not adequately describe uranium geochemistry. The commenter indicated that the description of uranium geochemistry does not discuss the range of redox values and concentration ranges for uranium, radium, arsenic, selenium, molybdenum, or other significant contaminants generally seen in undisturbed ore deposits.

*Response: The general geochemistry of uranium (common isotopes, oxidation states, and uranium minerals) is briefly described in Section 2.1.1. The physical characteristics and formation of roll-front uranium deposits are described in Sections 2.1.2 and 3.1.2. The GEIS does not include a discussion of other contaminants that are generally present in roll-front deposits, such as arsenic, selenium, and molybdenum. Important redox reactions and the concentration ranges for uranium, selenium, vanadium, and arsenic in roll-front uranium deposits in Wyoming are reported in Harshman (1974) and Davis and Curtis (2007). In response to the public comment, information on other important contaminants and ore minerals in roll-front uranium deposits and the distribution and concentrations of some trace and minor contaminants in roll-front deposits was added to Section 3.1.2, In addition, Figure 3.1-5 was revised to show the geochemical zonation of uranium and other metal and mineral components in roll-front deposits.*

## G5.21.14 Potential Earthquakes From Deep Well Injection

**Comment: 015-011**
A commenter expressed concerns about how the conclusions for potential earthquake impacts from deep well injection were reached.

*Response: In Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2, the GEIS discusses pressure changes in the uranium-producing sandstones due to ISL operations (i.e., due to injection and pumping of lixiviant) and the potential effects of pressure changes on faults in permitted areas. Because uranium-bearing sandstones at ISL sites tend to be highly porous and transmissive, it is unlikely that changes in fluid pressure would reactivate faults or trigger or induce earthquakes. Although deep well injection is described as an alternative for waste disposal in Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2, the GEIS does not discuss potential earthquake impacts resulting from deep well injection. In response to the public comment, additional information was added to Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2 to clarify the basis for the unlikely probability for earthquake generation from fluid pressure changes in the producing aquifer.*

### G5.21.15 Sandstone Uranium Deposits Compromised by Extensive Conventional Mining

**Comment: 032-025**
A commenter noted that extensive conventional mining activities, resulting in connection of large subsurface areas, and inadequate plugging of exploration holes have compromised favorable conditions for ISL mining in portions of the Grants Uranium District.

*Response: The NRC staff acknowledges that conventional uranium mining and inadequate plugging of exploration holes can compromise favorable conditions for ISL mining. The applicant should evaluate potential site-specific conditions resulting from previous mining activities and improper well abandonment that may adversely affect ISL operations. The issues raised by the commenter are important aspects addressed by the applicant in the site-specific reviews. Ground subsidence resulting from conventional underground mine workings is cited as a potential issue affecting ISL mining conditions in the Grants uranium district (Section 4.5.3.2). Historical information on excursions resulting from improperly plugged and abandoned wells from exploratory programs at ISL recovery sites and from abandoned mine workings are discussed in Section 2.11.4. Because information citing the effects of conventional mining activities and improperly plugged and abandoned wells on ISL mining is included in the GEIS, no changes to the GEIS were made beyond this response.*

### G5.21.16 Clarify Whether Mesaverde Group Aquifer Includes Tres Hermanos

**Comment: 032-037**
A commenter noted that the GEIS should clarify whether the Mesaverde Group Aquifer includes the Tres Hermanos A, B, and C units, which are sandstones within the Mancos Shale.
*Response: The Mesaverde Group Aquifer is described in Section 3.5.4.3.1. The NRC acknowledges that, locally, the Mancos Shale confining unit contains minor, water-yielding sandstone strata referred to as the Tres Hermanos A, B, and C units. Based on the level of detail intended for the description of sandstone aquifers and confining units in the GEIS, the Tres Hermanos units were not included in the description of the Mesaverde Group Aquifer. However, the occurrence of Tres Hermanos A, B, and C in the subsurface at new and existing ISL sites should be incorporated in the description of the affected environment at the site-specific environmental review level. Because the comment represents a concern that is beyond the level of detail intended for the GEIS, no changes to the GEIS were made beyond this response.*

### G5.21.17 Basis for 10 Percent Disturbed Land

**Comment: 036-018**
A commenter noted that no basis is given in the Geology and Soils Impacts section of the Executive Summary for the statement that "approximately 10 percent of the total site area" will be disturbed by construction activities during an ISL project's life cycle.

*Response: Information on the total permitted areas of past and current uranium recovery operations is provided in Section 2.11.1. Information on total permitted areas of existing and new ISL facilities in comparison to the total (disturbed land) surface area of existing and new ISL facilities (including wells fields, processing facilities, and satellite plants) is provided in Section 4.2.1. Based on the comment, the NRC staff reviewed the estimate and found that, historically, the amount of land disturbed was variable, but on average, 15 percent of the* *permitted area was impacted. The Geology and Soils Impacts section of the Executive Summary, Section 2.11.1, and the impact summary tables in Chapter 10 were revised to reflect that approximately 15 percent of the permitted area was disturbed by construction activities..*

## G5.21.18 Statement About Permanent Change to Rock Formations in Section 4.2.3.2

**Comment: 036-101**
A commenter noted that the statement that the removal of uranium from uranium ore bodies "will result in a permanent change to the composition of rock formations" in Section 4.2.3.2 could be read to imply the potential of significant impacts when no such impacts will occur.

*Response: The NRC staff agrees that the statement concerning removal of uranium from target sandstones in Section 4.2.3.2 could convey to interested stakeholders that ISL operations could result in significant, permanent impacts to aspects of site geology when no such impacts would occur. In response to the public comment, the first sentence in the second paragraph of Sections 4.2.3.2, 4.3.3.2, 4.4.3.2, and 4.5.3.2 was revised to read, "The removal of uranium mineral coatings on sediment grains in the target sandstones during the uranium mobilization and recovery process will result in a change to the mineralogical composition of the uranium-producing formations."*

## G5.21.19 Uranium Resources in New Mexico

**Comment: GA08-003**
A commenter noted that a study done by Arrowhead Center in Las Cruces estimated that New Mexico has up to 154,700 metric tons [341 million lbs] of uranium ore. The commenter also noted a geological prediction that another 136,100 metric tons [300 million lbs] of ore is deposited in this particular area.

*Response: The estimate of 154,700 metric tons [341 million lbs] of uranium ore in New Mexico is consistent with published data on uranium reserves within the Morrison Formation in the Grants District of New Mexico (McLemore, 2007; Table 5). The geological prediction of another 136,100 metric tons [300 million lbs] of ore deposited in this particular area could not be substantiated based on a review of recent published information on uranium resources in New Mexico (Energy Information Administration, 2004; McLemore, 2007). Because the estimate of 154,700 metric tons [341 million lbs] of uranium ore in New Mexico is consistent with published data on uranium reserves in the Morrison Formation, information on estimated uranium reserves within the Morrison Formation in the Grants District was added to Section 3.5.3.*

## G5.21.20 Movement of Oxidized Uranium

**Comment: GA23-004**
A commenter noted that uranium is very mobile in the environment in the hexavalent form and, in runoff situations, can move rapidly into the soil column and into shallow groundwater.

*Response: The NRC staff agrees with the observation that uranium in the hexavalent form (+6 oxidation state) can be mobile in surface water and groundwater and in the soil column. Potential environmental impacts of releases of uranium to soil and surface water from ISL operations and their mitigation are discussed in the GEIS Sections 4.2.3.2 and 4.2.4.1.2.*

*Requirements to mitigate the environmental consequences of any releases of uranium to soil, surface water, or groundwater are included in any license issued by NRC. The license conditions also require the licensee to restore any affected soil to radionuclide concentrations or conditions specified in 10 CFR Part 40, Appendix A, Criterion 6(6) and to restore affected groundwater to concentrations of hazardous constituents specified in 10 CFR Part 40, Appendix A, Criterion 5B(5). In response to the public comment, information on the mobility of oxidized uranium in the environment was added to the discussion of uranium geochemistry in Section 2.1.1.*

## G5.21.21 Geology of Ore Zones

**Comment: GR08-001**
A commenter noted that the drawings (schematic illustrations) of roll-front ore bodies are in most instances not representative of actual ore bodies in the underground. He commented that some ore bodies are up and down (stacked).

*Response: Ideal crescent- or C-shaped cross-sectional views of sandstone-hosted uranium roll-front deposits are generally presented in drawings to illustrate the zoning, alteration, and mineralogical changes associated with their formation (Figure 2.1-1). In the actual subsurface, sandstone-hosted uranium roll-front deposits can take many forms depending on the continuity and displacement along faults of producing and confining layers (Figure 2.1-2). As described in Section 3.5.3, roll-front uranium deposits can be discordant, asymmetrical, and irregularly-shaped, and can cut across sedimentary structures. In response to the public comment, information on the physical characteristics of roll-front deposits was added to Section 2.1.2.*

## G5.21.22 Depth of Ore Zone

**Comment: NE02-001**
A commenter asked about the average depth that uranium is recovered at ISL mines.

*Response: The depth to the production (recovery) zone at ISL mines is variable, ranging from 100 to 200 m [328 to 656 ft] (e.g., Church Rock, New Mexico; Gas Hills, Wyoming; Smith Ranch, Wyoming; and Crow Butte, Nebraska) to greater than 560 m [1,840 ft] at Crownpoint, New Mexico (GEIS Section 2.1). The depths of mineralized zones in uranium source formations in the uranium milling regions are discussed in Sections 3.2.3, 3.3.3, 3.4.3, and 3.5.3. The depth of uranium recovery at new ISL sites will be incorporated in the description of the affected environment at the site-specific environmental review level. Based on information on the depths of production zones at ISL sites in the uranium milling regions included in the GEIS, no changes to the GEIS were made beyond this response.*

## G5.21.23 References

Davis, J.A. and G.P. Curtis. NUREG/CR–6870, “Consideration of Geochemical Issues in Groundwater Restoration at Uranium *In*-Situ Leach Mining Facilities.” Washington, DC: NRC. January 2007.

Energy Information Administration. “Uranium Reserve Estimates.” 2004. <www.eia.doe.gov/cneaf/nuclear/page/reserves/ures.html> (14 September 2007).

Harshman, E.N. "Distribution of Some Elements in Some Roll-Type Uranium Deposits." *Formation of Uranium Ore Deposits.* pp. 169–183. Vienna, Austria: International Atomic Energy Agency. 1974.

McLemore, V.T. "Uranium Resources in New Mexico." Society of Mining and Metallurgical Engineering Annual Meeting, Denver, Colorado, February 25–28, 2007. Littleton, Colorado: Society of Mining and Metallurgical Engineering. 2007.

NRC. "Uranium Deposits in Wyoming and South Dakota." *Ore Deposits in the United States 1933–1967.* New York City, New York: American Institute of Mining, Metallurgical and Petroleum Engineers. pp. 815–831. 1968.

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

## G5.22 Groundwater Resources

### G5.22.1 General Concerns About ISL and Groundwater Contamination

**Comment: 001-001; 001-004; 017-012; 024-004; 035-001; 044-002; 1045-002; 1309-002; 1313-001; 345-002; 963-002; 1606-002; AL25-115; AL34-167; CH06-004; CH-08-008; GA01-003; GA08-008; GA10-003; GR01-003; GR06-005; GR14-006; GR24-002; HC007-003; NE01-005; SP11-006; SP12-003**
One commenter stated that ISL operations did not contaminate or significantly impact adjacent nonexempt groundwater resources over the past 30 years and asked to move forward with the GEIS. On the other hand, several commenters raised concerns in a broader sense regarding irreversibility and significance of ISL-induced groundwater contamination and its potential adverse impacts on people and neighboring states. Another commenter raised concerns about accidents and alleged violations.

*Response: As part of site characterization, the licensee is required to analyze and describe the hydrogeology of the site at the site-specific level, the integrity of the ore-bearing aquifer, and the level of natural confinement to ensure hydrogeological isolation of ore-bearing aquifers [NUREG–1569 (NRC, 2003a, Section 2.7.3)].*

*As discussed in GEIS Section 1.7.2.1, before ISL operations commence, the licensee needs to obtain an Underground Injection Control (UIC) permit and aquifer exemption for the ore-bearing aquifer (or a portion of it) where the licensee intends to conduct operations. GEIS Section 8.3.1.2 explains that the licensee is required by license condition to place site-specific excursion monitoring around the ISL well field for early detection of any problems with horizontal and vertical containment of recovery solutions in the exempted portion of the aquifer. Spacing for monitoring wells to detect horizontal excursions is variable, based on site-specific conditions, and has historically ranged from 90–150m [300–500ft] apart. Spacing for monitoring wells to detect vertical excursions in overlying and underlying aquifers is variable and ranges from one well per 1.21 ha [3 acres] to one well per 2 ha [5 acres]. If a horizontal or vertical excursion is detected, the licensee is required to report the excursion to NRC, following reporting requirements described in GEIS Section 8.3.1. GEIS Section 2.5 explains that the aquifer restoration program is designed to ensure that the water quality and the groundwater use in nonexempted aquifers will remain unaffected by uranium recovery operations. As discussed in GEIS Section 2.10, the licensee is required to provide financial sureties for cleanup and* *groundwater restoration, which are reviewed annually by the NRC staff. GEIS Section 1.7.1 discusses that the NRC staff ensures that the licensee complies with conditions of its NRC license and applicable regulations through an inspection program for ISL uranium recovery facilities. These procedures have been developed and implemented to ensure public health and safety. The NRC staff is not aware of any incidents in which water use in nonexempt portions of an ore-bearing aquifer has been impacted by contamination from ISL operations under its regulations. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL30-152**
A commenter stated that water in regional aquifers moves slowly; therefore, it is impossible to have regional contamination due to slowly moving groundwater {at a typical rate of 0.25 cm [0.1 in] per day}.

*Response: The extent and severity of potential regional-scale groundwater contamination due to ISL operations would be affected by conditions such as hydrogeological characteristics of the ore-bearing aquifers, the continuity and integrity of confining layers, groundwater velocity and direction at the local and regional scales, existence of fast flow paths through fractures in ore-bearing zones, seismic-induced activities, and the presence of active faults. Although the potential for regional-scale groundwater contamination due to ISL operations cannot be completely ruled out, the risk for regional-scale contamination is minimized or avoided by proper measures. To that end, the applicant is required to (1) analyze and report detailed hydrogeological characteristics of ore-bearing aquifers and the continuity and integrity of confining layers (GEIS Sections 3.2.4.3, 3.3.4.3, 3.4.4.3, and 3.5.4.3), (2) keep the production bleed (i.e., removal from the circuit) on the order of 1–3 percent of the pumped water during ISL operations (unless the applicant needs to adjust bleeds to retrieve excursions back into the production zone) (GEIS Section 2.4.1.2), and (3) place excursion monitoring wells to ensure the containment of recovery solutions within the production zone (GEIS Section 8.2.5) without affecting adjacent non-exempt groundwater quality. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 004-004**
A commenter raised concerns regarding potential contamination of groundwater due to changes in rainfall.

*Response: Ore-bearing aquifers at ISL facilities are generally confined sandstone aquifers, and their recharge zones (outcrop areas) typically are not within or in the vicinity of the ISL facilities. Considering slow flow velocities in these aquifers, short-term episodic precipitation events are not expected to significantly change potentiometric heads at the ISL sites. However, as part of site characterization as described in NUREG–1569 [NRC, 2003a, Section 2.7.3(5)], the applicant is required to analyze seasonal and historical variability of potentiometric heads at least over 1 year prior to ISL operations. These data would be used by the NRC staff during the site-specific environmental review to assess potential impacts of changes in precipitation on potentiometric heads within and in the vicinity of the ISL facilities. No changes were made to the GEIS beyond the information provided in this response.*

### G5.22.2 Importance of Water and Consumptive Use

**Comment: SP09-001; SP12-006**
A few commenters raised concern about regulation of exploratory wells and the impacts of large consumptive water uses during exploratory work on public wells.

*Response: NRC does not regulate preoperational exploratory wells and has no responsibility for permitting (and subsequent abandoning of) such exploratory wells before the site is licensed for ISL operations. The applicant is responsible for obtaining the necessary permits for drilling wells from the appropriate EPA, BLM, or state programs. As described in GEIS Section 1.7, the NRC staff would consider permit status and hydrologic testing of preoperational exploratory wells as part of the site-specific environmental review for a given ISL facility. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-105**
One commenter wanted to know how much water is consumed during construction.

*Response: As discussed in GEIS Sections 2.11.3, 4.2.4.2.1, 4.3.4.2.1, 4.4.4.2.1, and 4.5.4.2.1, groundwater use during construction is limited to routine activities such as dust suppression, mixing cement, and drilling support. The amounts of groundwater used in these activities are small relative to consumptive water uses during operations. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 012-002; 016-001; 025-003; 027-006; 031-006; 031-010; 050-036; 1015-010; 1309-003; 1309-012; 1315-001; 1317-007; 1317-013; 1602-012; AL02-003; AL06-111; AL25-123; CH07-014; CH08-011; CH12-001; GA10-007; GA14-002; GA15-006; GA25-002; GI01-006; GI02-009; GR14-004; NE01-004; NE06-001; SP12-004**
A commenter noted that estimate of consumptive groundwater use during ISL operations is conservative. However, several commenters raised concerns about large consumptive water uses during ISL operations and restoration, and their potential adverse impacts on and irreversible commitment and depletion of groundwater, which is considered to be an important and valuable water resource in arid and drought-prone high desert regions. Another commenter stressed the importance of water supplies by referring to escalating conflicting water demands especially in the western states.

*Response: Analysis and estimates for consumptive water use during ISL operations are to be addressed by the applicant as part of site characterization in an environmental review. As discussed in GEIS Section 2.4.1.2, the production bleed is typically 1–3 percent of the pumped water during ISL operations, suggesting a small fraction of pumped water is not returned to the production aquifer during ISL operations. The consumptive water use in 1 year {e.g., 0.2 million $m^3$ [63,000,000 gal], assuming a constant pumping rate of 0.4 $m^3/s$ [6,000 gal/min] and a 2 percent bleed}, as an example, is equivalent to the volume of water used to irrigate 18 ha [44 acres] for 1 year in Wyoming, as discussed in GEIS Chapter 4. The impacts of consumptive groundwater use on groundwater are discussed in Sections 4.2.4.2.2.2, 4.3.4.2.2.2, 4.4.4.2.2.2, and 4.5.4.2.2.2. In these sections, based on a small production bleed rate and site-specific hydrogeological properties of ore-bearing aquifers, the potential short-term impacts of groundwater use during ISL operations are estimated to be MODERATE and potential long-term impacts of consumptive water use during ISL operations on groundwater is deemed to be SMALL. Because the information has already been described* *in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-106**
One commenter wanted to know why consumptive use impacts are "MODERATE" and dependent on other users.

*Response: As described in GEIS Section 4.2.4.2.2.2, under a hypothetical case of the withdrawal of 0.25 $m^3/s$ [4,000 gal/min] from a single well with a 2 percent bleed and assuming representative transmissivities and storage coefficients, drawdowns of 71, 55, and 39 m [233, 180, and 128 ft] were reported at 1, 10, and 100 m [3.3, 33, and 330 ft] from the extraction well, which typically lie in the production zone over 10 years of operation, and hence represent the largest expected drawdowns in the area. Drawdowns typically decline exponentially away from the production zone toward the nonexempted portion of the ore-bearing aquifer, where the impacts on groundwater quality and quantity are the major concerns to water consumers. The consumptive groundwater use during ISL operations is estimated to be MODERATE in the GEIS due to a small production bleed rate, which is typically 1–3 percent of the pumped water.*

*The short-term consumptive water use impacts depend on other users because drawdowns during ISL operations could impact potentiometric head levels and, hence, pumpage rates and pumpage costs at privately owned production wells within and in the vicinity of the permit area if these wells are operated for drinking, irrigation, or livestock. However, in the long term, the operational impacts are estimated to be SMALL in the GEIS, because localized drawdowns will dissipate over time. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1305-084**
One commenter noted that GEIS Section 2.11.3, Page 2–46, Lines 27–33 fails to provide context for consumptive water use impacts.

*Response: Section 2.11.3, Page 2–46, Lines 27–33 provides an example for consumptive groundwater use at the Crow Butte ISL facility, but this section is not intended to provide estimates for consumptive water use impacts. The consumptive water use impacts for four uranium milling regions are discussed in GEIS Sections 4.2.4.2.2, 4.3.4.2.2, 4.4.4.2.2, and 4.5.4.2.2. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 015-025**
A commenter noted that expressing the operational consumptive water use in terms of irrigation water use should consider irrigation return flow for more accurate analysis.

*Response: The main purpose of expressing the total consumptive water use in terms of irrigation water consumption is to provide a basis for comparison in a general context. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1321-033**
A commenter asked to examine consumptive use sufficiently given that the consumptive use could be significant in water basins.

*Response: Impacts of consumptive water use on groundwater during construction, operational, and restoration phases for four uranium milling regions are discussed in a broader sense in Chapter 4. The short- and long-term impacts of, in particular, ISL operations and aquifer restorations depend on site-specific conditions. Therefore, the applicant is required to analyze and report detailed characterization of hydrogeology of the subsurface system and assess potential impacts of consumptive water use on groundwater during different phases of ISL activities. This information is expected to be included as part of site characterization and provided as part of a license application (NRC, 2003a). Because information on this topic has already been described in the GEIS and additional analysis will be completed in site-specific reviews, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-020**
A commenter asked for an explanation of how the amount of water used in operations could be reduced by available treatment methods.

*Response: As discussed in Executive Summary, Page xli, the amount of water used in operations can be reduced by using available treatment methods such as reverse osmosis and brine concentration. This issue is further discussed in GEIS Section 2.7.3 and 2.5.3. Because the information has already been described in the GEIS, minor revisions have been incorporated into these sections in the GEIS to improve the clarity.*

**Comment: 036-021**
A commenter noted that the statement in the Draft GEIS Executive Summary that the consumptive use of water during restoration is less than during operations was incorrect.

*Response: The NRC staff agrees with the comment, and the sentence has been rewritten to clarify that groundwater consumptive use during aquifer restoration could be greater than during ISL operation, if groundwater sweep is implemented during aquifer restoration in which pumped water is not recirculated. The same clarification has also been included in GEIS Chapter 10.*

### G5.22.3 Site Characterization, Aquifer Exemption, and Baseline Water Quality

#### G5.22.3.1 Site Characterization

**Comment: 1305-004**
A commenter asked for the range of geologic and hydrologic flow parameters in each basin.

*Response: The range for hydrogeological flow parameters, including transmissivity, storativity of the production aquifer, and the vertical hydraulic conductivity of the confining layers above and below the production aquifer, are provided for four uranium milling regions in GEIS Sections 3.2.4.3.3, 3.3.4.3.3, 3.4.4.3.3, and 3.5.4.3.3. These characteristics will be evaluated in the site-specific review. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1388-005; 1388-008**
A commenter noted that the GEIS did not provide information on groundwater flow and recharge areas in four uranium milling regions. A commenter noted that the GEIS lacks information on hydrologic boundaries, river basins, and groundwater flow.

*Response: Groundwater flow rate, hydraulic gradient, and flow direction could vary locally based on spatial variability in aquifer properties. They can also change based on seasonal variations in groundwater pumpage rates at demand locations and precipitation at recharge areas. As noted in NUREG–1569 [NRC, 2003a, Sections 2.7.3 (3) and (5)], the applicant is required to acquire, analyze, and report hydrogeological properties of the ISL site including groundwater flow direction and flow rate in the ore-bearing and in other important overlying and underlying aquifers and hydrogeological and hydrologic boundaries. The NRC staff evaluates this information as part of the site-specific environmental review for a specific ISL facility, and therefore no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-089; 1173-090; 1173-091**
A commenter noted that uranium production in the Powder River Basin is from the Wasatch Formation, not from the Fort Union Formation. The commenter also noted that the Pierre Shale is not a good analogy for aquitard properties in the Powder River Basin between layers where uranium is produced. The commenter also noted that confining layers in the Powder River Basin are discontinuous and localized.

*Response: In the GEIS, only the Smith Ranch and Reynolds Ranch areas in Converse County were included in the description of the affected environments (in Chapter 3) and potential environmental impacts during different phases of ISL activities (in Chapter 4) in the Wyoming West Milling Region. As discussed in the GEIS, the Fort Union Formation hosts the ore-bearing aquifer at the Smith Ranch and Reynolds Ranch ISL sites (NRC, 2006, pp. 12–13). The discussion in Chapters 3 and 4 has been extended to cover the Irigaray and Christensen Ranch ISL sites, where the ore-bearing aquifer is included in the Wasatch Formation.*

**Comment: 1173-051**
A commenter noted that the Northern Great Plains aquifer description is too general. The commenter also noted that coal beds in the Fort Union and Wasatch Formations and their recharge zones are not discussed.

*Response: The text in Section 3.3.4.3.1 has been modified to reflect the comments.*

**Comment: AL15-050; AL32-158; HC010-011**
A commenter stated that geology and hydrology characterization in the GEIS mischaracterized confinements and does not account for local unconformity or heterogeneity. Another commenter noted that when talking about regional aquifer versus site-specific ISL activities, one often loses sight of the controlled nature of activities. Another commenter noted that groundwater aquifers near current or potential uranium milling sites need to be evaluated at a site-specific level.

*Response: The GEIS does not replace site-specific environmental review of proposed or existing ISL facilities. Regional descriptions of aquifers and hydrogeological systems in the GEIS are intended to provide a broad description of groundwater systems in each ISL milling region. The applicant, however, is required to analyze and report all site-specific details of hydrogeological characteristics of the ore-bearing and other aquifers, the continuity and integrity of confining layers [NUREG–1569 (NRC, 2003a, Section 2.7.3(3)], and any geological and structural features (e.g., faults, fractures, unconformities) [NUREG–1569 (NRC, 2003a, Section 2.6.3(6)] that could affect groundwater flow within and in the vicinity of the permit area at a site-specific level as part of site characterization. Because regional description of aquifers has already been described in the GEIS and local geology and hydrology will be considered on* *a site-specific basis, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL15-051**
A commenter noted that the seismic zone in New Mexico and Arizona includes fractures and faults. This renders the confined aquifer concept moot, and hence fractures and faults need to be considered at a very site-specific level.

*Response: Geological structures such as folds, faults, and unconformities could affect the integrity, continuity, and confinement of the ore-bearing zone and containment of the recovery solution in the production zone. Some of these features may not be mappable at the regional scale, but they would be important at the site scale. The applicant or licensee is required to analyze, assess, and report all site-scale active or inactive geological features as part of site characterization as discussed in NUREG–1569 [NRC, 2003a, Section 2.6.3(6)–(7)]. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-046; 1314-047**
A commenter noted that the GEIS does not adequately address fast flow paths and heterogeneity in describing the hydrogeology of the ore-bearing aquifer in the Northwestern New Mexico Uranium Milling Region. A commenter noted that the discontinuous nature of confining layers (also subject to faulting and fracturing) above and below the ore-bearing aquifer at the local and regional scales has not been adequately disclosed in the GEIS.

*Response: GEIS Section 3.5.4.3.3 reports that estimated aquifer transmissivity ranges from 84 to 250 $m^2$/day [905 to 2,700 gal/day/ft], the storage coefficient ranges from $4.5 \times 10^{-5}$ to $4.13 \times 10^{-4}$, and groundwater velocity ranges from 1.5 to 3.9 m/year [5 ft to 12.9 ft/year] in the ore-bearing aquifer (the Westwater Canyon Sandstone aquifer in the Morrison Formation) at three ISL sites in Northwestern New Mexico, evidencing the same sort of heterogeneity of the ore-bearing aquifer and flow paths. The description of the regional aquifers in Northwestern New Mexico is provided in GEIS Section 3.5.4.3.1 based on information by Robson and Benta (1995). According to discussion in Section 3.5.4.3.1, the Morrison Formation (including the ore-bearing aquifer) is overlain and underlain by relatively impermeable confining layers in most parts of the San Juan Basin, acknowledging that impermeable confining layers may not be extensive and continuous at the regional scale. As discussed in GEIS Section 3.5.4.3.3, the Westwater Canyon is overlain and underlain at the local scale by continuous impermeable Brushy Basin Shale and Recapture Shale at the Crownpoint, Unit 1, and Church Rock sites. The GEIS does not generalize these findings over the entire Northwestern New Mexico Uranium Milling Region.*

*During license application, the applicant or licensee is required to analyze and report site-specific aquifer properties, integrity and continuity of confining layers, and detailed hydrogeologic conditions [NUREG–1569 (NRC, 2003a, Section 2.7.3(3)] and to acquire, analyze, and report geological structures such as fractures and faults and assess their potential impacts on groundwater flow [NUREG–1569 (NRC, 2003a, Section 2.7.3(6)] as part of site characterization and environmental report. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-093**
A commenter noted that uranium deposits are geochemically trapped (as a result of redox-based precipitation), in other words, isolated in an ore-bearing aquifer. Groundwater

from the ore-bearing aquifer was said to be still available to downgradient users for various uses, and the commenter asked this information to be included in GEIS Section 3.5.4.3.2.

*Response: GEIS Section 2.4.1 discusses the mobilization of geochemically trapped and isolated ore deposits in an ore-bearing aquifer by altering the natural geochemical condition by lixiviant injection. GEIS Section 2.1.2 discusses physical characteristics of uranium deposits. Suitability of groundwater in the vicinity and downgradient of the exempted portion of the aquifer is site-specific, and the applicant is required to acquire and report past, current, and potential future uses of water resources, type, and suitability and amount of groundwater use [NUREG–1569 (NRC, 2003a, Section 2.7.3(6)] in an environmental report. Potential use and suitability of groundwater in four different milling regions are discussed in GEIS Sections 3.2.4.3.3, 3.3.4.3.3, 3.4.4.3.3, and 3.5.4.3.3. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: NE05-001**
A commenter asked which geological strata contains the ore body.

*Response: The location of the ore body is identified by the applicant or licensee during site characterization. This information is available to the public within the applicant's or licensee's environmental report. Geological and hydrogeological characteristics of ore-bearing aquifers in four uranium milling regions are discussed in GEIS Sections 3.2.4.3.3, 3.3.4.3.3, 3.4.4.3.3, and 3.5.4.3.3. A schematic cross section for idealized ore-zone geology is provided in GEIS Section 2.4.1.2. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 042-003; 1015-004**
A commenter noted that Lakota and Fall River aquifers are unique due to their fractured porous sandstone formations that may lead to cross contamination of aquifers in the Southern Black Hills. Similarly, another commenter also stressed the fractured porous nature of the aquifers in the Southern Black Hills.

*Response: As discussed in GEIS Section 3.4.4.3.3, the Inyan Kara aquifer is the ore-bearing aquifer in the milling region in South Dakota. The level of confinement of the Inyan Kara aquifer at the regional scale is discussed in GEIS Section 3.4.4.3.3. Suitability of hydrogeological characteristics, integrity, continuity, and confinement of an ore-bearing aquifer is site-specific and needs to be addressed by the applicant as part of site characterization [NUREG–1569 (NRC, 2003a, Section 2.7.3(3)]. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-088**
A commenter asked to correct misquoted flow rates from uranium bearing aquifers on Page 3.2-20, Line 19 of the Draft GEIS.

*Response: There was a typographical error in the original document of AATA International Inc., 2005, Page 62. GEIS Section 3.2.4.3.3 has been revised to include a new reference with correct information on flow rates: "Collentine, et al. (1981, pp. 52–53) reported that wells in the Battle Spring aquifer typically yield 115–150 L/min [30–40 gal/min], but they are capable of yielding up to 570 L/min [150 gal/min]."*

**Comment: 028-013**
A commenter suggested using the reference by Mason and Miller (2004) for Wyoming West Uranium Milling Region's background radionuclide concentration in groundwater.

*Response: Information by Mason and Miller (2004) on background radionuclide concentrations in groundwater is consistent with the information in the GEIS. This reference has been included in the GEIS and the text in Section 3.2.4.3.3 ("Groundwater quality") has been modified to reflect relevant information from this reference.*

**Comment: 1173-033**
A commenter noted on Page 3.2-17, Lines 23–28, of the Draft GEIS that the Upper Colorado River Basin aquifer system is generally in Southwest Wyoming, only covering the southern part of the Wyoming West Uranium Milling Region. The northern part (Gas Hills) lies in the Wind River Basin, which drains into the Bighorn and Yellowstone Rivers.

*Response: The Upper Colorado River Basin aquifer system covers mostly the southwestern portion of the Wyoming West Uranium Milling Region. This information has been included in the first paragraph in Section 3.2.4.3.1. In the central and northern portions of the Wyoming West Uranium Milling Region, Wind River Formation contains the aquifers of primary importance. This regional hydrogeology information near the Gas Hill Region (in the central and northern parts of the milling region) has been included in GEIS Section 3.2.4.3.1. The following groundwater quality information has been included in GEIS Section 3.2.4.3.3:*

> *"The regional water quality of the eastern and central portions of the Gas Hills District transitions from a calcium-sulfate to a calcium-sodium bicarbonate-sulfate water in an upgradient to downgradient direction. In general, the regional TDS ranges from 264 to 1,100 mg/L [1.65E-2 to 8.87E-2 lb/ft$^3$]. The water from the Wind River aquifer in the Gas Hills District is Class III, suitable for livestock use in accordance with WDEQ/Water Quality Division Chapter VIII regulations. In the vicinity of uranium ore zones and roll-front deposits, elevated concentrations of radionuclides may occur rendering the water quality unsuitable for livestock use (NRC, 2004)."*

**Comment: 015-030**
A commenter noted that on Page 4.3-15, Lines 32–33, of the Draft GEIS, no discussion of aquifer tests is provided.

*Response: Aquifer tests are part of site characterization, and the applicant is required to conduct and report aquifer tests to determine hydraulic properties of the ore-bearing aquifers and confining layers within the permit area at a local scale. Regional hydrogeology information near the Gas Hills District (in the central and northern parts of the Wyoming West Uranium Milling Region) has been included in GEIS Section 3.2.4.3.1.*

### G5.22.3.2 Aquifer Exemption and Baseline Water Quality

**Comment: GA12-004; 036-094**
Commenters asked a general question about the description of the aquifer exemption and the rationale for the exemption. A commenter stressed the need for looking at local water quality, rather than regional water quality, of the ore-bearing aquifer for exemption for uranium recovery processes by referring to GEIS Section 3.5.4.3.3

*Response: The aquifer exemption is a site-specific issue and needs to be addressed by the applicant during site characterization. EPA has the sole decision-making authority for granting aquifer exemptions. The description of the aquifer exemption and the relevant regulatory codes are discussed in GEIS Section 1.7.2.1. The criteria for aquifer exemption are described in 40 CFR 146.4, which is cited in GEIS Section 1.7.2.1. Further discussion on implementation of aquifer exemption in the four uranium milling regions is provided in GEIS Section 1.7.5. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL16-058; HC019-001**
A commenter noted accurate baseline water quality is important; and if not done right, will allow more contamination. Another commenter noted that baseline testing should be conducted at wells used for human and animal consumption within 1.6 km [1 mi] of exploration wells.

*Response: As noted in GEIS Section 2.2, the applicant is required to determine baseline quality for the production zone and for adjacent unmineralized zones [NUREG–1569 (NRC, 2003a, Section 2.7.4(4)]. GEIS Table 2.2-1 lists typical baseline water quality parameters and indicators, based on NUREG–1569 (NRC, 2003a, Table 2.7.3-1). Prior to an application, the applicant is required to establish preoperational nonradiological and radiological groundwater baselines within the proposed permit boundaries and adjacent properties based on samples collected over a period of at least 1 year by at least four sets of groundwater samples sufficiently spaced in time. A set of samples is defined as a group of at least one sample at each of the designated baseline monitor wells. After the license is issued and the first well field is developed and all the wells are installed, according to NUREG–1569 [NRC, 2003a, Section 5.7.8.3(1)], an acceptable set of samples needs to be collected, including all well field perimeter monitor wells, all lower and upper aquifer monitor wells, and at least one production/injection well per acre in each well field. Pump tests are also done during this time to ensure monitoring wells communicate with production wells and overlying and underlying monitoring wells do not communicate with production wells. The data that are collected after the first well field is developed are used to determine UCLs and well field background levels that form the basis for groundwater restoration standards. This process is approved by NRC and used by the licensee as subsequent well fields are developed. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 017-010; 017-011; 032-026; 032-027; 032-029; AL30-153; CH08-009; GA11-003; GA13-003; GR01-010; GR04-001; GR12-006; NE04-001; NE09-003; SP11-008**
A commenter noted that uranium and decay products make ore-bearing aquifers unsuitable for drinking. Several commenters discussed naturally occurring uranium levels at or near ISL facilities, and hence, unsuitability of preoperational background water quality at these sites for drinking and other beneficial uses. On the contrary, several other commenters pointed out that the background water qualities at or near ISL sites are suitable for drinking. One commenter requested clarification of whether ISL was prohibited from being done in a drinking water supply. Another commenter suggested NRC was asking people to give up their drinking water supply. Several commenters brought up site-specific, local water quality issues to raise some concerns about background water quality and aquifer exemption. A commenter noted that groundwater quality in the Grants region varies spatially due to extensive mining and associated dewatering in the area. Another commenter noted that the Dakota sandstone is used for domestic water near Bibo and Seboyeta, near Mount Taylor. Another commenter noted that Ambrosia Lake contains the Westwater Canyon aquifer that may be used for future water supply.

*Response: The licensee is required to obtain an aquifer exemption and UIC permit before ISL operations commence. The aquifer exemption is a site-specific issue, and the EPA in conjunction with the appropriate state agency has the regulatory authority. The criteria for aquifer exemption are discussed under 40 CFR 146.4. According to 40 CFR 146.4(a) and (b), the aquifer or a portion of an aquifer, which meets the criteria for an "underground source of drinking water"' in 40 CFR 146.3 may be determined as an exempted aquifer, (a) if it does not currently serve as a source of drinking water and (b) it cannot now and will not in the future serve as a source of drinking water. Spatial variability in groundwater quality within and in the vicinity of the ISL facility is a site-specific issue, and the applicant is required to address it in the environmental review. Preoperational background water quality within and near the production zone is usually unsuitable for drinking due to high concentrations of radium associated with the uranium mineralization. However, groundwater surrounding or in the vicinity of the production zone can often be suitable for human consumption. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-089; AL30-153**
Two commenters suggested that radon concentrations within and outside the exempted portion of an ore-bearing aquifer need to be included and emphasized for better characterization of background water quality.

*Response: NRC did not include radon in a list of typical baseline water quality parameters provided in GEIS Table 2.2.-1 due to difficulties in sampling, but NRC has concerns about potential impacts of radon from the standpoint of NEPA.*

**Comment: 061-019; GR12-004**
One commenter raised concerns about how to determine baseline levels and indicated that site-specific license decisions need to assess impacts from prior operations on groundwater quality in determining the baseline. Another commenter noted that it is difficult to determine baseline conditions given past cross contamination caused by exploratory wells.

*Response: The background groundwater quality is determined prior to ISL operations based on groundwater samples in the permit area. The groundwater sampling reflects the groundwater quality that exists at the time the samples are taken and would include any prior groundwater quality effects that have resulted from past activities. During the site-specific license application review, NRC would evaluate the applicant's background groundwater sampling program and results to ensure it is sufficient to support a licensing decision. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-019**
A commenter asked for clarification on whether the baseline is determined based on water quality parameters averaged within a well field or averaged over more than one well field.

*Response: Baseline parameters are averaged over each specific well field [NUREG–1569 (NRC, 2003a, Section 5.7.8.3(1)], but not over the entire permit area. Information on how baseline water quality is established was provided on Page 2-8 of the Draft GEIS, and no changes were made to the GEIS in this regard.*

**Comment: GR12-005; 1314-032; 1314-045; AL14-035; AL16-059**
Several commenters expressed disagreements on how to calculate baseline levels, which is allegedly typically done by averaging groundwater concentrations over the production zone and adjacent nonmineralized zone. Another commenter noted that this averaging scheme does not

reflect NRC's preconstruction requirements for ISL operations in Section 2.2, Pages 2-6 and 2-7 in practice. Along the same line, another commenter noted that the GEIS inaccurately characterizes unsuitability of groundwater quality at the Crownpoint wells due to the aforementioned averaging scheme, although these wells supply drinking water to several Navajo communities.

*Response: During the site characterization phase and to support an application, one set of background groundwater quality samples is taken from the proposed licensed area, including the production area, prior to an application. NRC guidance in NUREG-1569 Section 2.7.2 does not prescribe how many samples are required for initial licensing, only that a "sufficient number of baseline ground-water samples are collected to provide meaningful statistics." NRC staff uses this data in its safety and environmental evaluation of the site to make licensing decisions that are protective of public health and safety. After licensing and prior to production at a well field, an additional set of baseline samples, generally one well per acre, is collected from within the well field production zone. Generally, four samples are collected, with adequate time between sets to represent any temporal variations and used for the determination of baseline water quality and restoration standards. Another set of samples is taken at the horizontal monitoring well ring to determine UCLs for horizontal excursion determination. An additional set of samples is taken to determine UCLs for vertical excursion determination for overlying and underlying monitoring wells, as appropriate.*

*Because the ISL facility licensed at Crownpoint, New Mexico, has not operated, baseline groundwater restoration standards and UCLs have not been established for individual well fields to date. The requirements for additional sampling to deterimine baseline restoration standards and UCL levels are found in License Conditions 10.21 and 10.22 , respectively.*

**Comment: 017-020**
A commenter noted that page 3.5-21 of the Draft GEIS states that groundwater in the Northwestern New Mexico Uranium Milling Region is suitable for drinking. The commenter considered this statement too broad, and believes that it does not reflect groundwater quality in minable portions of aquifers and is therefore in error.

*Response: Section 3.5.4.3.3 of the GEIS, which contains the statement in question, discusses groundwater quality broadly at a regional scale, as it is the main objective of GEIS Chapter 3. At the local scale, however, groundwater quality and its suitability for different uses could vary. Groundwater quality at the Crownpoint, Unit 1, and Church Rock sites is provided in Section 3.5.4.3.3 to highlight spatial variations in groundwater quality in the Northwestern New Mexico Uranium Milling Region. The applicant is required to measure and report groundwater quality parameters in the permit area, including the production zone(s) within ore-bearing aquifers, to determine background levels and acquire information on past, current, and predicted use and suitability of groundwater [NUREG–1569 (NRC, 2003a, Section 2.7.3(6)]. For clarification, GEIS Section 3.5.4.3.1 has been revised to indicate that groundwater in the Northwestern New Mexico Uranium Milling Region area is, in general, suitable for drinking.*

**Comment: 050-067**
A commenter asked for an explanation of when a tailored sampling list would be appropriate for baseline water quality parameters.

*Response: Typical baseline water quality parameters and indicators, based on NUREG–1569, are provided in GEIS Section 2.2. The licensee can tailor the list based on site-specific conditions. However, as discussed in NUREG–1569 [NRC, 2003a, Section 2.7.3(4)], the* *licensee is to provide the technical basis for any tailored list and seek NRC-approval. GEIS Section 2.2 has been revised to include this information.*

### G5.22.4 Control of Operational Impacts and ISL Solutions: Excursions, Drawdowns, Monitoring, and History

#### G5.22.4.1 Control of Operational Impacts, Excursion of ISL Solutions, and History

**Comment: AL30-151; SP11-007**
A commenter noted that the ISL footprint is small in comparison to the extent of the ore-bearing aquifer, and hence the impacts on groundwater would be SMALL and local. Another commenter noted that GEIS did not do a good enough job describing how uranium is limited to ore zone (small deposit in large regional aquifer).

*Response: A typical surficial footprint area of ISL facilities of the GEIS is small in comparison to the size of the permit area (GEIS Sections 2.3.2 and 4.2.1.1) or to the extent of regional aquifers. However, the relative size and extent of the ISL production zone in the ore-bearing aquifer is more important than the ISL footprint area in assessing operational impacts of ISL operations on groundwater. The depth, thickness, and extent of production zone(s) and the exempted portion within the ore-bearing aquifer and its hydrogeologic confinement are site-specific, and the applicant is required to address them in its application.*

*Potential impacts of ISL operations on groundwater resources are determined based on site-specific hydrogeologic characteristics of the ore-bearing aquifer and confining layers, consumptive water use during production, and water quality in the ore-bearing and surrounding aquifers, as discussed in GEIS Sections 4.2.4.2.2.2, 4.3.4.2.2.2, 4.4.4.2.2.2, and 4.5.4.2.2.2. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 032-009**
A commenter suggested changing the assessment for alteration of ore body aquifer chemistry during ISL operation from SMALL to MODERATE–LARGE in the GEIS, given that some of the supporting reasons for SMALL (e.g., aquifer would not be a potential drinking water source and aquifer would not be expected to be restored to within a statistical range of preoperational baseline quality) are not applicable, for example, in New Mexico.

*Response: Before ISL operations commence, the applicant needs to obtain an aquifer exemption for the ore-bearing aquifer or a portion of it. According to 40 CFR 146.4(a) and (b), the aquifer or a portion of an aquifer, which meets the criteria for an "underground source of drinking water" in 40 CFR 146.3, may be determined as an exempted aquifer (a) if it does not currently serve as a source of drinking water and (b) it cannot now and will not in the future serve as a source of drinking water. Therefore, the aquifer in question should have satisfied either or both of these conditions for the exemption. Moreover, as pointed out in Section 2.5, NRC licensees are required to return water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5B(5) or other standards approved in their license. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-107; 059-009**
A commenter noted that the GEIS underestimates the "water-groundwater" impacts in the operational phase of ISL as being SMALL. Another commenter disagreed that water quality impacts during operations are SMALL and temporary.

*Response: It was stated in the GEIS that (Page 4.2-21) potential impacts to the water quality of the uranium-bearing aquifer during and after ISL operations would be expected to be SMALL and temporary. The groundwater quality impacts due to ISL operations are expected to be SMALL because (1) the bleed production rate of 1–3 percent would allow containment of the recovery solution in the production zone, (2) the licensee is obliged to place monitoring wells for detection of potential horizontal and vertical excursions, and (3) the licensee is required to return the water quality parameters in the production aquifer to the standards in 10 CFR 40, Appendix A, Criterion 5B(5) or other standards approved in their license. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-108; 1173-078; AL30-151; GA04-005; GA23-004; GR01-009; GR08-001; GR12-010; GR18-005**
Several commenters questioned and raised concerns about the effectiveness of excursion mitigation and containability of recovery solutions in the ore zone due in part to connectivity of aquifers, nonideal geological characteristics of ore zones and heterogeneity in confining layers, fluvial nature of ore deposits and hence difficulties in controlling fluid movement, the flowing nature of groundwater, and high mobility of oxidized uranium into shallow groundwater. Another commenter noted that the GEIS did not do a good job in describing how to control and contain recovery solutions on the ore zone.

*Response: Ore-bearing aquifer integrity and the level of natural confinement for hydrogeological isolation of ore-bearing aquifers are site-specific and need to be addressed by the applicant as part of the site-specific environmental review.*

*The integrity and confinement of ore-bearing aquifers in each milling region are discussed in broader aspects in Sections 3.2.4.3, 3.3.4.3, 3.4.4.3, and 3.5.4.3. As discussed in Section 2.4.1.2, the production bleed of 1–3 percent provides for lateral confinement of recovery solutions. Furthermore, as discussed in GEIS Section 8.2.5, excursion monitoring wells are placed around ISL facilities for early detection of any problems with horizontal and vertical confinement. If an excursion occurs, the reporting requirement for the licensee is in place, as discussed in GEIS Section 8.3.1. Several cases of successful corrective actions for reported horizontal and vertical excursions at ISL facilities are discussed in GEIS Section 2.11-4. NRC staff is not aware of any incidents in which nonexempt portions of an ore-bearing aquifer have been contaminated by ISL operations under NRC regulation. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: CH07-003; CH11-008; CH11-009; GA15-001; NE04-009; SP08-011**
Several commenters raised concerns about excursions, their detection, how to contain them at ISL sites, how much water to pump to contain excursions when they occur, and their long-term impacts on public health.

*Response: As discussed in GEIS Chapter 8, the licensee is required to install monitoring wells in the production zone and in overlying and underlying aquifers, when appropriate, for detection of horizontal and vertical excursions. As discussed in GEIS Section 2.3.1.1 and Table ES-1, the licensee needs to perform mechanical integrity tests periodically to ensure the integrity of* *injection and production wells to reduce the risk of vertical excursions. As discussed in GEIS Section 2.4.1.4, if horizontal excursion occurs, the licensee typically retrieves excursions back into the production zone by adjusting flow rates at the nearby production and injection wells. Vertical excursions have typically occurred due to failures in well construction or vertical fluid migration pathways due to improperly abandoned exploration wells. Vertical excursions are typically restored by repairing or taking a failed well out of service and/or properly plugging exploratory drill holes. Impacted water is then pumped from the aquifer until the excursion monitoring well is below its UCLs. The potential environmental impacts of excursions on groundwater quality are discussed in GEIS Sections 4.2.4.2.2.3, 4.3.4.2.2.3, 4.4.4.2.2.3, and 4.5.4.2.2.3. The methodology and procedure for how to define excursions in terms of the UCL for excursion parameters, how the licensee needs to report excursions to NRC, how to change the sampling frequency, and when and how excursions are considered to be contained upon corrective actions are discussed in GEIS Sections 2.4.1.4 and 8.3.1. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-108**
A commenter questioned the NRC estimate for impacts from excursions as MODERATE to LARGE and noted that, irrespective of whether impacts are MODERATE or LARGE, the impacts from excursions must be "significant."

*Response: The impact from excursions beyond the exempted portion of the production aquifer is considered to be of concern in GEIS Sections 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2. The level of significance of the groundwater impact (MODERATE to LARGE) is determined by consideration of the volume of water that could leave the production zone, retrievability of excursions, and extent and proximity of operations to nearby private wells. As discussed in GEIS Section 8.3.1.2, licensees are required to take corrective actions when an excursion is detected to address the potential for impacts beyond the production zone. Several cases of successful corrective actions for reported horizontal and vertical excursions at ISL facilities are discussed in GEIS Section 2.11.4. NRC staff is not aware of any incidents in which nonexempt portions of an ore-bearing aquifer have been contaminated by ISL operations under NRC regulation. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-077**
A commenter disagreed with the conclusion on Page 4.2-21, Lines 30–36 stating that potential impacts to the water quality of the uranium-bearing aquifer as a result of ISL operations would be SMALL and temporary given that the aquifer could be restored to higher than baseline (e.g., ACL).

*Response: When uranium recovery is complete in a well field, currently licensed ISL facilities may be able to return water quality to preoperational class of water use. For new applications, licensees will be required to return water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5B(5). Criterion 5B(5) allows licensees to apply for alternate concentration limits if water quality parameters cannot be restored to either baseline levels or to the maximum values for groundwater protection provided in 10 CFR 40, Appendix A, Table 5C. NRC approval of proposed alternate concentration limits would ensure protection of public health and safety. Final NRC and state approval would be required for ending restoration of the well field. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-059**
A commenter disagreed with the estimate for the ISL operational impacts on groundwater to be SMALL to LARGE, because the commenter noted that none of the commercial ISL operations restored groundwater to premining conditions, and hence suggested specifying the operational impacts to be LARGE or SIGNIFICANT.

*Response: Impacts to groundwater from aquifer restoration are discussed in GEIS Sections 4.2.4.2.3, 4.3.4.2.3, 4.4.4.2.3, and 4.5.4.2.3. As discussed in GEIS Section 2.11.5, completed well field restoration efforts have restored water quality parameters to baseline levels or applicable class of use standards. For new applications, licensees will be required to return water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5B(5), which allow restoration to an NRC-approved baseline concentration; concentration levels in Appendix A, Table 5C; or an NRC-approved alternate concentration limit. Compliance with these standards would ensure protection of public health and safety. Moreover, in general, favorable hydrogeological conditions for effective isolation of ore-bearing aquifers and containment of recovery solutions, integrity and continuity of impermeable confining layers, successful implementation of restoration techniques, and continuous and effective monitoring of well fields could lower risks for operational impacts to groundwater. The extent to which these conditions are present are the focus of the NRC site-specific license application review. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1305-096**
A commenter noted that the discussion in GEIS Section 3.2.4.3.3, Page 3.2-21, Lines 10–38 has an inadequate analysis of impacts, because it does not provide analysis of potential future uses, demands on aquifers, and current uses that present water quality challenges. It does not involve analysis that blends observations in this section with data from past ISL experience.

*Response: GEIS Chapter 3 provides the description of the regional affected environments. Consistent with the overall organization of the GEIS, Section 3.2.4.3.3 provides the hydrogeologic description of the uranium-bearing aquifer as an affected subsurface environment as a result of ISL operations. GEIS Chapter 4 provides the discussion on the environmental impacts (addressing the groundwater quality and quantity impacts) as a result of different phases of ISL activities. Past ISL experiences regarding, for example, excursions and aquifer restoration are discussed in GEIS Section 2.11. Potential environmental impacts due to future water uses, present water quality challenges, and past ISL operations are site-specific issues that need to be addressed by the applicant in a site-specific environmental report. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-080; 1314-011; 1314-013; 1314-014**
A commenter stated that generic evaluations for hydrogeologic environments due to ISL operations at a region-wide generic manner are not appropriate. The commenter also noted that how local water uses interact with local hydrogeology cannot be evaluated generically. One commenter asked how current local users of groundwater for agricultural or domestic uses would be protected.

*Response: GEIS Chapters 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2 provide broader discussions on impacts on hydrogeologic environments as result of ISL operations. These sections are aimed at providing an initial context for the detailed site-specific evaluation of environmental impacts at individual ISL facilities. The applicant is required to conduct detailed site-specific studies for characterizing subsurface hydrogeologic environments and describe potential affected* *environments at the local scale as part of the environmental report. Furthermore, as discussed in NUREG–1569 (NRC, 2003a, Section 2.2.3) the applicant is also required to survey and report locations of all privately owned wells within 3.3 km [2 mi] of the permit area and their current uses and production rates and to assess potential impacts on these wells due to the ISL production as part of site characterization. Required environmental monitoring programs described in GEIS Chapter 8 and Section 2.9 and applicable referenced guidance documents include routine monitoring of all downgradient public wells that could be used for drinking water, livestock watering, or crop irrigation. As the comments were general in nature or pertained to information already discussed in the GEIS, no changes were made in response to the comments.*

**Comment: CH04-001**
A commenter questioned and wanted to know about the assurances not to contaminate groundwater due to ISL operations.

*Response: As described in GEIS Chapter 2, as part of site characterization, the applicant is required to provide sufficient information on site-specific geological and hydrogeological characteristics of the site to assess the integrity of the ore-bearing zone, effectiveness of confining layers, and efficiency of hydraulic control to prevent potential lateral and vertical excursions. As discussed in GEIS Section 8.3.1, the applicant is required to install monitoring well rings within, above, and below (when necessary) the ore-bearing zone for early detection of any potential excursions to ensure public health and safety. NRC licensees are required to return water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5B(5) or other standards, such as groundwater class of use, approved in their license. As discussed in GEIS Section 2.10, the applicant is required to provide financial surety for groundwater restoration and site cleanup. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA08-008; GI06-001; GR06-005; SP10-008; SP11-006**
Several commenters noted successful operation of ISL facilities without contaminating adjacent, nonexempted groundwater resources in the past; this seems to be in disagreement with ISL-induced groundwater contamination in Kingsville, Texas, as pointed out by another commenter.

*Response: NRC staff is not aware of any ISL-induced contamination in nonexempted groundwater sources adjacent to ISL facilities that are regulated by NRC in the regions considered in the GEIS. As discussed in GEIS Section 3.1.1, Texas is an NRC agreement state and, therefore, the facilities near Kingsville are state regulated. As a result, while NRC reviews state regulations for consistency with NRC regulations, because NRC has no role in state licensing actions or implementation of state regulatory programs, NRC has chosen to focus the GEIS on NRC regulated facilities.*

**Comment: 015-026**
A commenter noted that the use of Darcy velocity may not be appropriate to calculate vertical excursions across confining layers, and the commenter pointed out that Darcy velocity needs to be divided by the rock porosity.

*Response: The calculations in GEIS Sections 4.2.4.2.2.2, 4.3.4.2.2.2, 4.4.4.2.2.2, and 4.5.4.2.2.2 that use the Darcy velocity are for demonstration purposes only. For vertical excursion calculations in the GEIS, porosity of a confining layer and the vertical gradient across the confining layer are uncertain, and these uncertainties are embedded into the ratio of the* *vertical hydraulic gradient to the porosity of the confining layer, which was arbitrarily set to 0.1. In other words, the excursions are estimated based on pore velocity, which is calculated as the hydraulic conductivity multiplied by the hydraulic gradient porosity. These sections of GEIS have been revised for clarity.*

**Comment: 1321-029**
A commenter asked about addressing impacts to domestic uses, livestock watering, and agricultural uses of ore zone aquifers.

*Response: As part of the site characterization, the applicant identifies and reports existing wells within and in the vicinity of the permit area (NRC, 2003a, 1982, 1980). The applicant samples these wells as part of its monitoring program to establish background water quality and monitor for contamination from operations. The applicant addresses the impacts to domestic uses, livestock watering, and agricultural water uses in its site-specific environmental report. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 033-006; 1314-066; HC018-001**
Several commenters raised concerns about operational impacts of ISL facilities on groundwater resources at particular sites. For example, a commenter noted that Crook County, Wyoming, land owners depend on groundwater for farming and allowing any impacts is not acceptable. Another commenter noted that it is essential to have the same water quality and quantity during and after uranium extraction. A commenter noted that ISL operations could impact groundwater resources on tribal land.

*Response: As part of site characterization, the applicant identifies and reports existing wells and their current uses within and in the vicinity of the permit area (NRC, 2003a, 1982, 1980). If these wells are placed in the ore-bearing aquifer, the applicant includes these wells as part of the monitoring well network to ensure the public health and safety. As discussed in GEIS Section 1.7, the applicant is required to obtain an aquifer exemption as part of site characterization before ISL operation commences. EPA has the sole decision-making authority for granting aquifer exemptions. The criteria for aquifer exemption are discussed under 40 CFR 146.4.*

*As discussed in GEIS Section 2.5, NRC licensees are required to return water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5B(5) or other standards, such as groundwater class of use, approved in their license. Potential impacts to tribal lands were discussed in GEIS Section 4.5.8. Based on the analyses presented in the GEIS, the NRC staff anticipates that the short-term impact of consumptive use on groundwater resources near a well field would be MODERATE. Because localized drawdown near well fields would dissipate after pumping stops, these localized effects are expected to be temporary. Hence, the long-term impacts would be expected to be SMALL in most cases, depending on site-specific conditions. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-005**
The commenter asked whether CBM wells can be corroded by the lixiviant used in the ISL process.

*Response: Potential chemical impacts of ISL lixiviants on CBM wells would primarily depend on well casing materials used for the CBM wells and the exposure (contact) time of the well casing materials to lixiviants, if lixiviants reach the CBM wells. This is potentially a factor that the*

*NRC staff would evaluate on a case-by-case basis as part of the site-specific review for each ISL facility. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-004; 1173-079**
A commenter noted that the GEIS needs to address the potential for cross contamination between CBM and ISL production wells. The commenter asked to include whether monitoring wells are needed in coal aquifers with potential for CBM production below the uranium ore body.

*Response: The NRC staff agrees that the GEIS should address the potential for cross contamination. The text in GEIS Sections 4.2.4.2.2.2, 4.3.4.2.2.2, 4.4.2.2.2, and 4.5.2.2.2 has been revised to provide clarification with respect to the site-specific reviews of proposed monitoring wells for ISL operations. Briefly, potentials for cross contamination between ISL wells and other mining wells (used, for example, for oil, gas, CBM, or other mineral production, if it exists) would be addressed by the applicant in the site-specific environmental review. In such cases, detailed hydrologic analyses will likely be required to determine whether any additional monitoring wells would be required.*

**Comment: 1173-089; 1173-090; 1173-091**
A commenter noted that on Draft GEIS Page 4.3-14, Lines 9–21, the Pierre Shale was not a good analogy for aquitard properties in estimating the vertical migration of leaching solution across the confining layers. The commenter also noted that uranium production in the Powder River Basin is from the Wasatch Formation, and not the Fort Union Formation, as stated on Draft GEIS Page 4.3-14, Lines 28–30. The commenter further noted that on Page 4.3-15, Lines 13–15 and 30–31, of the Draft GEIS, the description was too simplistic and suggested that the confining layers are discontinuous and localized in the Powder River Basin.

*Response: In the Draft GEIS, only the Smith Ranch and Reynolds Ranch site areas in Converse County were included in the description of the affected environments (in Chapter 3) and potential environmental impacts during different phases of ISL activities (in Chapter 4) in the Wyoming West Uranium Milling Region. As discussed in the GEIS, the ore-bearing aquifer is the Fort Union Formation at the Smith Ranch and Reynolds Ranch ISL sites. The discussion in these GEIS chapters has been extended to cover the Irigaray and Christensen Ranch licensed site areas in Campbell and Johnson Counties, Wyoming, where the ore-bearing aquifer is located in the Wasatch Formation. GEIS Sections 3.3.4.3.3 and 4.3.4.2.2.2 have been revised accordingly to reflect this information.*

**Comment: 036-105**
A commenter asked to differentiate between "preoperational baseline" versus "preoperational class of use," referring to information on Page 4.2-26, Lines 33–37 of the Draft GEIS.

*Response: The commenter's requested clarification concerned the standards to be met in restoring affected groundwater following ISL operations in a well field. NRC has clarified the text in Sections 2.5, 4.2.4.2.3, 4.3.4.2.3, 4.4.4.2.3, and 4.5.4.2.3 to state that NRC licensees are required to return well field water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5(B)(5) or to another standard approved in their NRC license, consistent with NRC's position stated in Regulatory Issue Summary (RIS) 2009-05 (NRC, 2009)..*

### G5.22.4.2. Monitoring

**Comment: AL25-120**
The commenter stated that plumes of contamination are never contained by monitoring wells.

*Response: As discussed in GEIS Section 8.3.1.2, monitoring ring wells are used for early detection of any vertical or horizontal excursions. If detected, the licensees typically retrieve horizontal excursions back into the production zones by adjusting the flow rates of the nearby injection and production wells to increase process bleed in the area of excursion (GEIS Section 2.4.1.4). Vertical excursions can be addressed in the same manner as horizontal excursions but may also include installation and pumping from additional wells. NRC staff is unaware of any incidents in which nonexempt portions of an ore-bearing aquifer have been contaminated by NRC-licensed ISLs. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL25-116; CA07-010; GA10-004; GR33-001; SP10-009**
Several commenters noted a successful implementation of monitoring programs for containing recovery solutions in the ore zone, whereas a commenter expressed mistrust to monitoring programs by referring to failure in Kingsburg, Texas. Another commenter stated that excursions of recovery solutions outside the mining area are common in Wyoming and Texas.

*Response: Groundwater monitoring is discussed in GEIS Section 8.3.1.2. The monitoring systems are designed to detect excursions in the well field. Placement of monitoring wells accounts for site specific hydrologic characteristics and the presence or absence of underlying or overlying aquifers (NRC, 2003a). Operational experience with excursions at ISL facilities is discussed in GEIS Section 2.11.4. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: CH04-002**
A commenter wanted to know the processes in place for continuous monitoring of well fields.

*Response: The processes associated with the typical bi-weekly monitoring of well fields, required via license condition, are discussed in GEIS Section 8.3.1.2. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: CH-13-002; GI03-003; GI03-005; GI04-003; HC018-002**
Some commenters asked about whether an independent third-party monitors well fields, while several other commenters requested that an independent third-party monitor and sample wells.

*Response: As described in the GEIS, NRC establishes specific monitoring and reporting requirements by license condition on a case-by-case basis. Historically, third-party monitoring has not been practiced at the ISL facilities. The NRC staff conducts regular quality assurance audits and inspections at individual sites to confirm whether the NRC-approved monitoring programs are being implemented correctly by the licensee. It should be noted that, as part of inspection, nothing precludes the NRC from taking independent samples or splitting samples with the licensee if the NRC deems it necessary. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: HC012-004**
A commenter noted that the GEIS fails to assess that contaminated zones used by ranchers are not required to have monitoring wells.

*Response: As part of the site characterization, the applicant identifies and reports wells (e.g., used for domestic needs, livestock watering, and crop irrigation) within and in the vicinity of the permit area (NRC, 2003a, 1982, 1980). The applicant samples these wells as part of its monitoring program to establish background water quality and monitor for contamination from operations. No changes were made to the GEIS beyond the information provided in this response.*

### G5.22.4.3. Exploratory Drill Wells, Abandoned Wells, and Old Mines

**Comment: 032-016; 033-002; 034-010; 036-106; 050-079; 061-013; 061-019; 1173-092; 1601-006; 1602-007; AL01-129; HC006-001; SP13-001**
Several commenters raised concerns about the occurrence of improperly abandoned exploratory wells and old drill holes, abandoned UIC wells, open pits and underground mines, reclaimed areas of prior conventional mining, and consequential potential cross-contamination of aquifers through these features. A commenter noted the need to address impacts from old drill holes before starting new ones. Another commenter suggested refraining from discussing specific well plugging techniques, because the commenter considered that well-plugging techniques are site-specific. A commenter noted the existence of a large number of exploratory wells, for example in Grants District, and depressurized aquifers due to underground mine works could decrease the integrity of aquitards in isolating ore bodies and trigger vertical excursions. A commenter asked for revisions in GEIS Sections 2.4.1.3, 3.5.4.3.1, 4.5.4.2, and 4.5.4.2.2 to better describe the effects of exploratory wells on potential vertical excursion from production zones.

*Response: NRC does not regulate preoperational exploratory wells and has no regulatory authority for permitting and abandoning such exploratory wells before a site is licensed for ISL operations. In addition, NRC does not have regulatory authority over old unplugged drill holes, open pits, and underground mines, if they were not operated under its regulations. The NRC staff does consider the impacts of preoperational exploratory wells, abandoned wells, old unplugged drill holes, open pits, and underground mines on groundwater resources as part of the site-specific safety and environmental reviews for individual sites.*

*As part of site characterization, the applicant is required to identify and report all exploratory wells, abandoned wells, old drill holes, open pits, and past underground mine work in the permit area, if there are any. The occurrence of potential excursions from improperly abandoned wells is discussed in GEIS Section 2.4.1.3. Past vertical excursions at particular ISL sites as a result of improperly abandoned wells are discussed in GEIS Section 2.11.4.*

*In GEIS Section 2.6, it is stated that at the end of ISL operations, wells would be plugged and abandoned using acceptable practices identified as part of the EPA- or state-administered UIC program. A procedure for well plugging in accordance with the Wyoming UIC program requirement is provided as an example in GEIS Sections 4.2.4.2.4, 4.3.4.2.4, 4.4.4.2.4, and 4.5.4.2.4. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: HC012-003**
A commenter noted that GEIS fails to recognize insufficiency of plastic well construction and that such wells leak under high pressure in uranium mining.

*Response: As discussed in Section 2.3.1.1, the licensee is required to perform mechanical integrity testing following installation of injection and production wells and then to periodically (once every 5 years or less) test each well for cracks and leaks in the casing to ensure the internal and external integrity of a well. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.22.4.4. Deep Aquifers

**Comment: 1173-103**
A commenter wanted to know whether the Crow Butte Facility is injecting wastes or lixiviant into deep aquifers. If so, what is the name of the aquifer and what are the specific impacts.

*Response: According to "Request for Modification of Class UIC Permit Crow Butte Project, Dawes County, Nebraska, March 27, 2000," the UIC permit was granted for both Morrison and Sundance Formations at the Crow Butte Facility in 1995. The Crow Butte Facility has been disposing liquid waste into the Morrison Formation since 1996. The TDS in the Morrison and Sundance Formations was reported to be as high as 24,000-40,000 mg/L [24,000-40,000 parts per million] at a regional scale, and these formations are not being used as water supplies in the area.*

*As described in GEIS Section 1.7, the licensee must obtain the necessary UIC permits from EPA or the appropriate state agency (the Nebraska Department of Environmental Quality in the case of Crow Butte), a process that includes consideration of specific information about the formations to be used for deep injection and the maximum injection rates. NRC also reviews proposed deep well injection to ensure compliance with 10 CFR Part 20 to protect public health and safety. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.22.4.5. Drawdown

**Comment: 1173-076**
A commenter requested additional information on aquifer thickness for the discussion of drawdown impacts on existing wells and for discussion of implications on Page 4.2-20, Lines 40–50.

*Response: Drawdown with respect to the aquifer thickness would be a useful impact measure for unconfined aquifers, but not for confined aquifers so long as the confined nature of the production aquifer is retained during production. Drawdown with respect to potentiometric head levels from the top elevation of an aquifer would be a critical drawdown impact measure for confined aquifers.*

*Moreover, the aquifer thickness may show spatial variability at local and regional scales. The licensee analyzes and reports spatial variations in the thickness of the ore-bearing aquifer at the site-scale as part of site characterization. Characteristics of the production aquifer and confining units are considered in NRC site-specific environmental reviews. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 015-012; 015-029; 036-103**
A commenter considered drawdown calculations at 1, 10, and 100 m [3.3, 33, and 330 ft] from a single pumping well at the end of 10 years to assess the operational impacts on groundwater resources in GEIS Section 4.2.4.2.2.2 to be ambiguous. The commenter suggested the use of alternative approaches such as a regional extent of drawdowns of 1.5 m [5 ft] or larger in quantifying the operational impacts on groundwater. A commenter suggested the use of a site-specific potential range of drawdowns from prior licensing documents. A commenter asked for the inclusion of drawdown sensitivity analysis in assessing operational impacts of ISL on groundwater resources.

*Response: Drawdowns are site-specific and sensitive to hydrogeological characteristics of an ISL site, as discussed in Sections 4.2.4.2.2, 4.3.4.2.2, 4.4.4.2.2, and 4.5.4.2.2. The applicant is required to report hydrogeological characteristics of the ore-bearing zone, adjacent aquifers, and confining layers as part of site-characterization. The calculations presented in the GEIS report are for comparison and demonstration purposes only. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-075**
Regarding the discussion of drawdown in GEIS Section 4.2.4.2.2.2, a commenter suggested adding a figure to illustrate the cumulative effect of drawdowns of individual wells in a well field over a greater areal extent than what was presented in the GEIS.
*Response: Well field drawdown calculations presented in the GEIS report are for comparison and demonstration purposes only. Drawdowns are site-specific and sensitive to hydrogeological characteristics of an ISL site, as discussed in Sections 4.2.4.2.2, 4.3.4.2.2, 4.4.4.2.2, and 4.5.4.2.2. Characteristics of the production aquifer and potential for drawdown impacts are considered in NRC site-specific environmental reviews. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-066; 1601-006; 1602-008**
A few commenters raised concerns about loss of pressure in private water wells (for domestic and livestock wells) and impacts on other aquifers from ISL consumptive use.

*Response: Loss of pressure in private water wells near the production zone is site specific and sensitive to hydrogeological properties of aquifers (transmissivity, storativity, hydraulic gradient, aquifer thickness), the thickness and conductivity of aquitards, and the distance between the production zone and private wells. As described in GEIS Section 2.4.1.3, the applicant assesses aquifer parameters in the production zone and the integrity of confining layers through ongoing site and well field characterization including pump test analyses. The applicant also identifies and reports all private wells, their piezometric levels, and current uses within and in the vicinity of the permit area as part of site characterization. These private wells are considered to be part of the monitoring well network, and the licensee monitors them to identify potential drawdown impacts. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.22.5 Aquifer Restoration and Decommissioning: Methods and Operational Experience

**Comment: 032-010**
A commenter questioned the significance level of SMALL assigned to groundwater impacts due to decommissioning and suggested replacing the significance level of SMALL with SMALL to

LARGE due to ongoing contamination issues that may be significant at sites that failed to meet target water quality for restorations.

*Response: As described in GEIS Chapter 4, groundwater impacts from surface decommissioning are separate from groundwater impacts due to aquifer restoration. The aquifer restoration stage addresses actions used by an NRC licensee to restore the quality of groundwater affected by operations. On the other hand, as discussed in the Executive Summary, general decommissioning activities include radiological decontamination of surface facilities, dismantling and disposing structures that are no longer needed, plugging and abandoning wells, and reclaiming and revegetating the site to preoperational conditions. As discussed in GEIS Sections 2.6, 4.2.4.2.4, 4.3.4.2.4, 4.4.4.2.4, and 4.5.4.2.4, the environmental impacts to groundwater during dismantling and decommissioning ISL facilities are primarily associated with potential spills of fuels and lubricants and groundwater consumptive use. The consumptive groundwater use could include water use for dust suppression, revegetation, and reclamation of disturbed areas (GEIS Section 2.6), and hence, the impacts on groundwater during decommissioning are SMALL. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 019-001**
A commenter noted that potential impacts of ISL operations on groundwater conditions (i.e., distribution, flow, and chemistry) and how these impacts could affect corrective and remedial actions at the nearby facility should be addressed in a site-specific environmental evaluation of the proposed or existing facility.

*Response: The GEIS does not replace the site-specific environmental review of a proposed or existing ISL facility. The NRC staff will conduct a site-specific environmental evaluation of the proposed or expanded existing ISL facility including the impacts of ISL operations on groundwater conditions. Because the information has already been described in Sections 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: CA07-011; CH-08-010; SP10-010; SP10-011**
Several commenters noted that the purpose of groundwater restoration activities is to eliminate risk of postoperational contaminant migration from the exempted recovery zone to nonexempted portion of aquifers. A few commenters noted that restoration activities complement the natural and geochemical conditions to minimize the adverse impacts on public health and safety.

*Response: As discussed in GEIS Section 2.5, the purpose of aquifer restoration is to ensure that the water quality and the groundwater use in surrounding sources of drinking water (nonexempted portion of the ore-bearing aquifer) will not be adversely affected by uranium recovery operations. Moreover, aquifer restoration criteria and methods are determined on a site-specific well field basis, given that natural and geochemical conditions at ISL sites are site specific. NRC and the applicable state agency review aquifer restoration results to ensure applicable restoration standards are met. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 038-002; 048-002; 1015-009; 1314-015; AL14-036; AL18-068; AI24-105; AL25-121; CA01-001; CH03-001; CH03-002; CH03-003; CH06-018; CH08-012; CH09-001; GA01-004; GA10-005; GA19-005; GI01-008; GR03-002; GR14-008; GR16-006; HC014-003; NE03-001; SP03-001; SP03-002; SP07-001**
A commenter spoke about numerous successfully restored ISL well fields in Texas, Wyoming, and Nebraska. Another commenter noted that in the past 30 years, no U.S. ISL facilities have caused serious environmental health and safety risk or failed to restore an aquifer. On the other hand, several commenters questioned the practicability of groundwater restoration and raised general concerns about consequential impacts to public health and safety. Several commenters talked about earlier unsuccessful groundwater restoration activities that failed to restore groundwater to baseline and, hence, required lowering cleanup standards and/or caused delays. Several other commenters asked whether groundwater has been restored to baseline at ISL well fields, and if so, the name of successfully restored ISL well fields and whether groundwaters at these well fields were reclassified. A commenter stated that no amount of water can clean up water resources after being contaminated from ISL operations. Other commenters asked for general information about groundwater restoration activities including duration of restoration activities, cleanup standards, how it is bonded, and which constituents were not restored to baseline and how that affected groundwater quality in the previous restoration activities.

*Response: General information regarding the purpose of aquifer restoration and the different techniques (including groundwater transfer, groundwater sweep, reverse osmosis, permeate injection, and recirculation) employed during restoration are discussed in GEIS Section 2.5. NRC licensees are required to return water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). Examples of groundwater restoration for pilot and commercial-scale well fields are provided in GEIS Section 2.11.5. A list of target and actual restoration values or restoration values other than baseline of water quality parameters at two different ISL sites is given, as an example, in GEIS Tables 2.11-4 and 2.11-5 As discussed in GEIS Section 2.10, the licensee is required to provide financial sureties for remediation and restoration activities. Additional costs associated with delays in groundwater restoration need to be addressed in financial sureties that are reviewed by NRC annually. As discussed in GEIS Section 2.5.4, the NRC must review and approve the monitoring results before aquifer restoration is considered to be complete. The UIC permitting authority (either the state or EPA) must review and approve restoration results to their permit standards. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-075**
One commenter asked why restoration takes so long.

*Response: Aquifer restoration criteria and methods are determined on a site-specific, well field-by-well field basis, given that natural and geochemical conditions at ISL sites are site specific. As in any other projects involving natural systems, potential uncertainties associated with local hydrogeological characteristics of the aquifers and confining layers could potentially affect the duration of aquifer restorations. Because the ISL process mobilizes a number of constituents in addition to uranium, the licensee must restore well field water quality parameters in the affected groundwater to the standards in 10 CFR Part 40, Appendix A, Criterion 5(B)(5) or another NRC-approved standard. In general, because groundwater velocities are usually slow, groundwater restoration and stabilization periods could be lengthy. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-054**
A commenter criticized NRC for not using restoration challenges at ISL facilities discussed in GEIS Chapter 2 to predict long-term impacts at future ISL sites or suggest technical and management controls to mitigate the effects of what the commenter considered to be "failed groundwater restoration methods."

*Response: As discussed in GEIS Section 2.5, the purpose of aquifer restoration is to ensure that the water quality and the groundwater use in surrounding sources of drinking water will not be adversely affected by uranium recovery operations. NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). Aquifer restoration criteria and methods are determined on a site-specific well field basis, given that natural and geochemical conditions at ISL sites are site specific. The applicant has the flexibility in choosing a combination of remediation methods and implementing its own technical and management controls to achieve restoration targets in their restoration methods if approved by NRC. NRC staff is not aware of any incidents in which nonexempt portions of an ore-bearing aquifer have been contaminated by ISL operations under NRC regulation. While aquifer restoration can take years to complete, NRC requires ISL licensees to comply with the timely decommissioning requirements at 10 CFR 40.42 (NRC, 2008) that require notification of NRC within 60 days following the decision to permanently cease injection of lixiviant into a well field (an action that signifies intent to cease production and begin aquifer restoration for the well field). A licensee then has 24 months to complete restoration or notify NRC and request an alternate schedule. This process ensures that aquifer restoration is completed as soon as practical and the health and safety of workers and the public are protected. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 041-001**
A commenter noted that the GEIS does not address remediation of groundwater resources.

*Response: Groundwater restoration/remediation is discussed in GEIS Section 2.5. In this section, different restoration techniques (groundwater transfer, groundwater sweep, reverse osmosis, permeate injection, and recirculation) are discussed. This section also discusses the stabilization period and monitoring following the end of active restoration. Past aquifer restoration efforts at ISL sites are discussed in Section 2.11.5. The potential impacts of groundwater restoration are discussed in GEIS Sections 4.2.4.2.3, 4.3.4.2.3, 4.4.4.2.3, and 4.5.4.2.3. Because the information has already been described in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-023**
A commenter suggested the GEIS should analyze the environmental impacts of the restoration methods discussed in GEIS Section 2.5 to select the most effective approach.

*Response: GEIS Section 2.5 discusses different, commonly used restoration techniques involving groundwater transfer, groundwater sweep, reverse osmosis, permeate injection, and recirculation. NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). The licensee has the flexibility in choosing a combination of different restoration techniques to achieve the restoration goals approved by NRC. Aquifer restoration criteria and methods are determined on a site-specific well field basis, given the variability of natural and geochemical conditions at ISL sites. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1321-030; AL21-080; GR04-003**
A commenter noted that water can be reconditioned to better than drinking water conditions after restoration and reclamation activities. Another commenter stated that GEIS implies restoration to baseline, but it is unclear whether restored aquifers would be sufficient for use as drinking water sources. One commenter asked what groundwater could be used for after ISL is finished, in particular, livestock and irrigation uses were mentioned as concerns.

*Response: NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). As discussed in GEIS Section 1.7.2.1, before the ISL operations commence, the aquifer in the production zone must be exempt as a source of drinking water and, hence, not used for drinking purposes. Therefore, the licensee is not required to restore groundwater quality to drinking water standards. Other postrestoration water uses of the exempted aquifer (or portion thereof) are plausible but depend on site-specific conditions, including the baseline water quality and postrestoration water quality that was attained by the licensee and approved by NRC and EPA or authorized state. For example, well fields that are returned to baseline water quality would support the same nondrinking water uses (if any) that existed prior to ISL operations. Similarly, well fields that were restored to a particular class of use standard may be limited to uses applicable to that classification. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1602-009**
One commenter asked how old underground uranium mines in the vinicity of an ISL facility would affect "reclamation" (restoration).

*Response: As discussed in GEIS Section 2.5, water quality parameters measured by the licensee prior to well field operations are used to determine the site-specific water quality standards for reclamation/restoration. NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). The license application and the restoration plan would have to address the potential effects of existing conditions at or in the vicinity of the ISL site, including former uranium mines, on the ability to effectively restore groundwater. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-110**
One commenter wanted to know how Section 4.2.4.2.3 will be used in the site-specific analysis.

*Response: As discussed in Section 4.2.4.2.3, aquifer restoration criteria and methods are determined on a site-specific well field basis, given the variability in natural and geochemical conditions at ISL sites. Section 4.2.4.2.3 provides general background information for groundwater consumption during aquifer restorations at the ISL facilities in the Wyoming West Uranium Milling Region and puts the resulting potential environmental impacts into perspective by comparing groundwater consumption to water consumption for irrigation uses.*
*Section 4.2.4.2.3 does not replace the site-specific evaluation of potential groundwater impacts from restoration. The applicant is obliged to provide site-specific and well field basis restoration criteria, a technical basis for the restoration techniques chosen, a plan for how to dispose discharging wastes, and financial sureties for restoration activities as part of license application. GEIS Section 1.8.1.3 provides a discussion of how the GEIS will be used in the site-specific environmental review. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-111**
A commenter asked whether impacts to water quality after restoration are significant.

*Response: NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). These standards are protective of public health and safety. Because the standards are already discussed in GEIS Section 2.5, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-069**
A commenter noted that because none of the ISL operators in the United Stated has restored groundwater in the production zone to baseline, permanent groundwater contamination within and outside (through excursions) the production zone should be disclosed as an unavoidable environmental impact.

*Response: The impacts to groundwater from ISL operations and aquifer restoration are discussed in GEIS Sections 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2. GEIS Sections 2.11.4 and 2.11.5 provide a summary of operational experience concerning excursions and aquifer restoration. NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). In general, favorable hydrogeological conditions for effective isolation of ore-bearing aquifers and containment of recovery solutions, integrity and continuity of impermeable confining layers, successful implementation of restoration techniques, and continuous and effective monitoring of well fields during ISL operations, restorations, and stabilization periods are expected to limit potential environmental impacts. NRC staff is not aware of any incident in which nonexempt portions of an ore-bearing aquifer have been contaminated by ISL operations under NRC regulations. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1321-032**
One commenter noted that the GEIS should include analysis of restoration of mobilized metals (arsenic, selenium, molybdenum) and salts.

*Response: Typical baseline water quality parameters, based on NUREG–1569, are provided in GEIS Section 2.2, Table 2.2-1. The list includes arsenic, selenium, and molybdenum as trace and minor elements and potassium, sodium, magnesium, and chloride as major elements and ions that the licensee samples for prior to operation. NRC licensees are required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved in their license (NRC, 2009). The aforementioned constituents would be included in aquifer restoration efforts to demonstrate compliance with the water quality standards. Because this information is already discussed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-080**
A commenter asked whether treated CBM production water could be used for ISL aquifer restoration.

*Response: The licensee has the flexibility in choosing a combination of different restoration techniques to achieve the restoration goals approved by NRC. Aquifer restoration criteria and methods are determined on a site-specific well field basis, given the variability of natural and geochemical conditions at ISL sites. An applicant or licensee proposal to use alternative water* *supplies during ISL restoration would be reviewed by NRC as part of its safety and environmental reviews. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-104**
By referring to GEIS Section 4.4.4.2.3, a commenter suggested using groundwater sweep records from the Crow Butte facility rather than using records from the Wyoming East Uranium Milling Region.

*Response: The text in GEIS Section 4.4.4.2.3 has been revised to include information on consumptive water use from aquifer restoration activities, including groundwater sweep, at the Crow Butte ISL site (Crow Butte Resources, Inc., 2001).*

### G5.22.6 Miscellaneous Groundwater Comments

**Comment: 015-017; 015-024**
A commenter asked for a correct link for Whitehead (1996) and for Robson and Banta (1995) in the reference sections of GEIS Chapter 3.

*Response: The links for Whitehead (1996) (http://pubs.usgs.gov/ha/ha730/ch_i/) and for Robson and Banta (1995) (http://pubs.usgs.gov/ha/ha730/ch_c) have been updated in the reference list.*

**Comment: 015-019**
Regarding GEIS Section 3.3.4.3.1 description of the regional aquifer systems, a commenter requested clarification that recharge is in outcrop areas. The commenter also requested references for factual information discussed in the section.

*Response: The requested clarification on recharge was made to GEIS Section 3.3.4.3.1. The reference for the information discussed in Section 3.3.4.3.1 is included at the beginning of the discussion in that section as Whitehead (1996); therefore, no additional changes were made to the referencing in that section.*

**Comment: 015-027**
A reviewer noted that McWhorter and Sunada (1977) was incorrectly referenced as Whorter and Sunada (1977) in Sections 4.2, 4.3, 4.4, and 4.5.

*Response: All references in the GEIS to Whorter and Sunada (1977) were corrected as suggested by the commenter to McWhorter and Sunada (1977).*

**Comment: 015-023**
A commenter asked for a reference for statements of fact in Section 3.5.4.3.1.
*Response: The reference is provided in the first paragraph of Section 3.5.4.3.1 (i.e., Robson and Banta, 1995). Because the information is in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 032-028**
A commenter noted that the description in Draft GEIS Section 3.5.4.3 of local groundwater resources in the Grants Uranium District is not comprehensive.

*Response: Section 3.5.4.3.1 discusses important aquifer systems in the Northwestern New Mexico Uranium Milling Region at a regional scale. The source of this information is provided in the first paragraph of this section. Section 3.5.4.3.2 discusses aquifer systems in the vicinity of Crownpoint, Unit 1, and Church Rock sites, as an example. As discussed in GEIS Section 2.2, the applicant is required to provide detailed site-scale information on aquifers and groundwater resources as part of site characterization. Because the information will be included in the site-specific environmental review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-104**
A commenter asked for revision to a statement in Draft GEIS Section 4.2.4.2.2.2 to reflect that the Green River Formation in the Lost Creek area is not located above the uranium-bearing aquifer.

*Response: The mention of the Green River Formation has been replaced by "Quaternary-aged sedimentary deposits and sandstone layers" in Section 4.2.4.2.2.2.*

**Comment: 1173-101**
One commenter noted that, in Draft GEIS Section 4.4.4.2.2.2, the Pierre Shale is not a sandstone.

*Response: The typographical error as pointed out by the commenter has been corrected.*

**Comment: 1173-102**
One commenter asked to spell out MIT in Draft GEIS Section 4.4.4.2.2.2.

*Response: The acronym MIT (mechanical integrity testing) has been spelled out in the text.*

**Comment: 1173-103**
A commenter pointed out a typographical error in Draft GEIS Section 4.4.4.2.2.3 and asked to change "Crown Butte" to "Crow Butte."

*Response: The typographical error as pointed out by the commenter has been corrected.*

**Comment: 1173-034**
A commenter asked to change "low permeable" to "impermeable" in Draft GEIS Section 3.2.4.3.2.

*Response: The suggested revision has been incorporated.*

**Comment: 1173-051**
A commenter pointed out a typographical error in Draft GEIS Section 3.3.4.3.3 and asked to correct the information that Smith and Reynolds Ranches are in the Monument Hill District, not in Pumpkin Buttes.

*Response: The typographical error was noticed in* Draft *GEIS Section 3.3.4.3.3, and in response the phrase "the Pumpkin Buttes district" has been removed from Page 3.3-18, Lines 23–24.*

**Comment: 1173-094**
Regarding the discussion on impacts to deep aquifers in Draft GEIS Section 4.3.4.2.2.3, a commenter asked whether the Madison is the karstic Paleozoic aquifer.

*Response: The text has been clarified to indicate that the Madison Limestone is an example of a karstic Paleozoic aquifer.*

### G5.22.7 References

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NRC. "Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New uranium Recovery Facilities and (2) The Restoration of Groundwater at Licensed Uranium In Situ Recovery Facilities." Regulatory Information Summary 2009-05. ADAMS Accession No. ML083510622. NRC. April 29, 2009.

NRC. "Compliance With 10 CFR 40.42's Timely Decommissioning Requirements." Letter (July 7) from K.I. McConnell to S. Collings, Power Resources, Inc. Washington, DC: NRC. 2008.

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

NRC. "Environmental Assessment for the Operation of the Gas Hills Project Satellite *In-Situ* Leach Uranium Recovery Facility." Docket No. 40-8857. Washington, DC: NRC. 2004.

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

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs—Final Report." Washington, DC: NRC. August 2003b.
NRC. "Environmental Assessment for Renewal of Source Material License No. SUA–1341." Docket No. 40-8502. Washington, DC: NRC. 1998.

NRC. "Regulatory Guide 3.46, Standard Format and Content of License Applications, Including Environmental Reports, for In Situ Uranium Solution Mining." Washington, DC: NRC. 1982.

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

## G5.23 Surface Water Resources

### G5.23.1 Impacts of Water Impoundments on Soil and Surface Water

**Comment: 042-004; 050-047; 050-104; 050-121; 059-008; 061-015; 1015-005**
Commenters expressed a concern that extreme precipitation events, common in the western United States, could cause holding ponds at ISL facilities to overflow and contaminate surface water. Another commenter noted that leakage from ponds could impact soil, that impacts to surface water from impoundments were site specific, and, depending on site-specific conditions, the impacts of uncontrolled releases from evaporation ponds could be LARGE. Finally, one commenter noted that ephemeral drainages to perennial streams are also regulated by the State of Wyoming.

*Response: As discussed in Section 2.7.2, evaporation ponds can be used at ISL facilities to manage liquid wastes. With respect to storm water runoff into evaporation ponds, evaporation ponds at ISL facilities are required to be designed to contain runoff from extreme precipitation events. These requirements are specified in 10 CFR Part 40, Appendix A, Criteria 4(a) and discussed in NRC Regulatory Guide 3.11 (NRC, 1977). The design requirements are intended to minimize the risk that storm water runoff into the evaporation pond would cause water to overflow the pond. 10 CFR Part 40, Appendix A specifies that the drainage area upstream of an evaporation pond be minimized to reduce runoff into the pond. Regulatory Guide 3.11 (NRC, 2008) indicates evaporation ponds should be designed to contain the probable maximum runoff from the 6-hour probable maximum precipitation event for the drainage area of the pond. NRC staff evaluates design requirements as part of the site-specific safety review that is conducted in parallel with the NRC environmental review. The safety review is based on detailed review methods described in NUREG–1569 (NRC, 2003) and referenced in GEIS Section 2. NUREG–1569 (NRC, 2003) also addresses requirements for impoundment liners. The potential site-specific impacts of accidental releases from ISL evaporation ponds would also be evaluated in the site-specific safety review as part of the facility licensing process. No changes were made in the GEIS, because the impoundment design requirements are already referenced and would be addressed during the site-specific licensing process.*

### G5.23.2 Surface Water Resources and Ecology

**Comment: 1173-010; 1173-073; 1319-010**
One commenter proposed that no surface occupancy buffers be required around stream banks and that drilling in ephemeral drainages be prohibited. Another commenter noted that portions of the Wyoming East Uranium Milling Region are within the region covered by the Platte River Recovery Program. This program requires consultation with the U.S. Fish and Wildlife Service for water use above certain quantities associated with federal actions. Groundwater use that impacts surface water is also considered by this program.
*Response: Based on other comments provided by this commenter, these proposed restrictions relate to preventing disturbances to wildlife. The NRC staff believes that the need for such restrictions to protect sensitive habitats is site specific. The GEIS discusses potential ecological impacts and approaches to mitigate these impacts in Sections 4.2.5, 4.3.5, 4.4.5, and 4.5.5. Mitigation measures for a specific ISL facility may be proposed by a licensee following consultation on potential impacts with NRC, state, or other federal agencies. For sites in the Wyoming East Uranium Milling Region within the Platte River Basin, NRC consultation with the U.S. Fish and Wildlife Service would be required by the Platte River Restoration Implementation Plan for federal actions involving water resources. Reference to this program has been added*

*to the text of Section 3.3.4.1. Reference to the Platte River Recovery Implementation Program has also been added to Section 4.3.4.1 with respect to the impacts of groundwater pumping on surface water.*

### G5.23.3 Watersheds, Perennial Streams, and Stream Flow

**Comment: 015-015; 015-016; 015-018; 015-021**
One commenter questioned the values of stream flow and discrepancies with published values for various rivers and creeks reported in GEIS Sections 3.2, 3.3, and 3.4.

*Response: The NRC staff has reviewed all of the stream flow data reported in GEIS Sections 3.2, 3.3, and 3.4 and, where appropriate, has updated the values reported in the GEIS based on annual stream flow data calculated from daily mean flows obtained from the U.S. Geologic Survey Water Watch website (http://water.usgs.gov/waterwatch/). The average flow rates reported in the GEIS may differ from those in other sources for a variety of reasons (U.S. Geologic Survey, 2008).*

**Comment: 1173-032**
This commenter noted that the Crooks Gap Uranium District is only partly within the Sweetwater River watershed in the Wyoming West Uranium Milling Region.

*Response: The NRC staff agrees with the comment, and the text in Section 3.2.4.1 has been clarified to reflect this observation.*

**Comment: 1173-088**
This commenter noted a typographical error in Section 4.3.4.1.2 of the Draft GEIS related to the statement that there are fewer perennial streams in the Wyoming East Uranium Milling Region than in the Wyoming West Uranium Milling Region. The commenter also requested that the GEIS include a justification for this statement.

*Response: The NRC staff has confirmed that there are fewer perennial streams in the Wyoming East Uranium Milling Region than in the Wyoming West Uranium Milling Region. GEIS Section 3.3.4.1 contains information on surface water in the Wyoming East Uranium Milling Region. Perennial streams are more prevalent in the Wyoming West Uranium Milling Region because stream flow there is sustained by snowmelt in the mountains. Because the necessary information is available in the GEIS, no additional changes to the GEIS are necessary.*

### G5.23.4 Impacts to Surface Drainages and Surface Water

**Comment: 1173-063; 1173-074**
This commenter suggested the GEIS did not adequately disclose the nature of potential impacts to surface drainages and surface water from disturbance of soils during construction or from discharge of produced water during operation and aquifer restoration. The commenter also suggested that the foreseeable acreage of disturbed soil be disclosed, particularly for sites within the Colorado River Basin.

*Response: Compaction, erosion, and sedimentation were identified as potential impacts to surface water in GEIS Section 4.2.4.1.1. With respect to the Colorado River Basin, the NRC staff believes that the commenter's concern is about contributions of soil salinity to the salinity of* *the Colorado River. Although Figure 3.2-6 includes a small portion of the Bitter Creek watershed that is within the Colorado River Basin and lies within the Wyoming West Uranium Milling District, at the time of this writing no potential uranium milling sites are within the Colorado River Basin. GEIS Section 4.2.3.1 estimates that soil might be disturbed over approximately 10 percent of an ISL site area. With respect to providing more refined estimates of erosion, runoff, and sedimentation from uranium milling sites, these processes all depend on local soil, topographic, and meteorological conditions as well as the scale of the ISL facility. Text has been added to Section 4.2.3.1 identifying these potential impacts. Nevertheless, NRC believes that the impact of these processes on soil and surface water will be SMALL if best management practices are followed during construction.*

*Discharge of produced water to local drainages could affect channel stability and result in headcutting (erosion) of the channel. Discussion of these potential impacts has been added to Section 4.2.4.1.2.*

**Comment: 1173-121**
One commenter noted that temporary changes in spring and stream flow during construction were identified as potential impacts in the Wyoming West Uranium Milling Region and Nebraska-South Dakota-Wyoming Uranium Milling Region in Tables 10-1 and 10-3, but not in the Wyoming East Uranium Milling Region in Table 10-2.

*Response: The NRC staff agrees that these potential impacts could occur in the Wyoming East Uranium Milling Region, and Table 10-2 has been revised to include this potential impact.*

**Comment: 1173-100**
This commenter noted that precipitation in the Nebraska-South Dakota-Wyoming Uranium Milling Region was greater than, not similar to, that in the Wyoming West Uranium Milling Region as was stated in Sections 4.4.4.1.2, 4.4.4.1.3, and 4.4.4.1.4.

*Response: Although average annual precipitation does increase somewhat from the Wyoming West Uranium Milling Region to the Nebraska-South Dakota-Wyoming Uranium Milling Region, the average annual runoff estimated from stream flow records for the intermontane areas where the ISL facilities might be located does not differ significantly between the Wyoming West, Wyoming East, and Nebraska-South Dakota-Wyoming Uranium Milling Regions. NRC believes that runoff is a better indicator of potential surface water impacts than precipitation. The text in Section 3 on the affected environment describing surface water has been modified to discuss average annual runoff, and the text in Chapters 4 and 10 describing surface water impacts has been changed to reference runoff.*

**Comment: 1305-104**
This commenter requested, within the context of the GEIS Chapter 4 assessment of potential surface water impacts during aquifer restoration, that the GEIS provide examples, historical context, and explanation or analysis as to how permit requirements and subsequent decommissioning has worked to mitigate environmental impacts in the past.

*Response: GEIS Section 1.7 describes the licensing and permitting requirements for an ISL facility. NRC assumes licensees comply with applicable regulatory requirements, license conditions, and permit conditions when evaluating the potential environmental impacts of an ISL uranium recovery facility. The impact analysis in Section 4.2.4.1.3 discusses the factors associated with aquifer restoration activities that could contribute to potential surface water impacts and are expected to be addressed by specific permitting programs (e.g., storm water,* *land application, and surface water discharge). The licensing and permitting requirements involve not only the NRC but also other federal and state agencies, as well as tribal agencies if the facility is on Native American tribal land. Enforcement of permit and license requirements issued by other federal, state, or tribal agencies is the responsibility of those agencies. Oversight and evaluation of the effectiveness of those permitting programs is also the responsibility of the implementing agencies and is beyond the scope of the GEIS.*

*Consistent with its authority, NRC ensures that licensees comply with applicable NRC safety and environmental requirements during construction, operation, aquifer restoration, and decommissioning through an inspection program that is discussed in GEIS Section 1.7.1. As discussed in Section 2.6, decommissioning and remediation of the ISL facilities to meet NRC cleanup criteria are verified by environmental sampling of all potentially affected areas. NRC reviews licensee decommissioning plans to ensure affected areas are included in surveys so that any potential hazards would be addressed. NRC has regulated the decommissioning of various types of facilities for decades. Adding a historical evaluation of past decommissioning efforts to the GEIS is not considered necessary to demonstrate effectiveness. Historical information on environmental actions in response to spills, leaks, and excursions during operation and aquifer restoration is also discussed in GEIS Section 2.11. Because NRC considers the comment to be adequately addressed by information already included in the GEIS, no change has been made in response to this comment.*

### G5.23.5 Regulatory Process Related to Surface Water

**Comment: 050-101; HC010-009; HC010-015**
One commenter noted that construction impacts to water quality are site specific, and another commenter noted that the designated uses of specific water bodies within Wyoming need to be reviewed on a site-specific basis and that even impaired water bodies need to be fully restored, presumably to meet their designated use.

*Response: The NRC staff agrees that impacts can be site specific and that the designated uses of specific water bodies need to be considered in the environmental review for specific ISL facilities. Site-specific impacts to water quality would be considered during the environmental review for licensing specific ISL facilities. As a result, no change was made to the GEIS in response to the comment.*

### G5.23.6 General Water Resource Concerns

**Comment: 012-002; 1317-002; 1606-001**
One commenter noted that water was an important resource in the uranium milling regions. Another commenter was concerned about the potential impacts to fragile desert water systems and aquifers. One commenter mentioned that historically ISL uranium mines have caused surface water pollution.

*Response: The GEIS provides a description of the surface water and groundwater resources of the affected environment of the four uranium milling regions. The potential impacts of uranium milling activities to water resources are discussed in GEIS Section 4. Historical operating experience with spills is discussed in GEIS Section 2.11.2 which includes discussion of releases to surface water. Best management practices that can limit impacts to water resources are listed in Table 7.4-1. Because of the general nature of the comments, no changes were made to the GEIS beyond the information provided in this response.*

### G5.23.7 Surface Water and Spills

**Comment: 015-003; 1321-039**
One commenter noted that the potential impact of spills could vary from SMALL to LARGE depending on the severity of the release and the resources at the site. Another noted that spills during operations could flow directly into surface water in addition to contaminants being carried into surface water by storm water runoff.

*Response: GEIS Section 4 addresses the potential environmental impacts of unintended releases of these solutions to the environment. Although the GEIS identified spills as a potential source of surface water and shallow groundwater impacts in Section 4.2.4.1.2, the text has been clarified to indicate that spills could flow directly into surface water drainages or contaminants could be carried there by storm water runoff. The finding that the impacts would not be LARGE is based on the assumption that surface spills would be rapidly controlled and mitigated based on a site-specific spill prevention and control plan. The GEIS has been revised to indicate this assumption.*

### G5.23.8 Waste Discharges to Surface Water

**Comment: HC019-003; HC019-004**
This comment is contained in a resolution passed by the Crook County (Wyoming) Board of Commissioners. The resolution requested the GEIS establish a number of requirements including that no process bleed should be discharged into streambed, irrigation canal, or lake and that there should be no upland disposal of discharge water.

*Response: State and federal regulations limiting the discharge of process waters to land and surface water are described in GEIS Section 4.2.4.1.2. As stated in Section 1.5.2, the GEIS is based on existing regulations at the time of writing. Therefore, establishing new requirements is beyond the scope of the GEIS. Compliance with applicable local regulations is the responsibility of the ISL operator and would be established by ISL licensees consulting with the applicable local agencies. Because this comment addresses a local matter, no change was made to the GEIS.*

### G5.23.9 Impacts of Operations and Aquifer Restoration on Surface Water

**Comment: 1173-072**
This commenter questioned the finding in Section 4.2 that groundwater extraction during operations would be unlikely to affect nearby streams and springs. The commenter noted that if the ore-bearing aquifer was artesian or the upper confining bed was leaky, then there could be surface water impacts.

*Response: Although only directed to the operation phase, this comment would also apply to the aquifer restoration phase of the ISL project. The GEIS does not dismiss the possibility that net groundwater extractions from the ore-bearing aquifer could impact local surface water bodies or springs if the aquifer is hydraulically connected to these surface features. As stated in the GEIS, most, if not all, ISL operations would take place in confined aquifers. For the operations to impact local surface water features, the ore-bearing aquifer would need to have an artesian head and the upper confining beds would need to have sufficient permeability to allow groundwater to flow to the surface features. Such conditions near the ISL facility would not be favorable to licensing an ISL in the first place and would have allowed groundwater* *contaminated by the ore body to discharge to the surface water features even in the absence of any ISL operation. Thus, NRC staff considers it unlikely that ISL activities would take place at sites with ore-bearing aquifers with any significant connection to surface water features. Assuming the ore-bearing aquifer at an ISL facility had a weak hydraulic connection to a local surface water feature, the effect of the net groundwater extractions during operation and aquifer restoration would also be weak and the potential impact to the surface water feature would be SMALL. The text in Sections 4.2.4.1.2 and 4.2.4.1.3 and Table 10 has been modified to explain this.*

### G5.23.10 References

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

NRC. NRC Regulatory Guide 3.11, Rev. 3, "Design, Construction, and Inspection of Embankment Retention Systems for Uranium Recovery Facilities." Washington, DC: NRC. 2008.

U.S. Geologic Survey. "USGS Water Data for the Nation." 2008. <http://waterdata.usgs.gov/nwis/?dv_statistics_disclaimer> (09 February 2009).

## G5.24 Wetlands

### G5.24.1 Surface Waters and Wetlands

**Comment: 05-125; 012-002; 015-007; 1321-026; 1321-027; 1321-028; HC010-010**
Several commenters were concerned with impacts to surface waters and regional ecology from spills, operations, and construction activities. Another commenter requested fill and dredging activities be identified and stated such activities may require a Section 404 permit. Another commenter requested a discussion on the applicability of Executive Order 11990 for wetland protection.

*Response: GEIS Sections 4.2.4.1, 4.3.4.1, 4.4.4.1, and 4.5.4.1 identify potential impacts to surface waters and wetlands in the uranium milling regions. The GEIS acknowledges that spills may occur during operations. However, as stated in Section 4.2.4.2.2.1, flow monitoring and spill response procedures are expected to limit the impact of potential spills to surficial aquifers. Best management practices to minimize impacts are described in GEIS Chapter 7. Discharges into Waters of the United States, including wetlands or waters of the state, may require permits as a result of the action. Sections 4.2.4.1, 4.3.4.1, 4.4.4.1, and 4.5.4.1 describe permit-related activity within the milling regions that could include (1) water quality degradation from temporary increases in suspended solids concentrations above background levels during in-stream construction or runoff from disturbed lands; (2) increased sedimentation in waterbodies resulting from either in-stream construction or construction activities on adjacent upland areas; (3) channel and bank modifications that affect channel morphology and stability; (4) reduced flows in waterbodies where fills have occurred; (5) water quality degradation in water bodies, lakes, impoundments, or surface water-based public water supplies from spills or leaks of fuel, lubricants, or hazardous materials during construction; and (6) fills and destruction of wetland areas. As part of the Section 404 permitting process licenses applicants will be required to demonstrate appropriate avoidance, minimization, and mitigation. This action will comply with the request of Executive Order 11990 to minimize the destruction, loss, or degradation of* *wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Should impacts warrant individual permitting, public notification of impacts will be required. As part of the site-specific review, the NRC staff will follow the NEPA process to assess impacts of the project not only to waters and wetlands but also to other aspects of the human environment. As part of the site-specific environmental review, the NRC staff will consult with the appropriate federal and state agencies. Because the surface water and wetlands impact and permitting information is discussed in the Chapter 4 water resources sections of the GEIS, no changes were made to the GEIS in addition to the information provided in this response.*

## G5.25 Ecology

### G5.25.1 Concerns About Evaporation Ponds

**Comment: 015-06; 034-006; 036-108; 050-0471; HC010-001; HC011-004; NE04-003; 1173-082**
Several commenters expressed concerns about the hazards of evaporation ponds and their constituents to the ecology of the area. Some commenters were concerned about the exposure to selenium and other contaminant effects, particularly on migratory birds. Another commenter was concerned about the impact to sage-grouse and large game from mosquito populations carrying the West Nile Virus. Requests to make netting both required and not required were also expressed. Another commenter requested a description of effects of exposure to stored solutions in ponds to numerous types of wildlife and the assessment of management action to assess impacts to migratory birds.

*Response: The GEIS acknowledges that wildlife species may be exposed to selenium and other contaminants in Section 4.2.5.2. That section also mentions potential mitigation measures that include fencing and netting of evaporation ponds. In addition, the constituents and the description of waste management of liquids are described in GEIS Section 2.7.2. The best management practices described in the GEIS provide guidelines and possible suggestions that applicants can use to minimize ecological impacts. The use of standard management practices and mitigative measures as well as no reported impacts to wildlife from evaporation ponds from past NRC-licensed ISL facilities results in a SMALL potential ecological impact from evaporation ponds. During the license application process, a site-specific analysis will be conducted, evaluating the proposed waste application process. During that time, NRC's assessment of potential impacts to local species, the use of best management practices, and its consultation with state and federal agencies will occur. Analysis of mosquito population and West Nile Virus impacts were beyond the scope of this document but could be included in site-specific assessments if deemed necessary. No changes to the GEIS were made beyond this response. If applicable, the consideration of West Nile Virus may be incorporated into site-specific reviews on a case-by-case basis.*

### G5.25.2 Noxious Weeds

**Comment: 050-049; 05-113; 034-001**
A number of commenters expressed concerns about the need for mitigation measures to stop the spread of noxious weeds and asked NRC to consider adding a vegetation chapter emphasizing impacts to plant communities, wetlands, invasive species, noxious weeds, and introduced species.

*Response: GEIS Section 4.2.5.1 notes active control measures to prevent the spread of noxious weeds includes application of herbicides during construction. The GEIS also describes potential mitigation for vegetation disturbances by the use of active revegetation practices using approved vegetation mixes from the appropriate state natural resource agency within each geographical area. Using applicable control techniques, impacts from noxious weeds would be SMALL to MODERATE during construction and SMALL during operation, aquifer restoration, and decommissioning. The evaluation of potential impacts to specific plant communities and wetlands will occur during the site-specific environmental review. No changes to the GEIS were made beyond this response.*

## G5.25.3 Concerns About the Sage-Grouse

**Comment: 1173-015; 1319-004**
Several comments indicated that the ISL facilities may impact sage-grouse nesting/lek areas and requested a general discussion of sage-grouse management practices.

*Response: The GEIS acknowledges that impacts to wildlife including sage-grouse may occur. Chapter 3 has provided maps indicating known sage-grouse nesting/leks areas within the uranium milling regions. The GEIS references standard management practices issued by the Wyoming Game and Fish Department that can help to minimize habitat fragmentation, wildlife stress, and incidental death. These standard management guidelines can also be applied in nesting/leks areas within the South Dakota region during the application process. The magnitude of impacts depends on whether a new facility is being licensed or an existing facility is being extended and is expected to be SMALL to MODERATE during construction and SMALL during operation, aquifer restoration, and decommissioning. Site-specific analysis and consultation with the appropriate federal and state natural resource agency will further identify potential impacts and mitigation measure if this species or nesting/lek areas are found within or adjacent to the boundaries of the proposed facilities. Figure 3.4-17 was updated to include sage-grouse leks within South Dakota. Reference to the BLM sage-grouse guidelines were added to Chapter 4.2.5.1. These guidelines are intended to help BLM planning teams include sagebrush habitat and sagebrush-dependent wildlife species (including sage-grouse) consideration in BLM land use planning.*

## G5.25.4 General Comments on Threatened and Endangered Species

**Comment: 015-002; 015-013; 015-014; 015-028; 015-032; 015-033; HC010-005; HC011-001**
One commenter requested deleting the phrase regarding endangered species adapting quickly from the Chapter 10 summary of impacts. In addition, it was expressed that impacts to wildlife and endangered species would be as significant in the operational phase as in the construction phase. One commenter asked NRC staff to reconsider statements about temporary disturbance to sagebrush and species readapting quickly. Additionally, a commenter indicated that corrections were needed to the threatened and endangered species list found in Section 3.5.5.3.

*Response: The NRC staff agrees with the comment regarding quick adaptation of endangered species; therefore, the phases in the Chapter 10 summary have been removed. Potential operational impacts to threatened and endangered species were assessed with the understanding that the majority of impacts to these species would occur from construction activities. In general, the day-to-day operation of the ISL facility is low in active personnel and traffic volumes. During the license application, consultation with state and federal agencies will* *occur to identify appropriate mitigation measures, which may include operational timing considerations, buffers, fencing, nets, and other measures to limit impacts to endangered species. The GEIS references standard management practices issued by the Wyoming Game and Fish Department and the New Mexico Department of Game and Fish that can be applied to the other uranium milling regions. The GEIS indicates the vegetation disturbance would be short in duration if active revegetation occurs. It is understood, but not stated in the GEIS, that in arid environments natural revegetation would take a considerably longer amount of time. However, active revegetation by the applicant in the form of planting, seeding, and irrigation would return the disturbed area to a state similar to preconstruction. For completeness, species within the counties located within the Northwestern New Mexico Uranium Milling Region were included in the GEIS.*

## G5.25.5 Concerns About Mitigation and Timing

**Comment: 05-114; 034-003; 1173-081; 1173-122; CA09-001**
One commenter questioned whether the referenced Wyoming Game and Fish guidelines would be required. It was also requested that operators should be required to bury overhead power lines to wells and the NRC provide design changes to mitigate impacts of roads, power lines, etc. One commenter suggested that timing stipulations should be addressed in the Chapter 10 tables for each geographical area. A suggestion to discuss mitigation for temporary loss, or conversion of habitat, was made.

*Response: The NRC does not have the regulatory authority to require the referenced Wyoming Game and Fish Department guidelines or the New Mexico Department of Game and Fish guidelines. However, these guidelines are referenced to provide guidance to the applicants and the NRC staff for site-specific environmental reviews. As part of the site-specific analysis, temporary and habitat conversion impact would be identified and evaluated for the local vegetation types at each facility location, as appropriate. Text has been added to Section 4.2.5.1 identifying burial of overhead power lines as a form of mitigation. In addition, text was added to Section 4.2.5.2 adding operational timing that has been established by the Wyoming Game and Fish Department. Timing stipulation text was added to the tables in Chapter 10 under Ecological Terrestrial impact summaries.*

## G5.25.6 Habitat Loss and Fragmentation

**Comment: HC10-001; HC010-004**
Commenters indicated their concerns with respect to potential impacts to large game crucial winter habitat and sage-grouse from habitat loss/fragmentation, noise vehicle disturbance, fences, and roads that may impact migration routes.

*Response: GEIS Chapter 4 acknowledges that habitat fragmentation can potentially occur. The GEIS also presents crucial wintering area and nesting/lek location maps for each of the uranium milling regions described in Chapter 3. As part of the site-specific analysis this information will be used in identifying whether a proposed ISL facility is located within an area of concern. The GEIS additionally references the Wyoming Game and Fish Department guidelines and the New Mexico Department of Game and Fish guidelines to provide guidance to the applicants and the NRC staff during the site-specific environmental review. As part of the site-specific analysis, consultation with appropriate state and federal agencies will occur to address appropriate concerns and mitigation solutions to identified impacts. Reference to the BLM sage-grouse guidelines was added to Chapter 4.2.5.1.*

### G5.25.7 Comments on Migratory Birds

**Comment: 004-002; 015-001; 015-004; HC0011-003**
Commenters stated that the GEIS should document how impacts will be avoided or shown to be not significant, including contaminating habitats for migratory birds, nesting, and long- and short-term environmental impacts of construction/operation. Commenters also stated that ISL activities that would impact migratory birds should be coordinated with the Department of the Interior before actions are taken (e.g., roads, power lines). Additionally, one commenter requested that the referenced New Mexico guidelines be updated.

*Response: Short- and long-term impacts to migratory birds will be addressed in a site-specific analysis, including but not limited to individual site habitat conditions, available water sources, waste disposal options, approved best management options, nesting areas, and migration pathways. During this site-specific analysis, consultation with appropriate agencies (e.g., Department of the Interior) would occur to discuss the proposed action and potential impacts. Section 4.2.5.1 has been updated to include the statement "Construction activities would be required to comply with the Migratory Bird Treaty Act. Consultation with the Department of Interior should occur prior to construction activities." Section 4.2.5.1 has been revised to include references to updated guidance.*

### G5.25.8 Ecological Maps and Figures

**Comment: 1173-036; 1173-053; 015-20**
One commenter questioned the necessity of showing crucial wintering areas for species in the various regions if no wintering areas are present. Another commenter noted that wintering areas were lacking in the states of South Dakota and Nebraska.

*Response: For completeness, species maps were created for the uranium milling regions whether crucial wintering areas and nesting/leks were present or not. The following text was added to Section 3.2.5.1: "Crucial areas for some species were not identified in the region. However, maps of the region were included for completeness whether species were identified or not." Data requests for crucial wintering data were made to South Dakota Department of Game, Fish, and Parks and to the Nebraska Game and Parks Commission. No wintering data was made available from either agency at the time of this reporting. Sage-grouse leks data was available from South Dakota and was added to Figure 3.4-17. As stated in the GEIS, if a potential facility was to be located within crucial wintering area ranges, guidelines have been issued by the states. Consultation with the applicable state agencies would be conducted and a site-specific analysis performed to determine impacts from the facility to these species. The magnitude of impacts to ecology in crucial wintering areas could range from SMALL to MODERATE.*

### G5.25.9 General Vegetation Comments

**Comment: 050-122; 050-124**
The commenter requested a greater level of explanation of the differences in vegetation types between the Wyoming West and Wyoming East Uranium Milling Regions. In addition, the commenters requested clarification of the impacts to the Wyoming West Uranium Milling Region and Nebraska-South Dakota-Wyoming Uranium Milling Region because the vegetation ecoregions are different.

*Response: The scope of GEIS was to give a broad description of what vegetation types may occur within the four geographic milling regions. The GEIS descriptions were developed on an ecoregion level with some similar or overlapping ecoregions occurring within the four milling regions. Many of these ecoregions have similar vegetation types and compositions. Figures 3.2-7 and 3.3-7 provide detailed maps of the ecoregions of the Wyoming West and Wyoming East Uranium Milling Regions. For specific future locations of new milling sites, potential license applicants and the NRC review would be expected to address site-specific habitat types and terrestrial species. Part of this review would include an assessment of site-specific vegetation types and impacts. Although the ecoregions differ in nomenclature between the four regions, the general types of impacts to vegetation will be similar in nature (herbaceous vegetation removal, shrub and tree removal, the removal of vegetation from the milling site during construction, associated reduction in wildlife habitat and forage productivity, increased risk of soil erosion, weed invasion, and the modification of existing vegetative communities as a result of milling maintenance, the loss of sensitive plants and habitats as a result of construction clearing and grading, and the potential spread of invasive species and noxious weed populations as a result of construction). Section 4.4.5.1 has been changed to reflect that the Nebraska-South Dakota-Wyoming Uranium Milling Region also is similar in vegetation types to the Wyoming East Uranium Milling Region.*

## G5.25.10 Traffic and Noise impacts

**Comment: 1319-005; 1319-006; HC010-013**
The commenter requested that a buffer distance is needed from terrestrial biota and the noise generated from an ISL facility. In addition, the commenter indicated that noise from vehicle traffic will impact wildlife; in particular, nesting sage-grouse. The commenter indicated that studies conducted indicate that the noise from one or more vehicles can impact the sage-grouse, which is considerably less than the potential 400 vehicles as described in the GEIS. Another commenter requested that potential noise impacts be considered at a site-specific level.

*Response: During the site-specific environmental review, NRC staff would evaluate potential noise impacts to wildlife by considering factors such as the locations of sage-grouse nesting areas/leks with regard to specific facility locations and operations. As appropriate, the NRC staff would consult with state and federal agencies to address concerns and mitigation solutions to identified impacts. GEIS Table 2.8-1 identifies the annual vehicular traffic types that will be associated with an ISL facility. As shown in this table, well field traffic related to remote ion-exchange facilities would approximately be one trip per day. Based on the information, the GEIS results indicate that, in general, the impact of noise on wildlife is SMALL to MODERATE. No changes to the GEIS were made.*

## G5.25.11 Impacts to Terrestrial Ecology and Wildlife Discussion

**Comment: 015-002; 015-028; 015-032; 015-033; 034-002; 034-007; 034-009; 059-010; CA09-002; AL22-087; 050-113; HC010-012; HC010-16; HC010-018**
Numerous comments were made with respect to the underestimation of ecological-terrestrial impacts, missing species, or the disagreement of operational impacts being less significant than those associated with the construction phase due to larger duration of operational phase. Other commenters requested additional information and/or analysis for impacts to sagebrush communities, habitat creation/conversion/function, and description of hazards to small mammals and reptiles.

*Response: The analyses presented in the GEIS use a regional approach. The information presented in Chapter 3 is a broad description of typical ecological habitats and species that may be found within the different uranium milling regions. It is not within the scope of this document to conduct an analysis on a small, local level. The information presented in the GEIS is intended as an initial informational tool to provide licensees and the NRC staff with the types of concerns and potential impacts that may be associated with a specific site. Impacts were looked at a regional level in which it was determined that it is unlikely that the impacts from an ISL facility would destabilize a whole vegetation community or a wildlife population. In this sense, habitat type, species, impacts, or other resources that may be present in a milling region have been identified in the GEIS. During the site-specific environmental reviews, the NRC staff will evaluate potential impacts to and the interaction with the local ecology. As appropriate, the NRC staff would coordinate with the appropriate federal and state agencies to discuss the proposed action, potential impacts, and agency concerns. Mitigation measures would be identified as appropriate.*

*Potential impacts from the operational phase of the ISL facility were compared to those of the construction phase. The construction phase, while shorter in duration, could have a SMALL to MODERATE impact to area vegetation due to greater numbers of employees, noise impact from machinery, and loss of habitat, depending on the size and location of the facility. During the operations phase, a relatively small footprint of the processing facility would displace local habitat. Some stress from limited human presence would occur, including potential spills and habitat fragmentation due to roads and fencing. Temporary work spaces would be revegetated as would areas disturbed from buried pipeline construction. ISL facilities would be required to maintain best management practices to comply with numerous permits (e.g., Section 404, Section 7 endangered species consultation, NPDES) needed for operation (see GEIS Section 1.7). In addition, the NRC staff would consult with appropriate federal and state agencies to discuss potential impacts, which may include monitoring and surveys and potential mitigation options. The NRC site-specific environmental review would also reevaluate construction and operational impacts to the local vegetation, ecology, wildlife, and endangered species. As part of the license application, the NRC staff will follow guidance provided in NUREG–1748 (NRC, 2003) to evaluate impacts generated from the proposed ISL facilities. No changes to the GEIS were made in response to these comments.*

### G5.25.12 Waste Water Disposal

**Comment : 1319-002; 015-005**
Commenters requested the GEIS evaluate the waste water disposal options used by the ISL facility, and it was stated that land disposal of wastewater was not recommended by the U.S. Department of the Interior.

*Response: The NRC staff acknowledges that impacts can occur as a result of waste water land disposal, and Section 4.2.5.2 has been expanded to clarify potential impacts. Additional details related to waste disposal are described in Section 4.2.12.2. At NRC-licensed ISL facilities, the licensee is required to monitor and control irrigation areas, if used, to maintain levels of radioactive constituents below NRC release limits in 10 CFR Part 40, Appendix A and other constituents (e.g., arsenic, selenium, molybdenum) within state permitted levels. The licensee uses its environmental monitoring program (see GEIS Chapter 8) to evaluate the potential accumulation of constituents in soil caused by land application of treated process water. Monitoring includes analyzing water before it is applied to land to ensure release limits are* *met and soil sampling to establish background levels and to monitor for uranium, radium, and other constituents.*

*Specific waste water disposal methods will be evaluated by the NRC staff during the license application process. During the site-specific environmental analysis, the disposal method and potential impacts will be addressed. In addition, the applicant will be responsible for conforming to any conditions warranted by any required federal or state permits.*

### G5.25.13 Swift Fox Correction

**Comment: 015-022**
The commenter indicated that the reference on Page 3.4-44 for the swift fox discussion is incorrect.

*Response: The commenter is correct, and the appropriate reference to Section 3.3.5.3 was added to the GEIS.*

### G5.25.14 Inconsistency Between Sections

**Comment: 036-107**
The commenter noted that Section 4.2.5.1, Page 4.2-29 is inconsistent with Page 4.3-19.

*Response: The commenter is correct, and the text in Section 4.2.5.1 was revised to be consistent.*

### G5.25.15 An Assessment of South Dakota Species of Greatest Conservation Need

**Comment: 034-004**
One commenter requested that South Dakota's species of greatest conservation need should be identified and accessed.
*Response: The information present within the GEIS is an initial informational tool to allow the NRC staff get an early understanding of habitat types, species, impacts, or other resources that may be present in an area where a new license application has been submitted. During the site-specific environmental review, the NRC staff would assess the interaction between the ISL facility and the local ecology and evaluate potential ecological impacts. The South Dakota list of species of conservation need was added to GEIS Section 3.4.5.3.*

### G5.25.16 References

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

## G5.26 Meteorology, Climatology, and Air Quality

### G5.26.1 Permitting and Regulations

**Comment: 050-060**
One commenter questioned the accuracy of a statement in the GEIS Section 1.7.2.2 that before any construction of or major modification to an ISL facility begins, a New Source Review permit

scrutinizes the site-specific air quality impacts. The commenter questioned whether ISL facilities need Prevention of Significant Deterioration (PSD) permits but stated that other new source review permits may be required, such as a preconstruction permit. The commenter requested that the GEIS contain an explanation of thresholds for when an air quality permit will be required and a detailed discussion of what requirements ISL facilities must meet, including modeling, inventory of air emission sources, emission monitoring, and best available control technology measures.

*Response: The statement in the GEIS is accurate. The New Source Review requires stationary air pollution sources to obtain permits prior to construction. This is commonly referred to as construction or preconstruction permitting and consists of the three types of permitting requirements as identified in GEIS Section 1.7.2.2. PSD permits apply to major sources in attainment areas that are new or making major modifications. Nonattainment New Source Review permits apply to major sources in nonattainment areas that are new or making major modifications. Minor New Source Review permits apply to sources that do not require PSD or nonattainment New Source Review permits. As stated in GEIS Section 1.7.2.2, the factors that determine which permit applies to a particular proposed ISL facility are the National Ambient Air Quality Standards (NAAQS) compliance status and whether the facility was classified as a major source based on emission levels. NRC is not the regulatory authority for this permitting. Permitting authorities are identified in GEIS Table 1.7-1. Specific nonradiological air quality requirements such as modeling, monitoring, and best available control technology measures would be determined by the appropriate regulatory authority on a site-specific basis. In response to the comment, GEIS Section 1.7.2.2 was revised to (1) clarify the New Source Review process, (2) state explicitly that NRC is not the permitting authority, (3) include thresholds for classification as a major source, and (4) state that permitting is conducted on a site-specific basis.*

**Comment: 050-123; 050-126**
One commenter made two comments concerning regulations and restrictions that apply to ISL facilities: one asked what "applicable regulatory limits and restrictions" apply to ISL facilities, and the other questioned whether the more stringent Class I allowable increments would apply to the Nebraska-South Dakota-Wyoming Uranium Milling Region because of the presence of a Class I area in the region.

*Response: GEIS Section 3.2.6.2 identifies various federal and state air quality regulations. GEIS Section 1.7.2.2 describes the permitting process and indicates that applicable regulatory limits and restrictions can vary based on the facilities emission levels and the local NAAQS compliance status. GEIS Section 4.4.6 identifies that a Class I area is located in the Nebraska-South Dakota-Wyoming Uranium Milling Region and indicates that the applicability of the more stringent Class I requirements depends on the proximity of the potential ISL facility to this Class I area. As described in GEIS Section 1.7.2.2, NRC is not the regulatory authority for permitting. Permitting authorities are identified in GEIS Table 1.7-1. Specific requirements would be determined by the appropriate regulatory authority on a site-specific basis. Although the comments were directed at the nonradiological regulations, the radiological regulations are contained in 10 CFR Part 20 as described in GEIS Section 2.9. In response to the comment, GEIS Section 4.4.6 was revised to clarify that requirements are determined on a site-specific basis by the appropriate permitting authority.*

### G5.26.2 Climatology and Meteorology

**Comment: 010-001**
One commenter stated that the referenced climatic data was from the National Climatic Data Center and it would be helpful to provide a reference for climatic data in the STAR format needed to run MILDOS.

*Response: The information presented in this section of the GEIS was intended to present general climatic information for the various regions. Information concerning radiation doses associated with ISL activities is located in GEIS Section 4.2.11.2. If appropriate, STAR-formatted climatic data supporting radiation dose calculations would be incorporated at the site-specific environmental review level. Because STAR-formatted climatic data was not considered essential for the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 028-012**
One commenter stated that the pan evaporation rate in the Wyoming West Uranium Milling Region can exceed 127 cm [50 in] per year. Draft GEIS Section 3.2.6.1 states that the pan evaporation rates for this region range from about 76 to 127 cm [30 to 50 in]. The commenter stated that the average annual evaporation rate at the Sweetwater Uranium Project for 1984 to 1992 was 154 cm [60.66 in].

*Response: The pan evaporation rate information in the GEIS is from the National Weather Service and represents a range of what can be expected for each region. The NRC staff recognizes that particular locations within each region may experience values outside this range. If applicable, pan evaporation rate information relevant to the location of the proposed site would be incorporated in the description of the affected environment at the site-specific environmental review level. Because pan evaporation rate information was addressed in the GEIS and considered adequate for the regional-level characterization, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 042-002; 061-022**
Two commenters expressed that sudden weather events are not evenly distributed within a uranium milling region. One commenter stated that the Black Hills are unique because of sudden weather events. Another commenter stated that both the Wyoming East and the Nebraska-South Dakota-Wyoming Uranium Milling Regions have areas that are more subject to tornadoes than other areas and requested that the GEIS include information on tornadoes.

*Response: The discussion on climate in GEIS Sections 3.2.6.1, 3.3.6.1, 3.4.6.1, and 3.5.6.1 includes sudden weather events such as rainstorms, hailstorms, and flooding. The NRC staff recognizes that the sudden weather events may not be uniformly distributed throughout a uranium milling region or between regions. If applicable, sudden weather events relevant to the location of a proposed site would be incorporated in the description of the affected environment at the site-specific environmental review level. Because sudden weather events were addressed in the GEIS and considered adequate for the regional level characterization, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 50-082**
One commenter requested that the GEIS include average wind speeds including a wind rose graphic for all three Wyoming descriptions.

*Response: The discussions on climate in GEIS Sections 3.2.6.1 and 3.3.6.1 include average wind speed data for Wyoming. However, the climate information presented in the GEIS was intended to present general information and may not cover all of the information that would be addressed in a site-specific review. It would be expected that appropriate climatic data relevant to the proposed site would be needed for the site-specific environmental review to evaluate potential impacts from ISL facility air emissions. Because wind speed information was addressed in the GEIS and considered adequate for the regional level characterization, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA15-005**
One commenter (at the Gallup, New Mexico, meeting) stated that the area has experienced a drought over the last 15 years.

*Response: GEIS Section 3.5.6.1 does contain information on meteorology and climatology in the Northwestern New Mexico Uranium Milling Region. If applicable, drought conditions and other such climatic conditions would be incorporated in the description of the affected environment in the site-specific environmental review. In addition, environmental impacts of the ISL facility life cycle from drought and other such climatic conditions would be evaluated in the site-specific environmental reviews, if applicable. Because precipitation information was addressed in the GEIS and considered adequate for the regional-level characterization, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA16-006**
One commenter stated that the GEIS does not consider climate change.

*Response: GEIS Section 1.5.4 identifies topics that the NRC staff has determined to be outside of the scope of the GEIS. Consideration of human-induced climate change is one of these topics. GEIS, Appendix A, Section 4.9 provides the rationale for this determination. 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 timeframe of the ISL facility life cycle. 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 life cycle. Climate variation on the scale of the ISL facility life cycle is presented in the GEIS Sections 3.2.6.1, 3.3.6.1, 3.4.6.1, and 3.5.6.1. The GEIS contains information on mean, low, and high values for temperature, precipitation, and snowfall from the National Climatic Data Center for the 1971–2000 time period. Additional climate data is likely to be included in site-specific environmental reviews. If applicable, environmental impacts of the ISL facility life cycle from natural climate variation would also be evaluated in the site-specific environmental reviews. Because natural climate variation information is addressed in the GEIS and considered adequate for the regional level characterization, no changes were made to the GEIS beyond the information provided in this response.*

## G5.26.3 Baseline Air Quality

**Comment: 050-077**
One commenter requested that the GEIS include information on air quality concerns in the Powder River Basin including air quality violations at coal mines near Pumpkin Buttes and emission levels from natural gas compressor stations and CBM natural gas fields.

*Response: This comment focuses on air quality and emission sources other than ISL facilities in the Wyoming East Uranium Milling Region. As described in GEIS Section 3.2.6.2, the NAAQS attainment status provides a general description of the local air quality by classifying the area as in attainment or nonattainment for six common nonradiological air pollutants. As stated in GEIS Section 3.3.6.2, all of the area within this milling region is classified as in attainment. Air quality impacts from emission sources other than ISL facilities are considered by NRC in site-specific analyses as cumulative effects. Cumulative effects are addressed in GEIS Section 5. GEIS Table 5.3-3 contains a listing of six categories of actions that could impact various resources, including air quality, for the Wyoming East Uranium Milling Region. Each category includes a list of specific actions that illustrate each category. One of the categories is mineral extraction/energy development, and the various actions identified in this comment are listed as specific actions under the mineral extraction/energy development category in GEIS Table 5.3-3. However, as outlined in GEIS Section 1.5.2 and added to Chapter 5 in response to other comments, the detailed cumulative effects analyses will be conducted during the site-specific environmental review. Because other actions potentially impacting air quality were addressed in the GEIS and any detailed cumulative effects analyses are deferred to the site-specific environmental level, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-083**
One commenter requested region-specific air quality analyses. The commenter noted differences between the Wyoming West and Nebraska-South Dakota-Wyoming Uranium Milling Regions including natural gas fields in the Wyoming West region and larger population centers in the Nebraska-South Dakota-Wyoming region.

*Response: The discussion on air quality for the Nebraska-South Dakota-Wyoming Uranium Milling Region in GEIS Section 3.4.6.2 does state that it would be similar to the description for the Wyoming West Uranium Milling Region in GEIS Section 3.2.6. However, the affected environment description also provides region-specific information. GEIS Section 3.4.6.2 states that the Nebraska-South Dakota-Wyoming information in Section 3.4.6.2 is limited to the modification, supplementation, or summarization of the Wyoming West information in Section 3.2.6. Region-specific NAAQS attainment status and PSD areas are discussed in the GEIS (see Section 3.2.6.2 for Wyoming West and Section 3.4.6.2 for Nebraska-South Dakota-Wyoming). Region-specific information on natural gas and oil development is discussed in the GEIS (see Table 5.3-1 for Wyoming West and Table 5.3-3 for Nebraska-South Dakota-Wyoming). Region-specific information on demography is discussed in the GEIS (see Section 3.2.10.1 for Wyoming West and Section 3.4.10.1 for Nebraska-South Dakota-Wyoming). For each region, the cities are classified into one of four different groups by population size (see Figure 3.2-21 for Wyoming West and Figure 3.4-21 for Nebraska-South Dakota-Wyoming). However, the air quality information presented in the GEIS was intended to present general information and may not cover all of the information that would be addressed in a site-specific review. It would be expected that appropriate air quality data relevant to the proposed site would be incorporated in the site-specific environmental review level. Because region-specific air quality information such as NAAQS attainment status and PSD areas and region-specific demographic information such as classification of cities by size were addressed in the GEIS and considered adequate for the regional-level characterization, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-116**
One commenter asked why diesel emissions are limited to construction activities and whether ISL operations require diesel generators.

*Response: The statement in the draft GEIS Section 4.2.6, Page 4.2-34 is "Most of the combustion emissions are diesel emissions and are expected to be limited in duration to construction activities." The intended meaning of this statement is that diesel emissions are expected to be limited in duration during the construction phase. The intended meaning is not that diesel emissions are only generated within the construction phase to the exclusion of the other three phases. GEIS statements concerning fugitive dust and combustion emissions sources for the other phases (operation in Section 4.2.6.2, aquifer restoration in Section 4.2.6.3, and decommissioning in Section 4.2.6.4) refer back to the sources identified in the construction phase (Section 4.2.6.1). Information from a previously licensed ISL satellite facility presented in GEIS Section 2.7.1 identifies that diesel emissions originate from drill rigs, diesel-powered water trucks, and other equipment. The licensee determines what equipment it intends to use for a proposed action. Any specific permitting requirements would be determined on a site-specific basis by the appropriate regulatory authority identified in GEIS Table 1.7-1. NRC's role is to conduct an independent, detailed evaluation of the potential environmental impacts of the applicant's proposed action. In response to the comment, GEIS Section 4.2.6.1 was revised to clarify the intended meaning of the GEIS text.*

**Comment: 050-117; 1173-083**
Two commenters asked why New Mexico information is used in the Wyoming analysis.

*Response: The New Mexico information referred to in GEIS Section 4.2.6 consists of air emissions estimates for the construction phase of an ISL facility proposed for New Mexico. The fact that the facility is located in New Mexico is not relevant to how the information is used in GEIS Section 4.2.6.1. As described in GEIS Section 4.2.6.1, the information provides a reference point for emissions from a large, commercial-scale ISL facility. The key information relates to the magnitude of the emission estimates rather than the location or specific environment of the emission source. Because the comment did not raise an issue concerning accuracy of the GEIS information, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-118**
One commenter requested an expansion of the discussion in GEIS Section 4.2.6 on fugitive dust during construction activities to include creating or expanding roads, specifying emission levels, and assessing the significance.

*Response: The discussion of fugitive dust in GEIS Section 4.2.6 addresses road construction. GEIS Section 4.2.6 references GEIS Section 2.7.1 and Table 2.7-2. Text in GEIS Section 2.7.1 states that fugitive dust is generated from disturbed land associated with road construction. GEIS Table 2.7-2 provides estimated particulate (fugitive dust) emission levels for an existing ISL facility construction phase. GEIS Section 4.2.6.1 contains an assessment of the significance of fugitive dust emissions during the construction phase that uses the estimates previously mentioned. As discussed in GEIS Section 4.2.6, this is a general assessment. Site-specific environmental reviews would be conducted, and the significance for a particular proposed action would be assessed. Because the GEIS already considers fugitive dust during construction including roadwork, specific emission levels, and significance assessment, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 061-024**
One commenter requested that air quality studies should now be conducted for baseline information on Wind Cave National Park, which is classified as a Class I area.

*Response: GEIS Table 3.4-9 identifies that Wind Cave National Park has already been designated as a Class I area for PSD. GEIS Section 3.2.6.2 describes some of the emission standards established to protect Class I areas. GEIS Section 1.7.2.2 describes the permitting process, which is the mechanism used to address air quality. As indicated in GEIS Section 4.4.6, it has yet to be determined whether this Class I area would need to be considered in a site-specific environmental review. Because this requested information would be addressed at the site-specific environmental review level if appropriate, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 061-025; 061-026**
One commenter made two comments concerning the need for additional studies related to fugitive dust. One comment stated that air quality studies should be conducted for the Pine Ridge Indian Reservation, which is the most populated area to receive wind-carried particles. The other comment stated that information on how fast dust particles travel must be answered and requires study for these regions.

*Response: GEIS Section 3.2.6.2 describes particulate matter emissions standards under NAAQS. This GEIS section also explains that the primary NAAQS standards are established to protect public health and the secondary NAAQS standards are established to protect public welfare by safeguarding against environmental and property damage. GEIS Section 1.7.2.2 describes the permitting process used to address air quality. Because this requested air study information was not considered essential for the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-012**
One commenter stated that the GEIS does not include adequate air quality modeling. The basis for this statement is that if air quality modeling were included at the GEIS stage, this may not be needed at the site-specific stage.

*Response: The emission estimates presented in GEIS Table 2.7-2 presented an adequate informational basis for the analyses of impacts for the GEIS. The commenter suggests that supplementing the GEIS information may reduce or eliminate the need for review at the site-specific level. As described in GEIS Section 1.8, the NRC plans to use tiering and incorporate GEIS material by reference for environmental reviews of site-specific ISL license applications to help the present issues, eliminate repetition, or reduce the size of the site-specific document. However, there is no specific requirement for what the GEIS needs to include. If applicable, any air quality modeling relevant to the assessment of potential impacts for a proposed action would be provided at the site-specific review level. Because this requested air modeling information was not considered essential for the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-058**
One commenter questioned whether Jewel Cave National Monument in South Dakota and the Northern Cheyenne Reservation in Montana are still Class I areas.

*Response: GEIS Table 3.4-9 contains the list of federal mandatory Class I areas from 40 CFR Part 81, Designations of Areas for Air Quality Planning Purposes. Jewel Cave National Monument and Northern Cheyenne Reservation are not listed. It would be expected for a site-specific environmental review that the NRC staff would verify the status of any GEIS information that could be tiered or incorporated by reference in the site-specific environmental review, and if appropriate, supplement with any additional information relevant to* *the proposed site. This supplementation could include identification of other classifications of special or unique areas. Because federal mandatory Class I areas were addressed in the GEIS and considered adequate for the regional-level characterization, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-095**
One commenter questioned whether there was any NAAQS attainment problems associated with particulates from coal mining in the Gillette area or from inversions in the Sheridan area.

*Response: GEIS Section 3.2.6.2 provides the NAAQS attainment status for Wyoming and identifies that the state has only one area that is not in attainment. The City of Sheridan in Sheridan County is designated as nonattainment for particulate matter $PM_{10}$. GEIS Figure 3.2-15 contains a map that identifies the air quality attainment status for Wyoming and the surrounding areas. The areas within the Wyoming West, Wyoming East, and the Nebraska-South Dakota-Wyoming Uranium Milling Regions are classified as being in attainment as stated in GEIS Sections 3.2.6.2, 3.3.6.2, and 3.4.6.2. Air quality impacts from emission sources other than ISL facilities are considered by NRC in site-specific analyses as cumulative effects. Cumulative effects are addressed in GEIS Section 5. GEIS Tables 5.3-1, 5.3-3, and 5.3-4 contain listings of categories of actions, including mineral extraction/energy development, that could impact various resources, including air quality, for the Wyoming West, Wyoming East, and Nebraska-South Dakota-Wyoming Uranium Milling Regions. As outlined in GEIS Section 1.5.2 and added to Chapter 5 in response to other comments, the detailed cumulative effects analyses will be conducted during the site-specific environmental review. Because NAAQS attainment status and cumulative impact supporting information for these areas was provided in the GEIS and considered adequate for the regional-level characterization, no changes were made to the GEIS beyond the information provided in this response.*

### G5.26.4 Impact Assessment

**Comment: 050-115**
One commenter asked how the air quality impacts section of the GEIS (i.e., Section 4.2.6) will be incorporated into site-specific analysis. Furthermore, the commenter noted that factors determining the significance of ISL mining facilities impacts on air quality depend on site-specific conditions such as wind speed and direction, and cumulative sources of pollution.

*Response: The discussion on the use of the GEIS in the NRC license process in GEIS Section 1.8 states that NRC plans to use tiering and incorporate GEIS material by reference for environmental reviews of site-specific ISL license applications to help the presentation of issues, eliminate repetition, and focus on unique issues of the site. Additional information, including a definition of tiering, is presented in GEIS Section 1.8. For air quality, possible topics for tiering or incorporation by reference include information on regulatory limits, NAAQS compliance status, permitting process, PSD areas, and emission-producing activities associated with the different ISL phases. Concerning impacts, NRC staff could evaluate whether the emission estimates for a site-specific proposed facility exceed those presented in the GEIS. The NRC staff recognizes that site-specific conditions such as wind speed and direction, cumulative pollution sources, and other factors can play roles in determining the impact significance for any specific ISL proposal. Such information would be submitted to NRC in site-specific license applications and would be included, as applicable, in NRC site-specific environmental reviews. However, the information provided in the GEIS air quality impact section was intended to* *provide a simple synopsis that the impact significance for an ISL facility can be thought of in terms of the amount of emissions generated by the facility and the existing air quality into which these emission are being released. Because the usage of the GEIS for site-specific reviews was addressed in the GEIS and the assessment of air quality impacts was considered adequate for the regional-level consistent with the intended purpose and scope of the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-119**
One commenter questioned whether ISL impacts are SMALL just because an ISL operation does not require a Title V permit or whether ISL impacts do not occur because NAAQS limits are not exceeded.

*Response: The GEIS does not take the position that ISL impacts will automatically be classified as SMALL based on the issuance of a Title V permit or be considered nonexistent if NAAQS regulations are met. The discussion in GEIS Section 4.2.6 begins with a statement that in general, ISL milling facilities are not major nonradiological air emission sources, and the impacts would be classified as SMALL if three conditions are met. The preface to this statement indicates that it is generally applicable and not an absolute. Site-specific environmental reviews would be conducted that account for the local affected environment and the specific action proposed. The general assessment states that the impacts would be classified as SMALL rather than NONE. The definition of SMALL is provided in GEIS Section 4.1. Finally, the general assessment requires that all three conditions should be met—not just one. In response to the comment, GEIS Section 4.2.6 was supplemented to highlight that the GEIS assessment is a general one and site-specific environmental reviews would be conducted to account for the local affected environment and the specific action proposed.*

**Comment: 059-011**
One commenter stated that the air quality impacts in the GEIS are understated as SMALL. Two areas were identified (1) fugitive dust particles from additional traffic on dirt roads would be considered a huge impact and (2) radiologically contaminated dust would be considered an extremely LARGE impact.

*The GEIS Sections 4.2.6, 4.3.6, and 4.5.6 contain the rationale for the significance classifications for air quality. Fugitive dust emissions from the construction phase would be either similar to or bound the emissions from the other phases. GEIS Section 2.7.1 identifies travel on unpaved roads as a source of fugitive dust. GEIS Table 2.7-2 provides estimated particulate (fugitive dust) emission levels for an ISL facility construction phase. GEIS Section 4.2.6.1 contains an assessment of the significance of fugitive dust emissions during the construction phase that uses the estimates previously mentioned. The fugitive dust emission levels were under 2 percent of the regulatory limits, and the impacts were classified as SMALL. Because fugitive dust is addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

*The commenter's concerns regarding radiologically contaminated dust is addressed in Section 6.31, Public and Occupational Health, of this appendix.*

### G5.26.5 Mitigation

**Comment: 032-008; 1321-048**
Two commenters discussed mitigation that the GEIS should address. One comment stated that dust control measures including paving, revegetation, or dust suppressants should be used to mitigate fugitive dust emissions. The other comment stated that the GEIS does not contain information regarding opportunities to reduce air emissions associated with construction.

*Response: GEIS Section 4.2.6.1 states that in general, ISL facilities use best management practices to reduce fugitive dust emission. GEIS Table 7.4-1 provides a list of potential best management practices and management actions for various resources including air quality. GEIS Section 2.6 identifies that revegetating and reclaiming disturbed lands is part of the decontamination, decommissioning, and reclamation phase. In response to the comment, two changes were made. GEIS Section 4.2.6.1 was revised to include a reference to and description of GEIS Table 7.4-1. GEIS Table 7.4-1 was supplemented to include reclamation and revegetation as additional best management practices and management actions for air quality.*

**Comment: 1321-049**
One commenter recommended that the GEIS include a generic construction emissions mitigation plan to reduce construction emissions and commit to the use of these measures during construction, as appropriate for site-specific plans.

*Response: NRC does not have the statutory authority to require compliance with a generic emissions plan. Instead of developing a mitigation plan as recommended in the comment, the NRC staff supplemented the list of potential best management practices and management actions for the air quality portion of GEIS Table 7.4-1 with some of the specific actions identified in the comment. As stated in GEIS Section 3.2.6.2, the permitting process is the mechanism used to address air quality and, if warranted, permits may set facility air pollutant emission levels, require mitigation measures, or require additional air quality analyses. In response to the comment, GEIS Table 7.4-1 was supplemented to include additional best management practices and management actions for air quality.*

### G5.26.6 General

**Comment: 036-109**
One commenter stated that the NRC staff should reformat the GEIS air quality impacts section to include radiological information to improve readability and to include radiological emissions.

*Response: The format and content of environmental impact statements such as the GEIS inherently include topical sections that are complimentary or overlap. For example, potential air quality impacts can result from both radiological and nonradiological effluents and these air quality impacts can also effect public and occupational health. Thus, there is some flexibility regarding which sections of the GEIS-specific topics can be discussed and evaluated. The NRC staff has chosen a format for presentation of information in the GEIS that address radiological impacts to air quality in the GEIS public and occupational health section (e.g., 4.2.11),and nonradiological impacts to air quality in the GEIS air quality impacts section (e.g., 4.2.6). This is reasonable because the nonradiological air impacts are assessed and regulated differently than the radiological air impacts, so separating the discussion of impacts in this manner does not change the manner in which the impact analyses are normally* *conducted. As a result, GEIS Section 4.2.6 states that air quality impacts from radiological emissions are addressed in GEIS Section 4.2.11. No changes were made to the GEIS in response to this comment.*

**Comment: 1173-024**
One commenter suggested that data comparing total emissions of nuclear, wind, and hydroelectric power in exploration, construction, and operations phases could be added to the GEIS.

*Response: GEIS Section 1.5.4 identifies topics that the NRC staff has determined to be outside of the scope of the GEIS. The energy debate is one of those topics. GEIS Appendix A, Section 4.12 relates to the energy debate and discusses supporting or opposing renewable energy sources other than nuclear. The NRC staff considers wind and hydroelectric power emission information out of the scope of the GEIS, and therefore no changes were made to the GEIS in response to this comment.*

**Comment: 1321-044**
One commenter stated that the GEIS should clarify that subsequent NEPA analyses give additional consideration to Class I areas when proposed project-specific evaluations are conducted.

*Response: If applicable, information concerning Class I areas relevant to the location of the proposed site would be incorporated in the description of the affected environment in the site-specific environmental review. However, as described in GEIS Section 1.7.2.2, NRC is not the regulatory authority for permitting. Permitting authorities are identified in GEIS Table 1.7-1. Specific requirements would be determined by the appropriate regulatory authority on a site-specific basis. In response to the comment, GEIS Section 4.4.6 was revised to indicate that, if applicable, the NRC staff would include information concerning Class I areas in the site-specific environmental review.*

## G5.27 Noise

**Comment: 036-025**
A commenter addressed a statement in the GEIS Executive Summary that read, "All of the uranium districts are located more than 300 m [1,000 ft] from the closest community." The commenter stated that uranium districts are large areas that contain communities and could contain a single resident that could be impacted by noise at the ISL facility. The commenter further asserted that it is unknown whether an ISL facility at some point will be located less than 300 m [1,000 ft] from a community, and that NRC should qualify the statement by using the term "generally."

*Response: NRC provided a description of the affected environment as it applies to noise in each of the four regions in Sections 3.2.7, 3.3.7, 3.4.7, and 3.5.7. In Section 3.4.7, the NRC staff states that "Small communities are located within and near" the uranium districts of the Nebraska-South Dakota-Wyoming Uranium Milling Region. The NRC staff agrees with the commenter that communities or residents could be located within 300 m [1,000 ft] of uranium districts. This does not imply that the level of impact will be changed in the GEIS. The NRC staff will further evaluate potential noise impacts in site-specific assessments on a case-by-case basis. In response to the comment raised, the paragraphs under Noise Impacts of the GEIS Executive Summary on Pages xlv and xlvi were revised to include the term "generally."*

**Comment: 036-026**
A commenter stated that the description in the aquifer restoration paragraph under the Noise Impacts section of the Executive Summary mistakenly references the activity of construction.

*Response: The aquifer restoration paragraph under the Noise Impacts section of the Executive Summary states "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." This sentence should read "There are additional sensitive areas that should be considered within some of the regions, but because of decreasing noise levels with distance, aquifer restoration 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." In response to the comment raised, the aquifer restoration paragraphs in the GEIS Executive Summary, Noise Impacts, beginning on Page xlv was revised.*

**Comment: 059-012**
One commenter stated that the noise impacts (SMALL to MODERATE) are grossly understated and that the ISL activities would destroy the quality of life for residents. The commenter asserted that all noise impacts associated with all phases of the ISL facility life cycle will be LARGE.

*Response: NRC recognizes the significance of undeveloped areas. Potential noise impacts from proposed ISL facility construction, operations, groundwater restoration, and decommissioning are discussed in the GEIS Sections 4.2.7, 4.3.7, 4.4.7, and 4.5.7. The analysis presented in these sections considers impacts compared to typical background noise in rural, undeveloped areas. This discussion includes potential noise from well field development, uranium processing activities, and trucking activities associated with all phases of the ISL facility life cycle. Based on the analyses performed following the guidance of several federal agencies and administrations, the NRC staff concluded that because of decreasing noise levels with distance, construction, operation, aquifer restoration, and decommissioning activities and associated traffic would have only SMALL and temporary noise impacts for residences, communities, or sensitive areas that are located more than about 300 m [1,000 ft] from specific noise-generating activities. Because the commenter has not provided any additional information that would change the outcome of the NRC staff's analysis, no changes were made to the GEIS beyond the information provided in this response. Further, applicability of the GEIS conclusion will be determined during the site-specific review.*

**Comment: HC010-017**
One commenter stated noise impacts on wildlife species, including the sage-grouse, must be considered in the Wyoming West Uranium Milling Region, such as transportation and drilling machinery.

*Response: The ecological resources of the Wyoming West Uranium Milling Region are described in GEIS Sections 3.2. Figures 3.2-8 to 3.2-14 depict the sensitive species habitat areas for the Wyoming West Uranium Milling Region. The potential impacts to ecological resources from construction, operation, decommissioning, and aquifer restoration activities are described in GEIS Section 4.2.5. These potential impacts include the effects of noise on vegetation, wildlife, aquatic, and threatened and endangered species. These potential impacts include effects from noise and specifically address the sage-grouse in GEIS Section 4.2.5.1.*

*As discussed, if a proposed facility lies within the known sage-grouse areas, guidelines have been issued for the development of oil and gas resources (Wyoming Game and Fish Department, 2004), which would likely also apply to ISL facility operations. Consultation with the Wyoming Game and Fish Department and a site-specific analysis would determine appropriate impacts and mitigation measures.*

*Because the comments were addressed regarding the potential noise impacts to wildlife in the Wyoming West Uranium Milling Region, no changes were made to the GEIS beyond the information provided in this response.*

### G5.27.1 References

Wyoming Game and Fish Department. "Recommendations for Development of Oil and Gas Resources Within Crucial and Important Wildlife Habitats." Cheyenne, Wyoming: Wyoming Game and Fish Department. 2004.

## G5.28 Historical and Cultural Resources

### G5.28.1 Comments on Mount Taylor as a Sacred Area in New Mexico

**Comment: GA24-002; GR34-005; 036-096; 011-012**
Four commenters expressed concerns about the protection of important cultural values and practices associated with Mount Taylor, New Mexico. Two of the commenters included the additional concerns of protecting "mother Earth" and "the land" from uranium mining. A third commenter suggested additional discussion of Mount Taylor's listing in the National Register of Historic Places (NRHP) and implications for the NHPA regulations and NRC licensing conditions and questioned whether Mount Taylor's listing "automatically" prohibits uranium mining within the Mount Taylor listed area.
*Response: In 2008, Mount Taylor was determined to be eligible for listing in the NRHP as a traditional cultural properties by the U.S. Forest Service with concurrence by the New Mexico State Historic Preservation Office. Mount Taylor was also added in the New Mexico state register in 2008 for 1 year as an emergency listing pending further evaluation. The NRC staff recognizes that Mount Taylor is listed and is aware of the importance of Mount Taylor to Native Americans in the region. This would have to be addressed during any site-specific review involving this region. The NRC, through its regulations, recognizes and complies with the NHPA and its regulations regarding the protection of cultural resources and properties eligible for or listed in the NRHP. Regarding the question of whether Mount Taylor's listing in the NRHP automatically prohibits uranium mining, the laws do not require that a project be denied because a cultural property is listed in the NHRP, but afford the State Historic Preservation Officer (SHPO) a reasonable and timely opportunity to participate in planning to avoid or minimize adverse effects to it. A site-specific review of the potential impacts to the Mount Taylor area will be conducted for any proposed ISL facility in the area, and both NRC and the applicant would engage in Section 106 consultations with the New Mexico SHPO. Additional clarifying language has been added to GEIS Section 3.5.8.3.*

### G5.28.2 Comments on the Sacredness of Water and Other Culturally Important Resources

**Comment: CH-HC-001(CH06-001); 1314-004; AL05-140; AL05-145**
Two commenters expressed a concern about potential impacts of uranium mining on the status of water and the sacred and cultural uses of water by Native peoples. One commenter expressed concern that the GEIS fails to discuss the relationship between people and traditionally utilized plants and animals and that this might have an impact on population and culture.

*Response: The concerns and potential impacts that are mentioned in these comments depend on unique local conditions and practices that would be considered during the site-specific environmental review of an ISL proposal when consultations with tribes and other stakeholders will take place. No changes were made to the GEIS beyond the information provided in this response.*

### G5.28.3 Tribal Historic Preservation Office at the Oglala and Standing Rock Bands of the Sioux Nation

**Comment: CH07-007; 026-004**
One commenter noted that there is a Tribal Historic Preservation Office for the Oglala Band of the Sioux Nation. Another noted that the Standing Rock Sioux now also have a Tribal Historic Preservation Office.

*Response: Based on the information provided in the comment, the list of Tribal Historic Preservation Offices in Wyoming, South Dakota, Nebraska, and New Mexico in the GEIS has been updated in Sections 3.4.8.3 and Table 3.5-14. The list will also be reviewed and updated, as necessary, during the site-specific licensing process.*

### G5.28.4 Treaty and Land Claims of the Sioux Nation

**Comment: CH10-001; 026-001**
Two commenters expressed a concern about portions of the proposed uranium mining district in South Dakota and Wyoming, specifically the Black Hills region, which includes lands and places of cultural significance, was once part of the Great Sioux Nation as defined by the Fort Laramie Treaty of 1868, and which the Sioux continue to claim as their own.

*Response: The NRC is aware of the Sioux Nation's continued claim to the lands that were formerly part of the Great Sioux Nation established by the Fort Laramie Treaty of 1868 and the Supreme Court's 1980 ruling on the issue. These concerns would be discussed during the site-specific licensing review and consultation with Native American tribes who hold the Black Hills sacred. No changes were made to the GEIS beyond the information provided in this response.*

### G5.28.5 Potential Impacts to Cultural, Historical, and Sacred Places

**Comment: 038-004; 040-002; 042-005; 047-002; 049-001; 050-029; 050-081; 061-001; 061-003; 061-004; 1015-008; 1015-013; HC020-001; AL15-052**
Several of the commenters noted that numerous archaeological, historical, burials, traditional cultural properties, and sacred places may be adversely affected by construction and operation

of ISL facilities. Others noted that the GEIS failed to fully document culturally significant places and other cultural resources in the proposed ISL mining regions, especially in Wyoming, South Dakota, and Nebraska.

*Response: As discussed in the GEIS Appendix D and Section 4.2.8, detailed research regarding the presence or absence of archaeological and historical sites, burials, traditional cultural properties, and sacred places will be conducted as part of the site-specific ISL license application as discussed in Section 3.52, Pages 52–55. Detailed documentation of these resources, and consultations with tribes and other stakeholders regarding the importance of these resources as NRHP-eligible sites, traditional cultural properties, or places of cultural significances, will also be undertaken as part of the license application. In addition, consultations regarding potential adverse impacts to any significant and important resources by ISL facility construction and operation will also be addressed during site-specific ISL licensing in accordance with NEPA, NHPA, NRC rules and regulations, and other applicable federal, state, tribal, and local rules and regulations, insofar as these may apply.*

### G5.28.6 License Conditions To Address Potential Impacts to Historical and Cultural Resources

**Comment: 036-110**
One commenter noted that the GEIS should include a discussion of how NRC license conditions can be used to ensure that potential impacts from expansion of a mining facility are addressed and compliance with Section 106 of the NHPA is achieved.

*Response: As discussed in GEIS Section 4.2.8 and Appendix D, detailed research regarding the presence or absence of archaeological and historical sites, burials, traditional cultural properties, and sacred places will be conducted as part of the site-specific ISL licensing application as discussed in Section 3.52, Pages 52–55. Section 4.2.8 also mentions the procedure that requires licensees to stop work when a new discovery is made. GEIS Table 7.4-1 lists the following potential best management practices that can be used to avoid or reduce impacts to cultural resources: (1) consult with appropriate state and Tribal Historic Preservation Officer, (2) ensure that onsite employees complete cultural resource sensitivity and protection training to reduce the potential for intentional or accidental harm to sites or artifacts, (3) conduct preconstruction surveys to ensure that work would not affect important archaeological resources, and (4) develop additional mitigation measures such as documenting and collecting resources according to a cultural resource management plan (RMP) if construction threatens important archaeological resources and modification or relocation of facilities and roads is not feasible. NRC has also included actions necessary for compliance with the NHPA in license conditions for specific sites. This includes actions to be taken if historic or cultural resources are identified during ISL construction including provisions for work stoppage upon discovery of historic or cultural resources, taking inventories, and obtaining approvals from the applicable historic preservation offices prior to resuming construction. The aforementioned best management practices and license conditions for other licensed ISL facilities serve as a foundation for developing customized management practices that would be tailored to each application during the site-specific review.*

### G5.28.7 Suggested Additions to Specific GEIS Sections

**Comment: 1173-011; 1173-085; 1173-096; 1173-054; 1173-059**
One commenter suggested that brief discussions and impact assessments of ISL mining activities on the historic Oregon and Bozeman Trails in the Wyoming West and Wyoming East Uranium Milling Regions be added in Sections 3.2.8, 3.3.8, and 4.2. The same commenter noted that a discussion of Fort Robinson in relation to Native American history be added to Section 3.4, Page 55 and that the Northern Cheyenne tribe in southeastern Montana should be added to the list in Section 3.3, Page 43.

*Response: Based on the information provided in the comments, the changes suggested for Sections 3.2.8, Page 3.3-44; Section 3.3.8, Page 3.4-55; and Section 4.2 have been incorporated into the GEIS.*

## G5.29 Visual and Scenic Resources

**Comment: 036-027**
One commenter stated that mentioning the PSD Class I area, an air quality classification, is not appropriate in the visual and scenic impacts section.

*Response: The NRC staff understands that the statement in the Executive Summary could be confusing. The intent of this section is to convey that air quality can also have an impact on the visual resources (e.g., from dust and diesel emissions).*

*In response to the comment raised regarding the reference of an air quality standard in the visual and scenic resource impacts section, the visual and scenic resource impacts section of the Executive Summary was revised to clarify that the PSD Class I area in the region could be a potential receptor of visual impacts from air contaminants.*

**Comment: 059-013**
One commenter stated that the visual and scenic impacts (SMALL to MODERATE) are grossly understated and that the ISL activities associated with all phases of the ISL facility life cycle will be LARGE.
*Response: The NRC staff notes the comments and recognizes that individual perspectives will vary widely in the qualitative significance they attribute to the scenic changes resulting from the proposed ISL facilities. NRC staff also notes in the GEIS that assigning values to visual and scenic resources is subjective. The method used to evaluate the effect the proposed ISL facilities would have on the scenic quality of the four geographic areas followed BLM Visual Resource Handbook guidelines as applicable. BLM visual resource management system identifies and inventories existing scenic values and establishes management objectives for those values. These area-specific objectives provide the standards for planning, designing, and evaluating the potential visual resource impacts resulting from future management projects. The visual resource management system also provides for mitigation measures that can reduce potentially adverse visual impacts. Based on this evaluation method regarding visual qualities, the NRC staff concluded the impacts are SMALL. Because the commenter has not provided any additional information that would change the outcome of NRC staff's analysis, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-038**
One commenter stated that the information presented in GEIS Section 3.2.9 did not reflect the most recent visual/scenic resources information that has been collected from BLM from the LFO.

*Response: The NRC staff has attempted to locate the revised RMP from the LFO. According to the LFO website, a revision of the RMP was initiated in 2007 and decisions have been implemented since 1987. However, NRC staff could not find a published version of the revisions to date. According to the RMP timeline published in the July 2008 edition of the Wind River Breeze, BLM LFO newsletter, a draft of the revised RMP is anticipated to be published in 2009. K. Yannone of BLM LFO confirmed that the visual resources inventory has been contracted to the University of Wyoming and that no information to date has been published. As stated in the GEIS, a site-specific review of each ISL facility will be conducted and the updated LFO RMP will be incorporated as necessary.*

*Because the comments are related to a document that has not been published or made currently available to the public, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-096; 1173-097**
A commenter stated that GEIS Section 4.3.8 should mention that the Bozeman National Historic Trail passes through the Monument Hill Mining District in Section 4.3.8. The commenter also stated that sentences regarding viewshed areas in Sections 4.3.9.1, 4.3.9.2, and 4.3.9.3 may be incorrect depending on the status of the trail (i.e., whether the trail is a Class II visual resource management area).

*Response: Regarding the statement that the Bozeman National Historic Trail should be mentioned in Section 4.3.8, this GEIS section does not identify specific resources. As stated in the GEIS Section 4.3.8, prior to engaging in land-disturbing activities, applicants would review existing literature and perform region-specific records searches to determine whether cultural or historical resources are present and have the potential to be disturbed. The appropriate cultural resources inventory would be used to identify the previously documented sites and any newly identified cultural resources sites. As discussed in Section 1.8.3, license applicants and the NRC staff will perform site-specific evaluations during which the cultural resources will be evaluated.*

*Regarding the statement about the correctness of the GEIS statements about viewsheds, according to the Proposed Casper RMP and Final EIS dated June 2007, the Bozeman Trail is located in a Class II area. The current proposed ISL facility locations are all located within Class III through Class V areas. The distances of potential ISL facilities in the three uranium districts from the Class II visual resource management area reported in the GEIS indicates that the identified potential facilities are at least 32 km [20 mi] from Class II areas. The NRC staff notes that potential ISL facility locations could at some point be located within 32 km [20 mi] of a Class II area. In response to the comment raised, the sentences in GEIS Sections 4.3.9.1, 4.3.9.2, and 4.3.9.3 that indicate the specific distances of identified potential ISL facilities within the uranium districts were revised to exclude a specified distance.*

**Comment: GR09-002**
One commenter stated that during work on the Smith Ranch-Highland *in-situ* uranium mine in Wyoming the commenter led a tour for the Center for Disease Control and the National Institute

of Occupational Safety and Health. The memorable comment that the visitors made during the trip was how the operation looked like a bee farm.

*Response: The NRC acknowledges the comment. The NRC staff's evaluation of potential visual and scenic impacts introduced by ISL operations, found in GEIS Sections 4.2.9, 4.3.9, 4.4.9, and 4.5.9, determined that such potential impacts would be SMALL. No changes were made to the GEIS beyond the information provided in this response.*

## G5.30 Socioeconomics

**Comment: CH10-007**
The commenter expressed concerns about existing cultural and socioeconomic conditions in regard to poverty and what the potential impacts could be.

*Response: Socioeconomic conditions in the uranium milling regions were described in GEIS Sections 3.2.10, 3.3.10, 3.4.10, and 3.5.10. Factors such as demographics, employment structure, economic profile, and community profile such as housing, schools, and health and social services are discussed. Socioeconomic data were obtained using a region of influence of 48 km [30 mi] from locations of past, present, or potential future uranium milling, as discussed in Chapter 3. This radius accounts for populations that would be most directly affected due to the rural setting of most sites. Potential impacts discussed in GEIS Chapter 4 are related to construction workforce and influx of workers potentially affecting local services (e.g., housing, schools) and adding to local revenue. Revenues generated from local, state, and federal taxes would be expected to occur during operations, and impacts similar to construction are expected during decommissioning. Socioeconomic conditions will be evaluated as part of the site-specific analysis of each facility. If socioeconomic-related concerns arise, these will be analyzed in the NRC site-specific environmental review. Because the comments were general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA04-001; 050-087**
The commenter expressed concerns about local emergency room infrastructure's ability to handle accidents. Another comment was made to discuss needs of local voluntary fire departments and emergency services.

*Response: The NRC site-specific environmental review will include an assessment of socioeconomic factors, such as health and social services (as discussed in Chapters 2 and 3). This could include an evaluation of local infrastructure (e.g., emergency services, hospitals). As part of the site-specific review, the NRC staff will evaluate concerns relating to the ability of the local community infrastructure to handle potential accidents associated with a particular ISL facility's operation. Because the comments were related to site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA06-001; 050-046**
A comment was made regarding tax/royalty benefits to the Navajo Nation. A comment was also made that anticipated royalties and tax revenues need to be disclosed.

*Response: The NRC site-specific environmental review may include assessment of socioeconomic conditions such as income and tax structure/distribution (as discussed in Chapter 2). General potential tax benefits were discussed in GEIS Chapter 2, using the Crow Butte ISL facility in Nebraska as an example. Because the comments were related to* *site-specific review and information already provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA04-004; 050-039**
Two commenters expressed concerns that a local economy driven by a nonrenewable resource could result in a "boom and bust" scenario, such as that which has occurred in Jeffrey City, Wyoming, and Grants, New Mexico, where conventional uranium mines had developed strong economics and then closed.

*Response: Socioeconomic conditions related to a specific facility will be evaluated as part of the NRC site-specific environmental review. Socioeconomic conditions will be assessed based on current conditions and potential effects of an ISL facility. Socioeconomic impacts would not generally be evaluated based on projections of future economic conditions, because of the uncertain fluctuations in economic conditions. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: SP12-005; SP12-007; SP18-001; 1601-008; 1602-010**
One commenter expressed concerns about ISL impacts decreasing adjacent property values and land values. Another comment was made concerning ISL impacts increasing property values. Another comment was made regarding compensation to land owners for loss of property values.

*Response: Potential impacts to housing are discussed in GEIS Sections 4.2.10, 4.3.10, 4.4.10, and 4.5.10. The potential socioeconomic impacts that would affect different land owners at and around a specific ISL facility would be detailed in the plans the license application submitted to the NRC for such a facility. NRC provides its analysis of the types and ranges of potential impacts to land use in GEIS Sections 4.2.1, 4.3.1, 4.4.1, and 4.5.1 for each of the four uranium milling regions. These analyses comprise potential impacts on ranching, farming, and recreational activities including hunting, which is a popular recreational activity, along with off-road touring. These potential impacts would affect private property values similarly to publicly owned lands. Property value concerns may be addressed in the NRC site-specific environmental review if local concerns exist. However, compensation to land owners is not a socioeconomic factor that is generally considered in the NRC site-specific environmental reviews, because ISL applicants need to reach agreements separately with each individual property owner to obtain the consent of land owners to access, explore, construct, and operate their ISL facilities and find appropriate mitigation or compensation measures for impacts and losses of access, grazing, agricultural, recreational, or other activities that would affect the property owners. These impacts, mitigation, and compensation are to be defined and implemented between the land owners and ISL operators and are not negotiated by NRC staff. Because the comments were related to site-specific review or concerns on private agreements between land owners and ISL companies, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GR23-003**
A comment was made questioning how a business employing 70 people could produce the benefit of 8,000 people.

*Response: NRC staff would like to clarify the numbers that the commenter references. The commenter attended a public meeting in Grants, New Mexico, on September 9, 2008. During that public meeting, McKinley County Commissioner Ernest Becenti, Jr. and Mr. George Byers referenced a study that contains an analysis of the economic impacts of new uranium mining* *and milling operations in New Mexico. Mr. Byers stated that the study shows that about 8,000 direct and indirect jobs could be generated in the Grants area as a result of uranium mining. At the meeting, NRC staff Mr. James Park stated that in general, the number of employees that could be expected by a ISL facility licensed by the NRC may range from 70 to 80 people during operations and up to around 200 people at peak employment during construction. NRC staff believes that the commenter used the numbers 70 and 8,000 based on these comments made at the Grants public meeting.*

*GEIS Section 2.11.6 states that "Based on employment levels at existing operations and projected employment for proposed projects, staff levels at ISL facilities range from about 20 to 200, with peak employment depending on the scheduling of construction, drilling, and operational activities." These estimated numbers reflect similar information that Mr. Park offered at the Grants public meeting. The study that was referred to in the meeting was published August 1, 2008, by the Arrowhead Center, Inc., a nonprofit corporation wholly owned by New Mexico State University, and is titled "The Economic Impact of Proposed Uranium Mining and Milling Operations in the State of New Mexico." Pages 86 and 87 of this study state "The total number of jobs including indirect and induced employment is nearly 250,000 or about 8,300 jobs per year. Compared to New Mexico's total employment of 908,000 (Peach and Popp, 2008), the employment generated by uranium operations would be slightly less than 1 percent of all jobs in the state." This statement references the amount of jobs statewide based on the "base case" scenario. The base case assumes (1) total production from 2012 to 2042 of 315 million pounds of uranium, (2) an average cost of production of $50 (2008 dollars) per pound, (3) 234 mine workers per million pounds of production, and (4) 77 mill workers per million pounds of production. NRC staff believes that Mr. Byers and the commenter misunderstood that the 8,000 or so jobs projected by the study did not represent a site-specific analysis of the Grants area, but a hypothetical assessment of the impacts to the state using four specific variables. The determination of local economic impacts will be evaluated in the NRC site-specific environmental review for each facility. Because the comment was related to the site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: HC009-002**
A comment was made regarding socioeconomic impacts to livestock grazing.

*Response: Impacts to grazing were discussed during the scoping process, and GEIS Section 1.5.2 indicates that grazing will be considered a land use issue. In GEIS Section 4.2.1.1, NRC staff indicated that use of land as rangeland, pasture land, or cultivated fields would likely be excluded or lost in fenced areas and along dirt roads, well fields, and surface facility buildings for the life duration of an ISL facility. Although these land use impacts were deemed SMALL in relation to the small percentage of land use losses compared to the whole permitted land area, no mitigation measures were discussed. Therefore, NRC staff amended the GEIS to more clearly indicate that mitigation and compensation measures would need to be identified and agreed upon between land owners, grazing rights permit holders, and ISL facility companies to take into account the loss of grazing land or cultivated land due to the restricted access or fenced portions of an ISL facility on its permitted area. Amendments were made to GEIS Section 4.2.1.1. Additional potential impacts from uranium ISL production on livestock grazing may be analyzed in the NRC site-specific environmental review conducted for each facility.*

**Comment: AL10-019; AL18-067; AL18-069; AL23-091; AL23-092; CA04-002; CH13-001; GA08-002; GA08-004; GA11-002; GA18-002; GA18-006; GR05-003; GR06-003; GR09-003; GR13-002; GR17-003; GR17-004; GR19-003; GR20-002; GR30-001; GR33-002; NE04-007; NE11-001; 008-002; 017-016; 029-003; 035-004**
Several commenters stated that uranium mining will create jobs, have economic benefits, bring higher paying jobs, provide a good tax base and severance tax to the state, and have positive economic benefits to poorer communities. Other commenters expressed the opinion that uranium development will bring economic opportunities to the Navajo Nation.

*Response: The GEIS discusses employment and economic contributions to local economies by examples and estimates provided in Section 2.11.6. The NRC staff evaluated socioeconomic factors for ISL sites using NRC guidance in NUREG–1748 (NRC, 2003). Socioeconomic factors for specific ISL facility proposals will be further analyzed in the NRC site-specific environmental review. Because the comments were general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: CA-04-003; CAG01-002**
Commenters expressed concerns that delaying the GEIS will impact economic benefits.
*Response: The NRC staff acknowledges the comment. Because the comment was general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-038**
The commenter expressed concerns that the GEIS should analyze housing stock availability and affordability.

*Response: The potential impacts to housing are one of the factors the NRC staff typically considers in the site-specific environmental review of potential socioeconomic impacts from a proposed ISL facility. Housing stock availability and affordability are variable conditions that depend on local area conditions, as discussed in Chapter 4. NRC staff identified potential impacts to housing to be SMALL to MODERATE. Because the comment was related to the site-specific review and information already provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-044**
The commenter expressed concerns that the GEIS should analyze lost economic opportunities to land use from ISL operations. The commenter noted that the natural beauty of an area contributes to the rural character and can attract economic opportunities (local business, retirement), while industrial development can change the character and make the area less desirable and discourage other, more sustainable economic activities.
*Response: Analysis of lost potential economic development opportunities as the commenter suggests assumes there is a negative economic effect from siting ISL facilities in local communities (e.g., stigma that drives away future opportunities). While this may be a plausible potential effect, NRC is not aware of research that has established this conclusion to a degree that it could be practically applied to an impact study at the regional level as done in the GEIS. Given the diversity of views and economic conditions in the local areas where ISL facilities may be licensed, it appears unlikely that this view would apply to all locations. Regarding the comment about local natural scenery and character, impacts from ISL faculties on visual and scenic impacts are assessed in GEIS Sections 4.2.9, 4.3.9, 4.4.9, and 4.5.9. Additional potential impacts to land use and land value are local factors that may be considered in NRC site-specific environmental review of potential socioeconomic impacts from a proposed ISL facility.*

*The potential land use impacts from ISL facilities that would affect different land owners at and around a specific ISL facility would be detailed in the plans of the license application to the NRC for such a facility. NRC went beyond preparing a list of impacts and analyzed the types and range of impacts to land use in GEIS Sections 4.2.1, 4.3.1, 4.4.1, and 4.5.1 for each of the four regions of interest considered. These analyses comprise potential impacts on ranching, farming, and recreational activities including hunting, which is a popular recreational activity that generates income to land owners, along with off-road touring. These impacts are analyzed for the four phases of an ISL facility: (1) construction, (2) operations, (3) aquifer restoration, and (4) decontamination, decommissioning and reclamation. Impacts on land use are also summarized in the Executive Summary and in Chapter 10, Table 10-1. Mitigation measures as they pertain to land use impacts are described in Chapter 7. The degrees of land use impacts are deemed SMALL to MODERATE because of the small percentage of land that would be distributed or restricted (variable, but on average about 15 percent of the permitted area) (Section 2.11.1) compared to the whole permitted area of an ISL facility.*

*Appropriate compensation measures for the loss of grazing, agricultural, recreational, or other activities are to be defined and implemented between surface owners and ISL operators. In GEIS Section 4.2.1.1, NRC staff indicated that use of land as range land, pasture land, or cultivated fields would likely be excluded or lost in fenced areas and along dirt roads, well fields, and surface facility buildings for the life duration of an ISL facility. Although these land use impacts were deemed SMALL in relation to the small percentage of land use losses compared to the whole permitted land area, no mitigation measures were discussed. Therefore, NRC staff amended the GEIS to more clearly indicate that mitigation and compensation measures would need to be identified and agreed upon between land owners, grazing rights permit holders, and ISL facility companies to take into account the loss of grazing land or cultivated land due to the restricted access or fenced portions of an ISL facility on its permitted area. Amendments to the GEIS were made in Section 4.2.1.1.*

**Comment: 050-078**
The commenter expressed concerns that the GEIS analyzed socioeconomic information on Ft. Collins, Colorado, and Billings, Montana. Another comment was made questioning why Osage, Wyoming, and Hill City, South Dakota, were chosen to be analyzed and not Edgemont, South Dakota, or Crawford, Nebraska. The commenter also requested an evaluation of additional impacts that ISL operations would have on roads.

*Response: The purpose of this GEIS was to establish a starting point for its NEPA analyses for site-specific license applications for new ISL facilities. With respect to socioeconomics, this meant providing a broad regional discussion of each of the socioeconomic subcategories (e.g., income, demographics, housing) rather than not providing a detailed level of specific resources or analyzing any one community in depth. In GEIS Chapter 3, socioeconomic information was discussed as part of the description of the affected environment. The reason that Ft. Collins, Colorado, and Billings, Montana, were discussed was to include those communities as part of the potential affected environment on the regional state level because of their proximity to the Wyoming East and Wyoming West Uranium Milling Regions. In Chapter 4, the potential environmental impacts are analyzed. In the discussion of impacts for the Nebraska-South Dakota-Wyoming Uranium Milling Region, Osage, Wyoming (population 200), and Hill City, South Dakota (population 870), were mentioned small communities where the potential magnitude of socioeconomic impact would be expected to be larger. The NRC staff recognizes that other small communities in the region (e.g., Edgemont, South Dakota, and Crawford, Nebraska) could also have been mentioned. As part of the site-specific review, the NRC staff will follow the NEPA process to assess socioeconomic impacts of local areas for ISL* *facility applications. Impacts to roads from increased traffic are discussed under transportation in GEIS Section 4.2.2.2. Because the comment was related to information already provided or the site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-085**
A commenter requested discussion of hotel availability during tourism season.

*Response: As the commenter notes, hotel availability is a variable condition and is affected by factors such as tourism, energy development, and other seasonal factors. The NRC staff will consider potential socioeconomic impacts such as tourist activity on a case-by-case basis, as appropriate, during the site-specific environmental review. Because the comment was related to information that can only be analyzed on a site-specific basis, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 059-014**
The commenter asserted that the socioeconomic impacts to the community in Wyoming would be LARGE and expressed concerns that the GEIS underestimates the socioeconomic impacts with respect to the additional demands that will be placed on the community for services, housing, and schools that currently do not meet demand. The commenter indicated that recreational revenues could be adversely impacted.

*Response: Sections 4.2.10 and 4.3.10 discuss the potential impacts to socioeconomics in the Wyoming East and Wyoming West Uranium Milling Regions. NRC staff evaluated socioeconomic impacts in accordance with NUREG–1748 (NRC, 2003). Based on information from other NRC-licensed ISL facilities, the NRC staff estimates that the total peak employment during construction would be about 200 people including company employees and local contractors, depending on timing of construction with other stages of the ISL life cycle. 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 jobs could be created including those of workers and their families. 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 through taxes. Because of the small relative size and temporary nature of the ISL construction workforce, NRC staff estimates the net impacts would be SMALL to MODERATE, depending on proximity to less populated communities such as Jeffrey City and Bairoil, and to less populated counties such as Niobrara and Albany Counties. During the operation phase, use of local contract workers and local building materials would diminish and additional revenues would be generated by federal, state, and local taxes on the facility and the uranium produced. Because similar employment levels are expected during the temporary restoration and decommissioning phases, other previously mentioned socioeconomic impacts would be SMALL to MODERATE.*

*Socioeconomic conditions will be evaluated as part of the site-specific analysis of each facility. If additional potential socioeconomic related concerns arise, these will be included in the NRC site-specific environmental review. Because the comment was related to the magnitude of potential impacts and did not provide any additional information to incorporate, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 032-030; 050-076; 1173-008; 1173-039**
One commenter requested that population estimates be compared with state demographic results, noting that the 2000 Census underestimates the population. Commenters requested the use of more recent state census data and stated that U.S. Bureau of Census data for 2000 does not include recent energy developments, especially in Wyoming.

*Response: The NRC staff used U.S. Bureau of Census 2000 data to analyze potential socioeconomic impacts. These data were used to standardize demographic data for all geographic areas analyzed. State census data was not used, because not all states have the same years of collection and methods for collection. If warranted, the NRC staff will evaluate specific local socioeconomic conditions, such as CBM and natural gas booms, during the NRC site-specific environmental review. Because the comments were related to the site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-086; 1173-098; 1173-107**
One commenter expressed concerns that Campbell County—with all its coal mines and CBM development—does not have a high unemployment rate. The commenter also expressed concerns that Albany County's unemployment is due to the student population. Another comment was made that it is unlikely that the labor force would come locally from Carbon and Fremont Counties because of existing oil, gas, and wind development. Another comment was made that the Pine Ridge Indian Reservation, an area with a high unemployment rate, should be used in the socioeconomic analysis rather than Laramie, Wyoming.

*Response: Labor force data, such as unemployment, was analyzed using U.S. Bureau of Census 2000 data to standardize labor force data for all geographic areas analyzed. More current state census data was not used, because not all states have the same years of collection and methods for collection. Albany County's unemployment rate was based on U.S. Bureau of Census information that considers labor force as 16 years of age and older. Laramie, Wyoming, was included as an area with a low per capita income as discussed in Section 3.2.10. The Pine Ridge Indian Reservation was mentioned as an area with a high unemployment rate as discussed in Section 4.4.10. Socioeconomic conditions, such as current local labor force data, will be evaluated in the NRC site-specific environmental review. Because the comment was related to information already provided and the site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-050**
The commenter had questions about adequacy of the GEIS in the following areas: (1) How much of the existing uranium reserves in northwestern New Mexico might be exploited? (2) What are the effects of increased worker productivity on employment and wages? (3) What effect would volatile uranium prices have on communities? (4) How would increased pressure on infrastructure and services be offset by increased revenue from uranium operations? (5) What are the economic impacts of lost natural resources caused by environmental contamination and how will damage to the environment affect long-term economic stability? and (6) What are the costs to losing groundwater?

*Response: (1)—The GEIS does not assess the amount of uranium that is predicted to be extracted from the region, because that cannot be known at this time. It depends on the number of applications for uranium recovery that NRC might receive and of those applications, the number that NRC would approve, as well as the specific milling capacities of the approved uranium recovery facilities. Each mill would have operations tailored to the site-specific* *conditions (e.g., the number of ISL well fields is related to extent and characteristics of the ore deposit), and each ISL company would have different projections as to how much uranium it proposes to mill and how many employees it would need. Topic 1 will be evaluated as part of the NRC site-specific environmental review. The NRC staff will evaluate socioeconomic conditions based on current conditions and the proposed actions for each facility.*

*(2) and (3)—The potential impacts of worker productivity on employment and wages and the future prices of commodities are not typically addressed in NRC environmental reviews. The affected socioeconomic environment in the four uranium milling regions is described in Sections 3.2.10, 3.3.10, 3.4.10, and 3.5.10. Potential socioeconomic impacts to the four uranium milling regions are described in GEIS Sections 4.2.10, 4.3.10, 4.4.10, and 4.5.10. NRC believes the economic trends and characteristics, including employment and income levels, as discussed in these chapters, adequately addresses the current socioeconomic condition in general as recommended by NUREG–1748 (NRC, 2003). Socioeconomic conditions will not typically be evaluated based on projections of future economic activity, because of uncertain fluctuations in economic conditions. Topics 2 and 3 will be evaluated, and any additional analyses, if applicable, would be deferred to the site-specific environmental review.*

*(4)—The potential impacts to local infrastructure and services are addressed in the socioeconomic impacts sections of GEIS Chapter 4. This evaluation addresses the types of potential impacts expected from siting ISL facilities at locations within the milling regions where past, present, and potential future ISL sites have been or may be located. Because the potential infrastructure and services impacts and tax revenue depend on the local economic policies and conditions, and the local economic policies and conditions in the cities and towns of milling regions evaluated are variable, the type of analysis requested by the commenter would require separate, detailed local economic analyses for each city or town that could be affected by ISL. This level of detailed analysis is not practical nor is it necessary in a generic (i.e., programmatic) assessment of potential impacts. Rather, the analysis in the GEIS is intended to address the range of potential impacts applicable to affected cities and towns within the milling regions. As a result, the socioeconomic impact conclusions in the GEIS range from SMALL to MODERATE depending on the types of conditions that may exist in local cities and towns. While these conclusions, based on the currently available information, are expected to bound the impacts within the milling regions, NRC staff recognizes the possibility that an environmental review for a particular site may evaluate local socioeconomic conditions in greater detail, if necessary, and could reach conclusions that differ from what is provided in the GEIS. Because the recommended analysis is at a level of detail that is more appropriate for a site-specific environmental review, no changes were made to the GEIS in response to the comment.*

*(5)—The comment assumes there would be permanent environmental contamination and impacts from ISL operations that would cause available economic resources to be permanently lost from economies. ISL facilities are (1) only permitted to operate in an aquifer (or portion thereof) that is exempted as a source of drinking water, (2) monitored to detect and correct excursions of processing fluids, (3) required to restore well field water quality to meet NRC requirements following operations, and (4) required to decommission surface facilities. Therefore, the impact scenario suggested by the commenter lacks sufficient basis for inclusion in the GEIS socioeconomic analysis. As a result, no changes were made to the GEIS in response to the comment.*

*(6)—The potential impacts to groundwater are evaluated and discussed in GEIS Sections 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2. For further explanation regarding the*

*potential loss of a groundwater source, refer to the response provided for Comment 1314-051 in this section of Appendix G.*

*Because the comments were related to the site-specific review and information already provided or that cannot be provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-051**
The commenter expressed concerns that the GEIS does not adequately discuss the socioeconomic impacts of losing a groundwater resource.

*Response: The potential impacts to groundwater are evaluated and discussed in GEIS Sections 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2. As pointed out in Sections 2.5.4, 4.2.4.2.3, 4.3.4.2.3, 4.4.4.2.3, and 4.5.4.2.3, the primary objective of aquifer restoration is to return affected water quality parameters in the well fields to the standards in 10 CFR 40, Appendix A, Criterion 5B(5), or to an alternate standard approved by NRC. These standards have been developed and implemented to ensure public health and safety. The NRC staff is not aware of any incidents in which nonexempt portions of an ore-bearing aquifer have been contaminated by ISL operations under its regulations. Because the comments were addressed in the GEIS, no further changes were made to the GEIS.*

**Comment: AL24-097**
A commenter stated that the majority of people in New Mexico who suffered from the legacy of past uranium recovery activities live in economically depressed areas. The commenter also expressed concerns that the community is being promised jobs, but suffers past impacts.

*Response: Current socioeconomic conditions were assessed for factors such as demographics, employment structure, and housing in GEIS Chapter 3, and potential socioeconomic impacts from potential NRC-licensed ISL facilities are discussed in Chapter 4. GEIS Chapter 5 describes past, present, and reasonably foreseeable future actions (RFFA) in the four uranium milling regions and reflects impacts from past uranium mining and milling as one of the actions that would be included in the site-specific evaluation of cumulative impacts. The site-specific review also would assess current socioeconomic conditions and potential impacts to those conditions, making use of the GEIS Chapters 3 and 4 discussion and analysis as appropriate. Because the comment was related to topics that would be more fully evaluated in the site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: HC016-003**
The commenter expressed concerns about stress on roads, schools, housing, and hospitals from worker influx.

*Response: Socioeconomic conditions such as impacts to housing, hospitals, and schools were discussed in GEIS Sections 4.2.10, 4.3.10, 4.4.10, and 4.5.10. Potential impacts to roads were discussed in GEIS Sections 4.2.2, 4.3.2, 4.4.2, and 4.5.2. Specific local socioeconomic factors will be further analyzed in NRC site-specific environmental review of potential socioeconomic impacts from a proposed ISL facility. Because the comment was related to information already provided and site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-086**
A commenter questioned why Casper was used in the socioeconomic analysis for the Nebraska-Wyoming-South Dakota Uranium Milling Region.

*Response: Socioeconomic information was analyzed for Casper, Wyoming, because this area may include workers willing to commute long distances {more than 48 km [30 mi]} for employment opportunities or external labor necessary to fulfill specialized positions (if the local workforce is unavailable or does not have the necessary skill sets). Because the comment was general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1015-014**
The commenter expressed concerns about impacts to local industries including impacts to tourism, recreation, and ceremonial purposes.

*Response: Potential impacts to local industries including impacts on tourism and recreation value are factors that will be considered in NRC site-specific environmental review of potential socioeconomic impacts from a proposed ISL facility. Consultations will be held with Native American groups as part of the National Historic Preservation Act Section 106 historical and cultural process during site-specific analysis. Any concerns associated with potential impacts to land for ceremonial purposes will be addressed during the consultation period. Because the comment was related to site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL07-013**
The commenter questioned whether the GEIS economic analysis considers individual ISLs or regional situations.

*Response: Socioeconomic data in the GEIS was obtained using a region of influence of 48 km [30 mi], as discussed in Chapter 3. This radius accounts for populations that would be most directly affected. Socioeconomic conditions in the areas around a potential ISL facility will be evaluated as part of the site-specific analysis of each facility. Because the comment was general in nature, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-099**
A commenter questioned why three towns in Wyoming (Gillette, Sheridan, and Buffalo) were not included within the boundaries of the Wyoming East Uranium Milling Region as they would be a potential source of employees and housing.

*Response: The boundary for each region was chosen based on the following considerations as described in GEIS Chapter 1: (1) past and existing uranium milling sites are located within states where NRC has regulatory authority over uranium recovery; (2) potential new sites were identified based on NRC's understanding of where the uranium recovery industry has plans to develop uranium deposits using ISL technology; and (3) locations of historical uranium deposits within portions of Wyoming, Nebraska, South Dakota, and New Mexico. As stated by the commenter, Gillette, Sheridan, and Buffalo all fall outside the Wyoming East Uranium Milling Region boundaries.*

*As discussed in GEIS Chapter 3, socioeconomic factors were analyzed locally and within a region of influence of 48 km [30 mi] from the potential ISL facilities. These areas may include* *workers willing to commute long distances for employment opportunities or external labor necessary to fulfill specialized positions (if the local workforce is unavailable or does not have the necessary skill sets). However, the GEIS socioeconomic discussion also recognizes that workers may travel even greater distances {more than 48 km [30 mi]} for employment at an ISL facility. In GEIS Section 3.4.10.3, Gillette {64 km [40 mi] from a potential ISL facility} is recognized as a potential source of housing for facility employees. GEIS Section 4.3.10 provides an evaluation of potential environmental impacts on socioeconomic conditions in the Wyoming East Uranium Milling Region. In GEIS Section 4.3.10.2, both Gillette and Sheridan are recognized among the larger communities most likely to have available housing for facility workers. Housing availability would be assessed further as part of the site-specific environmental review. Because the information requested by the commenter is already in the GEIS or is related to the site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

### G5.30.1 References

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

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

Peach, J. and A.V. Popp. "The Economic Impact of Proposed Uranium Mining and Milling Operations in the State of New Mexico." Las Cruces, New Mexico: Arrowhead Center, Inc., Office of Policy Analysis, New Mexico State University. 2008.

## G5.31 Public and Occupational Health

### G5.31.1 Background Radiological Characteristics

**Comment: GA05-007**
This commenter was concerned that the radiation received from exposure to background and the radiation received from exposure to ISL facility releases were not the same. The commenter stated that the fact that people are exposed to radiation all the time does not make it acceptable to be exposed to radiation from ISL facilities because the exposures were not one and the same.

*Response: NRC requires that worker and public radiation doses be quantified as effective dose equivalent in millirem per year, which is intended to normalize doses by the expected health risk. This is achieved for different types of radiation and different body tissues by using weighting factors for radiation (alpha, beta, gamma, neutrons) and for body tissues (bone marrow, reproductive organs, lens of the eyes) to convert the radiation absorbed by a person to a common scale (in units of millirem) for determining compliance with NRC radiation protection requirements and for assessing the potential for harm or detriment. When this is done, if a person is exposed to the same dose from background radiation or from releases from ISL facilities, there is no difference in the expected health effects. NRC staff understands that members of the public can perceive involuntary man-made risks as more hazardous than voluntary natural risks. In the GEIS, the NRC staff considered potential human health impacts of ionizing radiation for both situations. Because the GEIS already considers the dose from ISL* *operations, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 032-031; 1300-014; 1314-033; GA17-003; GA23-010; GR18-002**
These commenters wanted clarification of how past mine wastes were going to be classified. One commenter specifically wanted the GEIS to discuss how radioactivity that remains from past operations will be considered when determining background. Another commenter stated that it is NRC's policy to allow applicants to characterize past mine waste as natural background. One suggested this legacy mine waste would exceed NRC dose limits. Another wanted NRC to protect the public from this historical contamination. One commenter thought the previous mistakes made by mining companies should be scrutinized.

*Response: The commenters are correct that it is NRC policy to consider past mine waste as part of background radiation. Doses from background radiation (which include naturally occurring radioactive material (including radon), cosmic radiation, and global fallout) are not included in the dose calculation for compliance with the public dose limit of 10 CFR Part 20, even if these sources are from technologically enhanced naturally occurring radioactive material (TENORM), such as preexisting radioactive residues from prior mining. In a decision on the Crown Point Facility hearing, the Commission agreed with this interpretation. This matter is discussed in GEIS Section 3.5.11.1. During site-specific reviews, cumulative effects analysis would need to consider the effects of past uranium activities within the region on public and occupational health. Additional discussion of the legacy of uranium mining is in Section G5.17 of this appendix. In response to the comments raised, GEIS Sections 3.2.11.1, 3.3.11.2, and 3.4.11.1 were revised to include this information as well.*

**Comment: 036-090**
This commenter noted that more detail needed to be included on the decay chain for uranium-238. The commenter was concerned that impacts to workers and the general public from radon had not been considered.

*Response: The additional information on the decay chain for uranium-238 would not add to the discussion and is beyond the scope of a plain language, public document. Details on the uranium decay chain are readily available in textbooks and on the internet from a variety of sources. Atmospheric release dose estimates include dose calculations for all progeny, and therefore dose from radon is included in the doses reported. Because the comments were specifically related to a level of detail beyond what is needed for the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-091**
This commenter noted that the GEIS should mention that TENORM is out of NRC jurisdiction and is part of background radiation for the purposes of dose calculations. The commenter thought NRC staff should refer to litigation related to this matter.

*Response: Lines 33 and 34 specifically state "TENORM is not regulated by NRC." Reference to this litigation already appears in Sections 3.5.11.1 but was added to Sections 3.2.11.1, 3.3.11.2, and 3.4.11.2 in response to this comment.*

## G5.31.2 Impacts to Members of the General Public

**Comment: 1321-014**
This commenter noted that, beyond the 10 CFR Part 20 dose limit of 100 mrem/yr as specified throughout the GEIS,10 CFR Part 20.1301(e) implies another dose limit specified in 40 CFR Part 190 which is specific to uranium fuel cycle facilities.
*Response: The commenter is correct that dose limits in the EPA's 40 CFR Part 190 should also apply pursuant to 10 CFR 20.1301(e). The dose limit in 40 CFR 190.10(a) is different from the NRC's 100 mrem/yr public dose limit in 10 CFR 20.1301. It is noted that the dose limit in 40 CFR Part 190 has radon and its progeny as exceptions. Therefore, licensees must comply with both the 10 CFR Part 20 and 40 CFR Part 190 dose limits. In response to the comment raised, GEIS Section 2.9 was revised to include reference to dose limits as specified in 40 CFR Part 190.*

**Comment: 036-111**
This commenter noted reference to 40 CFR Part 190 was needed in Section 4.2.11.1. This commenter asked for clarification was needed concerning direct gamma radiation and that it should not be an air quality issue as alleged by opposition parties in Hydro Resources, Inc. litigation. The commenter thought NRC should explain that the dose from direct exposure to members of the public is likely zero due to the distance from the source and duration of exposure.

*Response: The commenter is correct in that the public will not likely receive a dose from direct gamma radiation due to the distance from the source. Even though all pathways are listed, there is no reason to explicitly point out that direct radiation is not a contributor. Because the comments would not add to the detail within the GEIS, no changes were made to the GEIS beyond the information provided in this response. Reference to 40 CFR Part 190 was added in Section 2.9 in response to another commenter.*

**Comment: 1309-014; 1313-003; CH06-010**
These commenters were concerned about the rate of diabetes in local populations, and one was specifically concerned with the rate of diabetes in Native Americans. The commenters thought that the rate of diabetes was connected to the arsenic levels in the drinking water. One commenter noted that diabetes was already an epidemic in the United States.

*Response: This issue is not related to the uranium milling activities that are the subject of the GEIS. Because the comments were not related to the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1313-003; AL06-108; AL13-026; CH06-011; SP08-005**
These commenters were concerned about the rate of cancer. Two commenters were specifically concerned about the rate of cancer in Native Americans. One claimed the cancer rate among Native Americans in this region is probably the highest in the country and is the highest in South Dakota. One commenter stated the United States already has a cancer epidemic.

*Response: The NRC staff considered the potential human health impacts of ionizing radiation (e.g., radiation dose) from ISL facilities. Dose is directly related to the number of latent cancer fatalities as discussed in Section 4.2.2. Latent cancer fatalities were the predominant health risk considered by the NRC to establish the regulatory dose limits in 10 CFR Part 20. From*

*ISL operations, the risk of latent cancer fatalities to any given individual, based on conservative assumptions, is very low and would likely not be distinguishable among normal cancer rates in the population. Cancer could be caused and compounded by several environmental and lifestyle factors. Because the GEIS already considers the public health effects, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL06-112; AL25-117; GA13-004**
Several commenters were concerned about the air emissions and the potential for uranium to become airborne. One in particular was concerned about a school that was in close proximity to the processing plant.

*Response: As discussed in GEIS Section 2.7.1, ISL facilities can release radon gas and uranium particulates during normal operations. To protect workers and the public from these types of releases, all ISL facilites must demonstrate compliance with NRC worker and public radiation dose limits at 10 CFR Part 20. The limits for the public are set to levels of radiation dose that are protective of health and safety for any offsite member of the public. For context, the 100 mrem/yr NRC public dose limit is less than one-third of the radiation exposure associated with natural background radioactivity that is discussed in GEIS Section 3.2.11. ISL facilities monitor the air downwind from ISL operations at the facility boundary and also use computer models to evaluate downwind air concentrations and calculate doses for released constituents to demonstrate compliance with the NRC regulations. ISL facilities that use vacuum drying technology essentially eliminate uranium particulate emissions. Offsite receptor doses reported in GEIS Table 4.2.2 are based on modeling facility releases and resulting air concentrations and dose at the offsite location where the dose is expected to be the highest. The calculated values for public doses for a variety of ISL facilities are well below the NRC public dose limit and provide confidence that members of the public that live near ISL facilites will not receive unsafe levels of radiation dose from ISL operations. Because the GEIS already considers the public health effects, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 001-005; 002-003; 005-005; 057-003; 1479-001; AL05-144; AL25-119; CH06-002; CH07-001; CH07-002; CH10-004;CH10-011; GA01-002; GA03-005; GA05-004; GA14-001; GA18-001**
These comments were concerned about potential health issues that may arise due to ISL operations and how health issues were going to be resolved. One commenter urged NRC to conduct a thorough analysis of potential health impacts, and another commenter noted that health could be an issue for years to come. Another noted that ISL was a dirty process with potentially great public hazards. One commenter suggested epidemiological studies should be conducted to assess health impacts prior to providing any new licenses. This commenter said that such studies should include health effects that might result from proposed milling activities as well as past operations. Some wanted this to happen before any future activities are attempted. Several people expressed their opinion that uranium was a dangerous substance, and one referred to uranium as the most dangerous substance on earth. Another was concerned about the decay of uranium. One noted that the land that we love should not be contaminated. Another mentioned NRC's mission statement relating to public health issues. Several expressed concern about how they were going to be protected. Two expressed the need to manage the risks. They said that if even one person was hurt or put in a health care facility, then it was not worth all the effort and money to be gained from the nuclear process.

*Response: The mission of the NRC is to license and regulate the nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health* *and safety, promote the common defense and security, and protect the environment. NRC regulates the safety of a variety of radioactive materials based on established safety practices and available scientific information on radiation safety. The GEIS discusses NRC radiological safety regulations and related activities that apply to ISL facilities in Section 2.9. The NRC staff considered the potential human health impacts of ionizing radiation (e.g., radiation dose) from ISL facilities as described in GEIS Sections 4.2.11, 4.3.11, 4.4.11, and 4.5.11. NRC has dose limits (10 CFR Part 20) that are protective of all populations. NRC regulation and oversight of ISL facilities ensure the necessary measures are taken by ISL operators to confine mobilized uranium within the well field where the facility is operating, ensure monitoring programs are in place to provide early detection of any migration of process fluids away from the well field, and enforce necessary corrective actions to prevent uranium from contaminating adjacent water sources to ensure the public is protected. An airborne radiation monitoring program would also be required at the facility boundary as discussed in Section 8.2.1 to demonstrate compliance with NRC public dose limits. Because the comments represent concerns of a general nature and potential health effects are already addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL17-064; CH06-021; CH09-003; CH10-002; GA04-003; GA04-006; GA04-007; GA05-005; GA13-005**
Several commenters were specifically concerned about potential health effects to children. Some of the commenters were concerned about grandchildren and future generations as well. Another commenter was concerned about children drinking water with uranium in it and the uranium getting into their kidneys and killing the cells there. One commenter was concerned that his children would die. Another was concerned that these future generations were not being given a choice in the matter.

*Response: The NRC staff considered the potential human health impacts of ionizing radiation (e.g., radiation dose) from ISL facilities. NRC has dose limits (10 CFR Part 20) that are protective of all populations, including children. Also, as discussed in Section 4.2.4.2.2.2, in order for ISL operations to occur, the uranium-bearing production aquifer must be exempted as an underground source of drinking water. When production is completed, the licensee is required to restore the aquifer to preoperational conditions if possible. If not possible, then NRC requires the production aquifer be returned to another NRC-approved limit (e.g., MCLs or to ACLs). MCLs and ACLs are alternate limits for a variety of regulated constituents that, based on review of site-specific conditions, are also considered to be equally protective of public health and safety. Because the GEIS already considers the public health effects of adults and limits are set to be protective of all populations, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL01-131**
This commenter was concerned about the effects on the reproductive system if someone received radiation as a baby or a young child. The commenter was concerned about reproductive effects that could be passed on to future generations.

*Response: The NRC staff considered the potential human health impacts of ionizing radiation (e.g., radiation dose) from ISL facilities as described in GEIS Sections 4.2.11, 4.3.11, 4.4.11, and 4.5.11. NRC has dose limits (10 CFR Part 20) that are protective of all populations. Dose limits are also set to be protective of all organs, including the reproductive system. Because the GEIS already considers the public health effects and dose limits are protective of the reproductive system, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-028**
This commenter asked that health impacts during aquifer restoration should include yellowcake production or drying.

*Response: Because aquifer restoration continues to remove uranium from pumped groundwater, some yellowcake production and drying will occur during aquifer restoration activities, but much less than during full operations. In response to the comments raised, the GEIS Public and Occupational Health impact summaries for aquifer restoration in the Executive Summary, Section 4.2.11, and Chapter 10 were revised to convey that production of yellowcake and therefore yellowcake drying activities would occur at a reduced rate. While this drying activity was added to the applicable health impact summaries, the worker and public health impact conclusion in the GEIS for aquifer restoration activities given this reduced level of yellowcake production remains as SMALL.*

**Comment: 010-002**
This commenter noted that releases from an ISL facility during normal operations are limited to radon and uranium particulate (when a thermal dryer is used).

*Response: The commenter is correct. The additional constituents listed in Section 4.2.11.2.1 would apply to a conventional mill and not an ISL. In response to the comments raised, GEIS Section 4.2.11.2.1 was revised to remove reference to the uranium decay products listed and refer to releases of radon and uranium particulate releases.*

**Comment: 001-002; 1015-007**
These commenters were concerned about the risks associated with the various exposure pathways from contaminated water. One commenter was concerned about animals drinking contaminated water or grazing on contaminated vegetation and then potential health effects from consuming contaminated meat products. Another commenter was concerned about potential contamination to water that could potentially affect agriculture, drinking water, and recreation.

*Response: NRC staff considered the potential human health impacts of ionizing radiation (e.g., radiation dose) from ISL facilities. NRC dose limits (10 CFR Part 20) apply to all pathways, such as consumption of locally produced food, air inhalation, and drinking water, as applicable, and are protective of all populations. Common contributors to offsite doses from ISL facilities include radon and uranium particulate air releases (Section 2.7.1). Water pathways are not considered significant contributors to offsite doses, because as discussed in Section 4.2.4.2.2.2, in order for ISL operations to occur, the uranium-bearing production aquifer must be exempted as an underground source of drinking water. When production is completed, the licensee is required to restore the wellfield water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5b(5) or other standard, such as groundwater class of use, approved in their license. These standards ensure public health and safety are protected.*

*In addition, as discussed in NUREG–1569 (NRC, 2003a, Section 2.2.3), the applicant is also required to survey and report locations of all privately owned wells within 3.3 km [2 mi] of the permit area and their current uses and production rates and to assess potential impacts on these wells due to the ISL production as part of site characterization. Required environmental monitoring programs described in GEIS Chapter 8 and Section 2.9 and applicable referenced guidance documents include routine monitoring of all downgradient public wells that could be used for drinking water, livestock watering, or crop irrigation. Environmental monitoring programs also can include, if applicable, vegetation (including forage), food, and fish*

*(Section 8.2.3). Because the GEIS already discusses the effects on groundwater and regulatory limits and monitoring programs are established to protect the public from applicable exposure pathways, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-120**
This commenter suggested that groundwater contamination should be discussed in the public and occupational health section.

*Response: Groundwater impacts are already discussed in Sections 4.2.4, 4.3.4, 4.4.4, and 4.5.4. Because the comment recommended adding information that was already contained within the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 020-001**
This commenter stated that the GEIS should be expanded to include the low dose radiation research conducted by DOE. Further, the commenter wanted DOE conclusions of this report contradicting the linear no threshold theory should be discussed.

*Response: NRC bases its regulations on the linear no threshold theory. Any challenge to regulations would be beyond the scope of the GEIS. Because the comments were concerned with regulations, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-114**
This commenter stated that NRC needed to add specific statements within the operations section about the minimization of potential impacts to workers from site radon emissions due to ventilation requirements and the use of downflow pressurized ion exchange columns. They stated that radon emissions had virtually been eliminated.

*Response: Section 4.2.11.2.1 discusses the potential impacts on workers as a result of ISL facility operations, based on historical measurements at the Crow Butte facility in Nebraska. Exposure to radon progeny is reported as working-level months, which is a unit commonly used in occupational environments. These exposures to radon are well below the regulatory limits. Because the GEIS already considers the health effects to workers from existing facilities, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 059-011**
This commenter asserted that the radiological air quality impacts were understated as SMALL. The commenter was concerned about effects of resuspended dust from well field pipeline spills, radon releases from well system relief valves, and emissions from yellowcake dryers. The commenter was concerned with gusts of wind carrying these particles long distances.

*Response: Doses reported in GEIS Table 4.2.2 include radon emissions from processing facilities, well fields, and yellowcake drying operations. Some facilities effectively have no yellowcake emissions because they use vacuum drying equipment. Resuspended dust from well field spills is not expected to contribute significantly to off-site public doses, however, NRC requires licensees to report spills and this information would be evaluated for potential safety and environmental concerns when spills are reported.*

*These reported dose estimates in Table 4.2.2 apply to the maximum offsite location, meaning that doses are calculated in 16 compass sectors, the highest is reported, and all are still below the NRC dose limits. The reported doses are calculated taking into account the meteorological conditions for the specific locations so the local conditions would be considered. Therefore, the gusts of wind that the commenter refers to would be considered, but also the frequency with which they occur. A license application for a specific site would include local meterological data and site-specific dose estimates that would be reviewed by NRC staff.*

*Additionally, NRC has public and worker dose limits (10 CFR Part 20) that are protective of all populations. Because the doses are well below the dose limits imposed by NRC that are protective of the public, the effects are determined to be SMALL. Additionally, GEIS Section 2.4.2.3 discusses offgas discharge from the dryer and the fact that 95–99 percent efficiency scrubbers are used to remove particulates before they are released to the atmosphere. Because the GEIS already considers the public health impacts at the maximum offsite location, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-019**
This commenter stated that providing regional averages of air quality to arrive at a background air quality level masked the actual air quality at localities and therefore provides a low level of estimated air contamination in certain regions.

*Response: The commenter is correct in that local areas could have higher background radiation than those listed in the background radiological conditions sections. However, the purpose of the GEIS was to provide data for regions that could be used during the site-specific reviews for individual facilities, as appropriate. It is not intended for the GEIS to be a substitute for all site-specific information that would be necessary for the NRC staff's environmental review. NRC has a statutory obligation to assess each site-specific license application to ensure it complies with NRC regulation before it issues a license. Because the GEIS is intended to be generic, site-specific averaging of air quality measurements is not discussed, and no changes were made to the GEIS beyond the information provided in this response.*

### G5.31.3 Impacts From Off-Normal Operations or Accidents

**Comment: CH11-005**
This commenter was concerned about public health impacts from excursion/incidents. The commenter is concerned about contamination and getting cancer from it.

*Response: NRC staff considered the potential human health impacts of ionizing radiation (e.g., radiation dose) from ISL facilities. Dose is directly related to the number of latent cancer fatalities as discussed in Section 4.2.2. Latent cancer fatalities were the predominant health risk considered by the NRC to establish the regulatory dose limits in 10 CFR Part 20. From ISL operations, the risk of latent cancer fatalities to any given individual, based on conservative assumptions, is very low and would likely not be distinguishable among normal cancer rates in the population. Cancer could be caused and compounded by several environmental and lifestyle factors. Additionally, monitoring to detect excursions is discussed in GEIS Section 8.3.1.2. Because the GEIS already considers the public health effects and discusses how the doses relate to regulatory limits, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-113**
This commenter expressed the opinion that the dryer explosion accident was unrealistic. The commenter stated that the hypothetical employee would be wearing protective equipment such as a respirator and the yellowcake would settle such that not much could be ingested.

*Response: Section 4.2.11.2.2 already states that the assumptions used for this analysis are conservative. The calculation was done with the assumption of a respirator being used. Because the conservatisms were already stated in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GA04-001; GI05-001**
These commenters were concerned about the first responders and emergency rooms having the capabilities to handle accidents. One commenter was concerned about whether training was given to first responders in rural communities. Another commenter was concerned with whether or not the health care facilities can handle these types of accidents.

*Response: ISL uranium recovery facilities have both potential radiation hazards and chemical hazards. EPA and OSHA, or state agencies with comparable authority, require emergency response plans for certain amounts of hazardous chemicals, and specify the level of training required for emergency responders. NRC requires licensees to have a spill contingency plan or emergency response procedures to deal with yellowcake or other spills of radioactive materials. Typically, coordination with local emergency responders and local hospitals would be an element of these emergency plans if local emergency services are expected to respond to a uranium recovery facility or to treat injured workers. No changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-112**
This commenter wanted the thickener spill dose assessment to be reexamined, claiming that the released material is a slurry and is not subjected to resuspension. The commenter stated that the slurry would not become airborne nor would it create a breathable aerosol. The commenter was concerned that there was a statement that the worker could receive a 5 rem dose if he or she did not evacuate the facility.

*Response: The NRC staff recognizes these estimates are conservative. A statement is included that states the dose limit would only be exceeded if the worker was unprotected and did not evacuate soon enough after the accident. Because the comments discuss conservatisms that are already mentioned in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

### G5.31.4 General

**Comment: 002-002; AL13-026**
These commenters were concerned about the toxicity of uranium. One was concerned about the fact that it is an endocrine disruptor.

*Response: Uranium has toxicological properties similar to other heavy metals, and exposure to toxic levels of uranium is associated with kidney damage. For toxic effects of uranium to occur, the material must be ingested, inhaled, or absorbed through the skin. The NRC weekly intake limit of 10 mg [3.5E-4 oz] for uranium at 10 CFR 20.1201(e) protects workers from the chemical toxicity of soluble uranium in air. Potential public exposures from ISL uranium airborne* *particulate emissions (Section 2.7.1) must comply with NRC regulations at 10 CFR Part 20, Subpart D and are expected to be well below toxic levels. Most modern ISL facilities are expected to use vacuum drying equipment that would substantially reduce uranium emissions compared with facilities that use thermal dryers. Public groundwater exposures to uranium from ISL activities are not expected, because ISL facilities are required to operate in an exempted aquifer, operational practices implemented by licensees provide adequate control of recovery solutions within well fields, and well field monitoring is implemented by licensees to detect excursions (GEIS Chapter 1; Sections 4.2.4.2, 4.3.4.2, 4.4.4.2, and 4.5.4.2; Chapter 8). Aquifer restoration to NRC standards at 10 CFR Part 40, Appendix A, Criterion 5B(5) or other standard approved by NRC would ensure protection of public health and safety (Section 2.5). Because the same regulatory programs and ISL practices discussed in the GEIS to limit radiological impacts also serve to limit uranium chemical exposure impacts, no changes were made to the GEIS in addition to the response to this comment.*

**Comment: 036-078**
This commenter wanted the necessity of radon flux measurement clarified. The commenter specifically said that NRC should consider revising Regulatory Guide 4.14 to reflect the lack of necessity for radon flux measurements.

*Response: All ISL uranium recovery licensees may not need to do a background radon flux survey or measurement. Currently, the need for pre-operational and operational radon flux surveys are made on a case-by-case basis by NRC staff based on the specific facility design and operations specified in the license application. An effort is underway at NRC to evaluate and update regulatory guidance and Regulatory Guide 4.14 will be included in this effort.*

**Comment: 036-115**
This commenter said that in the summary of occupational and public health impacts radon settlement should be changed to radium settlement.

*Response: The commenter is correct. In response to the comment, the GEIS Executive Summary was revised to change radon settlement to radium settlement throughout.*

**Comment: 036-135**
This commenter suggested that the definition of radon should be modified to include exposure to radon progeny.

*Response: The definition is for radon and not radon exposure, and therefore the current definition is acceptable. Currently the definition states that exposure to radon could be a potential health hazard. Because the comments would not add to the definition, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: AL18-068**
This commenter noted that with 30 years of operations, there has not been a serious environmental health or safety risk nor has there been any failure to restore an aquifer to its preleach standard.

*Response: NRC recognized previously the potential for operational mishaps at ISL uranium recovery facilities and NRC consultants were asked to prepare NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees" (NRC, 2001), which provides consequence analyses for chemical and radiation hazards at ISL uranium recovery facilities. NUREG/CR-6733 also provides recommendations on how NRC* *could use the results of the consequence analyses to risk-inform the regulation of ISL uranium recovery facilities.*

**Comment: AL22-086**
This commenter was concerned that the list of preparers did not include anyone with education or training in biological effects of ionizing radiation.

*Response: Nuclear engineering staff who worked on the project have experience/education in health physics including the biological effects of ionizing radiation. Because the comments were very specific to the types of training staff had and only education is shown in the list of preparers, no changes were made to the GEIS beyond the information provided in this response.*

### G5.31.5 References

NRC. "A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees." NUREG-6733. Washington, DC: NRC. 2001.

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

## G5.32 Waste Management

### G5.32.1 General Waste Management Comments

**Comment: 018-006**
One commenter asked how ISL wastes are disposed.

*Response: GEIS Section 2.7 describes effluents and waste management at ISL facilities, including descriptions of air effluents, liquid wastes, and solid wastes that can be generated by ISL facilities. Some effluent streams, wastes, and treatment methods vary depending on available options. Radioactive wastes generated by ISL facilities are defined as 11e.(2) byproduct material by NRC. Unless suitable to remain onsite or to be released offsite for unrestricted use, 11e.(2) byproduct material wastes must be disposed at a facility that is licensed to accept byproduct waste. ISL facilities also generate normal trash (i.e., solid waste) that would be disposed at a local landfill. Some hazardous waste (e.g., fluorescent lights, waste oil, and batteries) would be generated at an ISL facility, thereby requiring disposal at a facility approved for hazardous chemical wastes. Soils in areas where ISL operations occur would be included in decommissioning surveys when operations end, and any contaminated soils that exceed NRC release limits at 10 CFR Part 40, Appendix A, Criterion 6 would be removed and disposed of as 11e.(2) byproduct waste. Because the information requested by the commenter is already described in the GEIS, no changes were made to the GEIS in response to this comment.*

**Comment: GA12-005**
One commenter asked for more information on the process bleed and how it is managed as a waste.

*Response: GEIS Section 2.7.2 discusses waste management of liquid waste streams, which are predominantly from the process bleed (the 1 to 3 percent of the process flow rate that is* *diverted as a waste stream to ensure the well field is balanced; i.e., more water is pumped out than in). The process bleed consists of water from the return flow after dissolved uranium is extracted. This waste water is commonly disposed of in a well that is permitted for deep well injection as discussed in GEIS Chapter 1 or is stored in evaporation ponds until the site is decommissioned (when the ponds are remediated and pond bottom sludge is disposed of at an licensed facility as byproduct waste). Some facilities, if they obtain the proper permits from state regulators, may choose land application of treated wastewater as another disposal method. Both the treated water and land are included in monitoring programs to ensure any residual contaminants are maintained below permitted levels. As the comment pertained to information that is already discussed in the GEIS, no changes were made to the GEIS in response to the comment.*

**Comment: 050-069**
One commenter asked whether all ISL sites have disposal wells.

*Response: There are currently three NRC-licensed operating ISL sites in the United States. Two are in Wyoming (Smith Ranch, Irigarary/Christensen Ranch) and one is in Nebraska (Crow Butte). All three of these sites use deep well injection for disposal of liquid wastes. Other liquid waste disposal options have been approved in the past for disposal of liquid wastes produced by ISL sites as discussed in the GEIS Section 2.7.2. These other options include the use of evaporation ponds, land application, and surface water discharge. Each disposal option considered must comply with all NRC and state regulations and permitting requirements. Therefore, all options may not be available in each location where an ISL facility might be located. The State of South Dakota, for example, does not permit deep well injection as a waste disposal option. Because the GEIS already discusses the applicable liquid waste disposal options including deep well injection, no changes were made to the GEIS in response to this comment.*

## G5.32.2 Scope of the Assessment of Waste Management Impacts

**Comment: 050-024**
One commenter requested the GEIS analyze liquid waste disposal methods (e.g., land application, deep well injection, evaporation ponds) to find the most preferable to support evaluation of methods in site-specific reviews. The commenter suggested each liquid waste disposal option discussed in the GEIS presents different environmental impacts including trace metals buildup (land application), mosquito breeding, and wildlife impacts (evaporation ponds).

*Response: GEIS Section 2.7.2 discusses the waste disposal methods that have been permitted at past ISL facilities. These waste disposal methods are considered in the evaluation of potential impacts in Chapter 4, either explicitly or implicitly and where applicable, including for land use, geology and soils, water resources, ecology, public and occupational health, and waste management. Examples provided by the commenter (e.g., trace metal accumulation in soils from land application and wildlife impacts from evaporation ponds) are included in the geology and soils and ecological impacts sections of the GEIS. In regulating licensees, NRC does not require that a most preferable option be chosen by applicants or licensees; rather, NRC approves approaches proposed if the approach meets NRC requirements. Because the GEIS evaluates the potential impacts from the liquid waste treatment options, the GEIS is expected in its present form to provide a reasonable context and basis for evaluating waste management impacts for a proposed ISL site. As a result, no changes were made to the GEIS in response to the comment.*

**Comment: 050-059**
One commenter requested GEIS Chapter 1 should describe under what situations a facility may require a storm water discharge permit. They expressed a concern about regulating levels in evaporation ponds to prevent hazardous constituents getting into storm water discharge.

*Response: As discussed in GEIS Section 1.7.2.1, industrial storm water discharges to surface water are regulated by the EPA NPDES permitting process, which would be administered by EPA, authorized states, or tribes. In general, storm water permits apply to facilities that plan to discharge storm water from a point source into a surface water body. Additional discussion of storm water permitting is included in the surface water impact analysis sections in GEIS Chapter 4. Readers seeking additional details of such programs are referred to the agencies responsible for their implementation.*

*In addition to permit requirements, the NRC safety review would verify design, operational controls, and monitoring programs are sufficient to ensure all effluents meet NRC limits at 10 CFR Part 20 (GEIS Section 2.9 discusses effluent control and environmental monitoring programs). The safety review would also verify that sufficient freeboard (e.g., distance from water level to top of impoundment) and reserve capacity is provided for evaporation ponds to maintain containment of pond contents during storm events. Such controls, in addition to provisions for leak detection systems and related monitoring discussed in GEIS Section 2.7.2, provide assurance that containment of licensed materials will be maintained. Because the comment requested information that is either already included in the GEIS or is best provided by agencies responsible for implementing permitting programs, no changes to the GEIS were made in response to the comment.*

**Comment: 1300-011**
One commenter suggested GEIS Section 2.7.1 should include emissions generated during transportation of wastes during decommissioning.

*Response: In response to the comment, Section 2.7.1 was revised to include a more complete description of the vehicle-emissions-generating activities, including decommissioning waste truck shipments, expected at an ISL facility for the various phases of the ISL facility lifecycle. GEIS Table 2.8-1 provides the estimated number of annual waste shipments from decommissioning (approximately 150). This magnitude of temporary trucking activity is not expected to significantly impact regional air quality; however, as discussed in GEIS Chapter 4, the evaluation of air impacts for any proposed facility would be based, in part, on existing air quality in the region where the ISL facility would be cited. Because regional air quality can change over time, the attainment status would need to be considered when evaluating air quality impacts of any proposed facility in the site-specific environmental review.*

**Comment: 050-072; 1300-009; 1305-074; 1300-010**
Some commenters requested clarification of waste disposal practices in the GEIS and identification of the existing disposal facilities licensed to accept 11e.(2) byproduct waste from ISL facilities. In addition, one commenter requested information on the disposal locations for 11e.(2) byproduct wastes from all historical, existing, and proposed ISL facilities. Another asked what are the amounts of byproduct material each licensed disposal facility is permitted to receive and an evaluation of associated impacts of that disposal. Another asked for clarification on how solid wastes are disposed, including building materials, pipeline equipment, contaminated soils, and used vehicles. This commenter requested a discussion of waste disposal impacts and clarification of federal and state permitting requirements for onsite disposal of solid wastes.

*Response: The existing facilities that are licensed by NRC to accept 11e.(2) byproduct material wastes for disposal are the Pathfinder-Shirley Basin uranium mill tailings impoundment in Mills, Wyoming, and the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Additionally, three sites are licensed by NRC Agreement States to accept 11e.(2) byproduct material for disposal (i.e., the EnergySolutions site in Clive, Utah; the White Mesa uranium mill site in Blanding, Utah; and the Waste Controls Specialists site in Andrews, Texas). The evaluation of disposal impacts at the licensed disposal sites is not necessary in the GEIS, because the existing facilities have already been licensed to accept such wastes and the environmental impacts of these facilities operations have already been evaluated as part of prior licensing actions. Proposals for onsite disposal of byproduct wastes at locations without available disposal capacity are uncommon, but if such proposals were received by NRC, they would be evaluated on a case-by-case basis against criteria in 10 CFR Part 40, Appendix A. Onsite burial of non-radioactive solid wastes would not be regulated by NRC and would need to satisfy applicable federal and state requirements. Because the potential environmental impacts from existing or future waste disposal facilities have already been (or will be) addressed by other licensing and permitting reviews, this information was not needed in the GEIS to support evaluation of potential environmental impacts from new ISL facilities, and therefore no changes were made to the GEIS in response to these requests.*

*Historically, ISL 11e.(2) byproduct wastes from a number of ISL facilities have been disposed in tailings impoundments for conventional uranium milling facilities to reduce the number of waste disposal sites in regions where uranium milling activities were prevalent. Including a comprehensive history of waste disposal from ISL sites is not necessary to support the evaluation of potential environmental impacts from new ISL facilities and therefore no changes were made to the GEIS in response to this request. As discussed in GEIS Chapter 4 waste management impacts sections, before an ISL facility can operate, NRC requires that facility must have an agreement in place with a licensed disposal facility to accept the 11e.(2) byproduct wastes associated with all phases of that ISL facility's lifecycle. Such agreements ensure sufficient disposal capacity is available throughout the life of the ISL facility.*

*Regarding disposal of structures, contaminated soils, and equipment, these materials are surveyed to identify any radiation hazards. Materials that meet NRC unrestricted release criteria for surface contamination (NRC, 2003a, Sections 5.7.6.3 and 6.3) are segregated from those that do not meet the limits. Alternatives for handling process buildings and equipment include reuse, removal, or disposal. Contaminated items are decontaminated to the meet release criteria (NRC, 2003a) if they are to be released for offsite unrestricted use; otherwise, they are disposed of as 11e.(2) byproduct material at a licensed disposal facility. In response to the comment requesting clarification of solid waste disposal, GEIS Section 2.6 was revised to clarify the characterization and disposal of decommissioning solid wastes.*

### G5.32.3 Characteristics of Wastes Generated by ISL

**Comment: 036-076; 1173-068; 1479-002; AL20-077**
Some commenters expressed views and asked for clarification about the types of wastes generated by ISL facilities. One suggested ISL facilities generate large amounts of toxic waste. Another asked what types of hazardous wastes are produced that would be regulated under the Resource Conservation and Recovery Act (RCRA). One mentioned that most ISL facilities would be conditionally exempt, small quantity generators of RCRA wastes, noting the common RCRA wastes are characterized as universal wastes that include fluorescent lights, batteries, and oil. Another commenter asked whether evaporation pond concentrates are

considered hazardous and requested clarification on the applicable waste treatment prior to discharge into ponds.

*Response: GEIS Section 2.7 describes the characteristics of effluents and wastes generated by ISL facilities. This section focuses on the common types of wastes generated by ISL facilities. Limited discussion is devoted to hazardous (RCRA) wastes because ISL facilities, in general, do not generate significant amounts of this type of waste. Waste treatment options are also discussed in Sections 2.7 and 2.5.3. Waste treatments vary from site to site depending, in part, on the disposal options that are available. Facilities that rely on land application would need to treat waste water—for example, by reverse osmosis—whereas facilities that rely on deep well injection or evaporation ponds may not be required to pretreat the waste water. Some facilities choose to employ brine concentration, for example, to limit the volume of waste water and limit the overall volume of water consumed by the ISL process. Evaporation pond liners, sludges, and any other contaminated areas of the ponds are classified as 11e.(2) byproduct material and are disposed at a licensed facility. Because the GEIS discussion of wastes generated by ISL facilities is sufficient to support the evaluation of environmental impacts, no changes were made to the GEIS in response to the comments.*

**Comment: 036-070; 1305-075**
A few commenters asked whether more up-to-date information could be used for liquid waste stream constituents in the GEIS Section 2.7.2.

*Response: The information provided in GEIS Table 2.7-3 on liquid waste constituents was the most complete information on liquid waste stream constituents for an ISL facility identified in available documents. The estimates are based on a 2,400-ha [6,000-acre] ISL facility using alkaline lixiviant (sodium bicarbonate), a 0.076 $m^3/s$ [1,200-gal/m] production flow rate, and uranium processing similar to what is described in the GEIS Section 2.4. An NRC license application review for a specific site would evaluate the waste stream information provided by the applicant for the specific site. As the comments provided no bases for questioning applicability of the information for supporting the evaluation of potential environmental impacts from ISL facilities, no changes were made to the GEIS in response to the comments.*

**Comment: 036-072**
One commenter recommended adding to the discussion of liquid waste streams in GEIS Section 2.7.2 information on radium concentrations in liquid waste streams if radium treatment is used.

*Response: Information on radium concentrations in water before and after treatment with barium chloride is already provided in GEIS Section 2.7.2. Because this information is already discussed in the GEIS, no changes to the GEIS were made in response to this comment.*

**Comment: 036-075**
One commenter requested clarification of the classifications of solid wastes in Table 2.8-1, noting that some ISL operational wastes are non-radioactive but still considered byproduct material. The commenter also suggested that that solid materials that have radioactive byproduct material present but have been sufficiently decontaminated for other uses are not wastes and are not classified as 11e.(2) byproduct material.

*Response: NRC agrees with the comment regarding Table 2.8-1 and has edited the terminology used in describing solid wastes to enhance clarity and consistency in GEIS Tables 2.6-1 and 2.8-1 and related text in Sections 2.6, 2.7.3, and 2.8. NRC also notes that a licensee* *may decontaminate some solid materials that have been contaminated with 11e.(2) byproduct material so as to make those solid materials suitable for release for unrestricted use.*

**Comment: 1173-062; 1305-073**
Two commenters questioned the use of waste volume estimates in the GEIS for decommissioning wastes. One commenter requested the GEIS use actual volumes of waste generated during decommissioning rather than the estimates provided (Tables 2.6-1 and 2.8-1). Another commenter noted in GEIS Section 2.6 (Table 2.6-1) that decontamination and decommissioning waste volume estimates are for the Smith Ranch facility and requested volumes for all current and past ISL facilities including mean and standard deviation of wastes per facility from all current/past facilities.

*Response: As shown in Table 2.11-1, the Smith Ranch facility is the largest currently NRC-licensed ISL facility, and therefore the waste volume estimates provided in Table 2.6-1 reasonably bound values for other past and current facilities. No ISL facilities of this size have been decommissioned to date. Therefore, no data exist on actual volumes of decommissioning wastes at a comparable ISL facility. As a result, the information presented provides a reasonable basis for understanding the magnitude of decommissioning and reclamation waste volumes for a modern ISL facility for use in evaluating potential impacts from future ISL facilities. Therefore, no changes to the GEIS were made in response to these comments.*

### G5.32.4 Waste Treatment and Disposal Methods

**Comment: 050-100; 1305-103**
Two commenters asked questions about land application as an option for waste water disposal at ISL facilities. One commenter inquired about the length of the land application monitoring program that is used to check whether constituents are building up in irrigated soils (noting that long-term postsite closure monitoring is needed). Another requested examples of where land application has been used and whether any impacts were identified.

*Response: Land application monitoring programs are reviewed and approved by NRC and the applicable state regulatory agencies (e.g., for WDEQ). Monitoring results are reported by licensees in publicly available semiannual or annual effluent monitoring reports. Both agencies review the monitoring results for compliance with their respective regulatory requirements. The monitoring would continue for the duration of the land application program. As discussed in the GEIS Section 2.7.2, land application areas would also be included in site decommissioning surveys to verify the radiological status of the area was in compliance with NRC release limits at 10 CFR Part 40, Appendix A, Criterion 6 prior to terminating the license and releasing the site for unrestricted use. NRC would not require additional monitoring once a license is terminated. An NRC-licensed ISL facility that has land application of treated waste water is the Smith Ranch Highland facility in Wyoming. This practice is being closely monitored by both NRC and WDEQ. The licensee's monitoring results for irrigated land areas and additional information are on the public record and available through the NRC website and therefore will not be summarized here.*

**Comment: 036-074**
One comment requested clarification of GEIS Section 2.7.2 regarding the water quality of permitted deep disposal wells. The commenter noted deep disposal well water quality is always poor; otherwise, the disposal well likely would not be permitted.

*Response: The NRC staff has made a reasonable effort to summarize the permitting programs of other agencies. As discussed in GEIS Chapter 1, the permitting of deep injection wells is the responsibility of the EPA and authorized state agencies. NRC staff considers those agencies best able to clarify the details of their permitting requirements. As a result, in response to this comment, no changes were made to the GEIS.*

**Comment: 1321-007**
One commenter suggested the GEIS discuss disposal options for contaminated soil, equipment, and liquids from accidents and excursions.

*Response: The mechanism by which soil, equipment, and liquids can become contaminated would not affect the available and applicable disposal options. Disposal options for such waste materials would be the same as discussed in GEIS Section 2.7. For example, Section 2.7.3 discusses solid waste disposal and includes contaminated soil from leaks and spills. Any soil contaminated with byproduct material released in an accident would be classified as 11e.(2) byproduct material and usually disposed at a facility licensed by NRC to accept byproduct waste for disposal. Because waste disposal methods are already addressed in the GEIS, no changes were made in response to this comment.*

**Comment: 1321-043**
One commenter requested the GEIS address the range of air-pollution-control technologies used at ISL facilities.

*Response: GEIS Section 2.7.1 discusses air emissions and applicable control technologies that have been used at ISL facilities. License applicants have the option of selecting among available processing and effluent control technologies. The effluent control and the effluent and environmental monitoring programs discussed in the GEIS Section 2.9 verify that control devices are working as intended and that the facility complies with the applicable NRC standards for radiation protection in 10 CFR Part 20. NRC Regulatory Guide 3.56 describes emission control devices for uranium mills as including bag or fabric filters (e.g., baghouse), and wet scrubbers. Since that guide was developed, vacuum dryer technology that produces significantly reduced particulate emissions has become common at ISL facilities. As discussed in Section 2.7.1 radon releases are limited by use of pressurized processing systems. Because wet scrubber systems were not mentioned in the GEIS, they were added to the discussion of control technologies in Section 2.7.1. In addition, the discussion of vacuum dryer technology in Section 2.7.1 was clarified to note that it significantly reduces particulate emissions from drying operations.*

**Comment: 036-102**
One commenter noted that in GEIS Section 4.2.3.2, treatment of waste waters prior to discharge to evaporation ponds is mentioned, and this is not always done.
*Response: NRC agrees with the comment and has clarified the statement. Treatment of waste waters prior to discharge into evaporation ponds is an option that may be used, for example, to reduce the amount of consumptive water use from processing activities.*

**Comment: 1173-084**
One commenter recommended the GEIS consider the possibility of dust emissions from wind dispersal of solids from a dried up evaporation pond or from land application.

*Response: NRC staff finds the recommended scenarios for dust emission not sufficiently likely to warrant consideration in the GEIS. Evaporation ponds would be maintained in a manner* *where it is unlikely they would be allowed to run dry such that sediments would be blown away by winds. Treated waste water used for land application is routinely sampled for a variety of constituents of concern. Therefore, constituent buildup on soils or vegetation sufficient to threaten public health and safety from wind dispersal to offsite locations also appears unlikely. Because the recommended additions to the GEIS are not necessary for the evaluation of environmental impacts from ISL facilities, no changes were made in response to the comment.*

**Comment: 1321-004; 1321-005; 1321-046**
One commenter suggested the GEIS lacks information on leaks from evaporation ponds. The commenter also requested the GEIS include information on effectiveness of pond liners and clarification of the type of monitoring for evaporation ponds.

*Response: Information on historical evaporation pond leaks is included in 2.11.2. A number of cases are described. These involve, for example, leaks from the upper liner of a double-lined system. Ponds are designed with a leak detection system. When leaks are identified, the ponds are drained, the leak is repaired, and the underdrain system is drained. ISL facilities are required to have sufficient reserve capacity so ponds can be drained for such repairs. GEIS Section 2.7.2 references NRC Regulatory Guide 3.11 (NRC, 2008) for details regarding evaporation pond monitoring programs. These programs include daily documented checks of freeboard and leak detection systems. Leak detection systems are sampled and analyzed for indicator parameters when sufficient water has been collected. If the water analysis indicates a leak, NRC must be notified within 48 hours of this verification and a series of corrective actions are taken by the licensee. As the requested information is already included explicitly or by reference in the GEIS, no changes were made to the GEIS in response to these comments.*

**Comment: 1321-045**
One commenter requested the GEIS include action levels for decontamination of land application areas after disposal of treated effluent. These action levels should allow licensees to survey land to verify that water is sufficiently treated prior to land application.

*Response: GEIS Section 2.6 provides the criterion (10 CFR Part 40, Appendix A, Criterion 6) used for remediation of contaminated soil. This criterion applies to any areas of the site, including those used for land application, where a potential exists for soils to be contaminated with licensed material. Because the information requested is already provided in the GEIS, no changes were made in response to the comment.*

## G5.32.5 Regulation of Wastes and Disposal Methods

**Comment: 036-067**
Regarding a statement in GEIS Section 2.6 suggesting radioactive construction wastes would be considered 11e.(2) byproduct material, one commenter mentioned that the construction wastes such as drill cuttings are TENORM not 11e.(2) byproduct material.

*Response: The statement in Section 2.6 was clarified to convey that all radioactive wastes generated during operations, aquifer restoration, and decommissioning are considered 11e.(2) byproduct material that must be disposed at a licensed facility or otherwise decontaminated to be suitable for release for unrestricted release or to remain onsite following license termination.*

**Comment: 036-073**
One commenter requested NRC clarify that NRC has no authority to approve Class I deep disposal well permits when discussing the deep well injection disposal method in Section 2.7.2.

*Response: In response to the comment, the paragraph was clarified to state that licensees must receive an UIC permit from EPA or the state in order to use deep well injection at a site.*

**Comment: 1173-017**
A commenter recommended NRC reconcile text in Section 1.7.5.1 regarding how the state of Wyoming classifies underground injection wells for ISL fluids (e.g., Class V permits required for injection wells leaching in areas previously mined by older conventional mining and milling) with the text and text box on 1.7.2.1 that suggests all waste and lixiviant injection wells are Class I or III permits.

*Response: NRC received clarification from the WDEQ regarding its classification and permitting of underground injection wells and this information was incorporated into Section 1.7.5.1. This revision clarified that in Wyoming, injection of fluids at an ISL mine unit for uranium production operations requires UIC Class III wells. Injection of ISL waste for disposal underground requires either a Class I or Class V UIC permit.*

**Comment: 050-058; 050-102**
One commenter asked about surface water discharge permits at ISL facilities. The commenter asked whether any past ISL facilities had received surface water discharge permits for produced waters and whether there were any resulting environmental impacts. They also asked why the surface water impacts section considered a Wyoming Pollutant Discharge Elimination System storm water discharge permit without numeric standards appropriate mitigation.

*Response: As discussed in GEIS Chapter 1, EPA, or authorized states, have regulatory authority over the NPDES permit program. EPA, or the authorized state, would determine whether produced waters could be discharged under an NPDES permit and any permit conditions on that discharge. In general, NRC allows licensees to request to treat and discharge liquid wastes to surface water bodies under an NPDES permit if the treated wastes meet applicable NRC effluent requirements. In practice, licensees typically choose other disposal methods, such as those described in Section 2.7.2. Currently, NRC has at least one licensee that has an NPDES permit, but staff is not aware of any that are currently releasing water under an NPDES permit. Regarding the Wyoming Pollutant Discharge Elimination System permit, as stated in Section 4.2.4.1.2, while the permit does not include specific numerical water quality standards, it does include monitoring requirements and specifies that storm water discharge shall not cause pollution, contamination, or degradation of waters of the state. As the comments pertained to topics already discussed in the GEIS, no changes were made in response to the comments.*

**Comment: 1321-036**
One commenter suggested adding a description to the discussion of the NPDES operational permit for any process water discharges to Section 1.7.2.1, because it describes NPDES storm water permits but not other NPDES process water discharge permits.

*Response: In response to the comment, the suggested information was added to Section 1.7.2.1.*

**Comment: 1321-037**
One commenter recommended additional language for the discussion of NPDES-permitting requirements in GEIS Section 2.7.2.

*Response: In response to the comment, the recommended additional language on NPDES permitting requirements was added to GEIS Section 2.7.2.*

### G5.32.6 References

NRC. Regulatory Guide 3.11. "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities." Revision 3. Washington, DC: NRC. November 2008.

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

## G5.33 Decommissioning

**Comment: 1305-072**
Regarding the discussion of decommissioning of ISL facilities in GEIS Section 2.6, one commenter asked whether there were any past instances of wells abandoned and not plugged or abandoned and not plugged using accepted practices. They inquired about potential hazards to surface waters and subsurface waters if a well was abandoned and unplugged or not plugged using accepted practices.

*Response: NRC recognizes in GEIS Section 2.4.1.3 that improperly abandoned exploration wells may lead to excursions of leaching solutions, i.e. lixiviant, beyond the well field boundaries. In Section 2.11.4, NRC notes that some vertical excursions at the Irigaray and Christensen Ranch facilities were believed to be related to improperly abandoned wells from earlier exploratory programs prior to regulation by an Underground Injection Control (UIC) program. Additionally, NRC identifies in GEIS Chapter 4 discussions that wells and well integrity failures could create vertical pathways for excursions.*

*With respect to ISL facility decommissioning, as discussed in Section 2.6, state or other federal agencies regulate well drilling through permit programs. Well drilling permits include conditions requiring application of accepted practices for well plugging. NRC also reviews well plugging and abandonment plans as part of its review of ISL aquifer restoration plans. NRC decommissioning site inspections include visual verification that wells are correctly sealed and abandoned according to plans. Potential problems associated with failure to plug or to adequately plug wells depend on the type of well and the site conditions; however, in general, poorly abandoned wells can provide a pathway for surface contaminants to enter groundwater, present hazards to surface dwelling humans and animals, and, in locations where artesian aquifers exist, present the potential for groundwater to be transported through the well to the ground surface where it can collect or flow into local streams. In turn, GEIS Section 2.6 indicates well plugging protects the water supply and eliminates physical hazards. The permitting and inspection activities limit the potential for problems related to well plugging at NRC-licensed ISL facility sites. In response to this comment, discussion of NRC decommissioning visual inspection of wells was added to Section 2.6.*

**Comment: 1601-007**
One commenter asked whether reclamation was affected by the presence of underground mines. They also noted that the issue needed to be addressed.

*Response: The discussion of land reclamation in GEIS Section 2.6 is focused on ground surface reclamation activities. Underground mines could present specific challenges for surface reclamation, but site areas normally subject to reclamation at an ISL facility (i.e., disturbed operational areas) would most likely not be located in close proximity to underground mines thereby limiting the potential impact of underground mines on reclamation. Any operational underground mines on or near an ISL site would need to be reclaimed in accordance with applicable mining laws. The potential influence of historical abandoned mines on groundwater restoration are discussed in Section G5.22. Because complications to surface reclamation from underground mines are a site-specific issue, no changes were made to the GEIS in response to this comment.*

**Comment: 019-014**
One commenter recommended the decommissioning section should explain how soil gets contaminated with radium from ISL processes.

*Response: The potential for soil to become contaminated with radium is from solutions from extraction wells that could be unintentionally released to soils through spills or leaks. This fluid would contain mobilized uranium as well as daughter products, including radium and other constituents (e.g., metals). The radium is detectable by gamma survey, and all areas where there is a potential for such contamination would be included in decommissioning surveys and cleaned up, as needed, to meet the applicable regulatory criteria at 10 CFR Part 40, Appendix A, Criterion 6(6), prior to terminating the facility license. In response to this comment, the discussion in Section 2.6 on contaminated soils was revised to clarify the origin of the radium in soil.*

**Comment: 019-015**
A commenter noted in GEIS Section 2.6 discussion of decommissioning surveys that gamma monitoring could miss uranium without daughters.

*Response: The commenter is correct that gamma surveys could miss detecting uranium without daughters. The context of the discussion of gamma surveys in the GEIS Section 2.6 is regarding soil contamination surveys of well fields. Soil contamination of well fields at an ISL facility is from leaks and spills of uranium rich lixiviant. This solution containing uranium, having been pumped from the ore body using extraction wells, would include progeny that would be detectable with a gamma instrument. Text in Section 2.6 was clarified to convey that radium from lixiviant would be present and thereby provide additional context for the mention of gamma surveys of well fields.*

**Comment: 1321-006**
A commenter suggested the GEIS include estimates of contaminated soils during decommissioning. The commenter specifically referred to Table 2.6-1 as including information for a single site that does not account for variability among sites ranging in size.

*Response: The commenter is correct that the extent of soil contamination could vary from one site to the next. Nonetheless, the estimates provided in Table 2.6-1 are expected to be appropriate because they are from surety calculations reviewed by NRC staff and they apply to one of the largest ISL facilities that NRC has licensed and therefore are considered to be* *applicable for large sites and bounding for smaller ones. Because the GEIS estimates are considered applicable or bounding for most sites, no changes to the GEIS were made.*

**Comment: 036-065; 036-066**
One commenter recommended the noncontaminated waste estimate of 90 percent discussed in GEIS Section 2.6 is optimistic and should be replaced by types of waste and regulatory classification. This commenter also suggested decommissioning and decontamination wastes from operations must go to an NRC-licensed facility, whereas the GEIS Section 2.6 refers to landfill disposal for materials suitable for unrestricted release.

*Response: Staff checked the cited reference for the 90 percent value and found the basis for the number was not clear therefore, the sentence was deleted. That number was not needed, because more detailed decommissioning waste volume estimates were provided in GEIS Table 2.6-1. The wastes listed in Table 2.6-1 are classified in a manner that is consistent with applicable NRC regulations. Regarding the comment about disposal of wastes at area landfills, the NRC standard review plan for ISL facilties (NRC, 2003) discusses the applicable protocols and criteria for unrestricted release of decommissioning structures, waste materials, and equipment. In response to the comments, the text in Section 2.6 was revised to clarify that the byproduct wastes represent 11e.(2) byproduct material for NRC licensed disposal and solid waste includes material for unrestricted release. Additional text was also added to Section 2.6 to clarify the survey and segregation of materials into categories for unrestricted release and for disposal as byproduct wastes.*

**Comment: 050-073; 1319-007; HC009-004; HC009-009**
Commenters requested clarification of reclamation standards for ISL sites in GEIS Sections 2.6 including consequences of not meeting goals and under what conditions a reclaimed site would not be suitable for wildlife and other uses. One requested a performance-based approach with measurable standards. Another commenter requested clarification of the statement in Section 2.6 regarding reclamation to return land to "production or to planned postoperational land use." Another recommended timely reclamation, mitigation, and weed control is needed. One noted local limitations for restoring vegetative cover based on climate and requested the GEIS describe what type of cover would be used for each milling region.

*Response: As stated in GEIS Section 2.6, NRC reviews and approves licensee-submitted surface reclamation plans for ISL facilities. These plans should include contour maps of the land prior to construction, and applicants are expected to identify any features that cannot be restored to preconstruction condition (NRC, 2003). It is common for local vegetation to be used to ensure reclaimed lands blend with surroundings. Establishing specific vegetative cover recommendations is beyond the scope of the GEIS because such details are site-specific. Other federal, state, and local agencies may add requirements on facilities for restoring lands depending on the specific location of the facility and the jurisdictions that apply. Applicants are required to include general reclamation plans in their license applications. NRC site-specific review and consultations with other agencies would clarify whether specific additional surface reclamation requirements apply. Consequences of not completing timely reclamation include delay in terminating the NRC license and possible license violations. The statement in the GEIS about reclaimed lands normally supporting wildlife is so qualified because not all sites or portions of sites are reclaimed to the complete natural state (e.g., because the site may be used for other planned development). In response to the comment, the statement on returning land to production was clarified to convey that land would be returned to near preconstruction conditions or to planned postoperational land use. Planned postoperational land uses would be,* *for example, using a site for a subsequent land development that may have different reclamation needs as opposed to a site that was expected to be returned to undisturbed conditions.*

### G5.33.1 References

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

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

## G5.34 Cumulative Effects

### G5.34.1 General Comment: GEIS Does Not Adequately Address Cumulative Effects

**Comment: 050-031; 050-127; 050-129; 059-019; 057-004; 059-017; 059-020; 1302-002; 1305-003; 1305-106; 1315-105; 1319-003; 1319-013; 1314-003; 1314-026; 1314-030; AL20-076; AL27-134; HC010-006; NE06-005; NE06-011**
Multiple commenters stated that the GEIS fails to address or inadequately addresses cumulative impacts. Some commenters identified a need for site-specific analysis. Others commented that the cumulative impacts section of the GEIS does not constitute a "hard look." Another commenter stated that documents cited in Section 5 are either not relevant or are insufficient in characterizing federal resources in question.

*Response: NRC has prepared the GEIS to identify and evaluate potential environmental impacts associated with ISL uranium recovery facilities, specific locations of which have not been determined but could be located in portions of Wyoming, Nebraska, South Dakota, and New Mexico. GEIS Section 1.1 explains that in its review of individual ISL license applications, the NRC staff would evaluate the site-specific data to determine whether relevant sections of the GEIS could be incorporated by reference into the site-specific environmental review. The cumulative impacts section of the GEIS presents an approach to conducting site-specific reviews and was not intended to represent a site-specific cumulative impacts analysis. The cumulative effects chapter includes discussions by region for concurrent actions as well as a section on approaches to conducting a site-specific cumulative effects analysis by region. The documents cited in GEIS Chapter 5 were included to identify activities in the regions that a site-specific review should consider. Because the comments generally referred to the lack of a detailed cumulative impacts analysis (which would be prepared during the site-specific review), no changes were made to the GEIS beyond the information provided in this response.*

### G5.34.2 Past, Present, and Reasonably Foreseeable Actions

**Comment: 015-031; 048-003; 050-035; 050-128; 059-020; 963-006; 1173-066; 1300-014; 1305-085; 1314-021; 1314-025; 1314-027; 1314-028; AL14-037; AL16-055; GA23-008; GR14-009; HC010-014; NE04-004 (pp. 60 and 78); NE06-014; NE08-001**
Commenters stated that the cumulative impacts analysis does not address impacts from activities including the following: past milling activities, other industries, historic mining and milling in general, exploratory wells, aquifer changes from varied sources, radiological impacts from past activities, Mobil Section 9 Pilot project or 250 abandoned mines, increased energy development, exploration, nuclear power, fuel cycle, climate, CBM impacts in the

Powder River Basin, and other activities impacting groundwater. Other commenters stated that the GEIS does not address reasonably foreseeable actions in general. One commenter noted that information about the capacities of the Anaconda Bluewater Mill, SOHIO Mill at Cobolleta, and the Mobil Section 9 Pilot project in Crown Point are not disclosed in Table 5.2-1.

*Response: The GEIS notes that direct, indirect, and cumulative effects from ISL facilities as well as other past, present, and RFFA within the four regions may affect groundwater, surface water, ecology, historic/cultural resources, and environmental justice. Possible past, present, and RFFA in the site-specific review will be identified, and impacts will be analyzed. GEIS Section 5.4 discusses approaches to conducting a site-specific cumulative effects analysis, including discussion on multiple resources to be reviewed during that process.*

*For consistency, past actions included in GEIS Tables 5.2-2 through 5.2-6 were selected from draft/final EISs recorded in the EPA's EIS database for a specific timeframe. Other past, present, and RFFA that may not have resulted from the EIS database would be evaluated during the site-specific review for specific ISL facilities proposed in any of the four regions. In response to the comment on Table 5.2-1, NRC conducted an additional review of available information on past, existing, and proposed uranium recovery sites in the four milling regions. Table 5.2-1 was then revised to include additional sites and update the information on potential or actual proposed new sites.*

### G5.34.3 Specific Document Changes or Action Requests

**Comment: 050-131; 050-132; 050-133; 1173-108; 1173-109; 1173-110; 1173-111; 1173-112; 1173-113; 1173-114; 1173-115; 1173-116; 1173-117**
Two commenters requested adding specific EISs to Tables 5.2-2 and 5.2-3. Other comments suggested editorial changes to Tables 5.3-1, 5.3-2, 5.3-3, and 5.3-4 (e.g., mine names, county designations, addition of a cultural resource site). A commenter requested that Page 5-8, Table 5.2-3 be updated to include the EIS for South Gillette Area Coal Lease Applications. Another commenter requested that Section 5 consider information regarding Dry Fork Station (draft EIS withdrawn), Casper BLM EIS, updates to West Antelope Coal Lease Application, and Powder River Oil and Gas EIS (pre-2005). Commenters also requested addition of wind projects and transmission lines to Table 5.3-1, as well as new coal plants in Campbell County. One commenter requested that NRC verify data contained in Table 5.3-2 with WDEQ and BLM. One commenter requested that Page 5-18, Lines 6–8, list total coal production of mines in the Wyoming part of the Powder River Basin in and adjacent to the Wyoming East Uranium Milling Region.

*Response: Tables included in Chapter 5 are not intended to provide an exhaustive list of projects occurring in the four regions, but rather to identify representative project types that could be evaluated during a site-specific review. Other projects are not included in the GEIS, but will be identified during site-specific evaluation for cumulative effects. In response to specific change requests (e.g., mine names, county designations), changes to Tables 5.3-1, 5.3-2, and 5.3-3 were made. Table 5.2-3 was updated to include the South Gillette Area Coal Lease Applications. In response to a request to verify table data with WDEQ and BLM, both agencies have reviewed the GEIS and submitted comments based on their review of the GEIS. Regarding the request to cite total coal production of mines in the Wyoming part of the Powder River Basin, these data were not provided by the commenter or identified in desktop research.*

### G5.34.4 Significance

**Comment: 050-018**
A commenter questioned how NRC will determine whether cumulative impacts are significant.

*Response: As part of the site-specific environmental review described in GEIS Section 1.7, NRC staff will conduct site-specific cumulative impact assessments for specific ISL facility proposals. The guidance document, NUREG–1748 (NRC, 2003), discusses significance evaluations in Section 3.4.6.3. This section discusses consideration of context and intensity in determining significance of impacts. "Context means that consideration should be given to what the impacts are, where they will occur, how long they will last, what population or resource is affected, and the carrying capacity of the affected environment. Intensity refers to the impact severity, and can be addressed by a number of criteria delineated in 40 CFR 1508.27."*

### G5.34.5 Other

**Comment: NE04-005**
The commenter was concerned about how barium, if it is used for ISL activities, will be kept out of his livestock water.

*Response: This commenter incorrectly thought barium should be addressed, but it is from CBM facilities and is not an ISL activity product. Because this comment is not related to topics covered in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 050-002**
One commenter stated that the ISL activities in the four identified geographic regions (Wyoming East, Wyoming West, South Dakota-Nebraska-Wyoming, and Northwestern New Mexico) should be considered together as one programmatic action. The commenter is concerned that the combined and cumulative impacts will be compounded in the "close geographic areas" and requested additional description of those cumulative impacts be included in Section 4.2.2.

*Response: Cumulative impacts (effects) were one of the topical areas addressed in three public scoping meetings related to this GEIS (Appendix A). GEIS Chapter 5 addresses cumulative impacts from proposed ISL facility construction, operation, groundwater restoration, and decommissioning on all aspects of the affected environment, considering the impacts from past, present, and RFFA in the uranium milling regions. Due to the complex and site-specific nature of a cumulative impact assessment, this GEIS provides useful information in Chapter 5 for understanding the potential for cumulative impacts when licensing future ISL facilities in the milling regions, but does not make conclusions regarding cumulative impacts for specific regions. In conducting a site-specific cumulative effects analysis, an approach such as CEQ (CEQ, 1997) 11-step process described in Appendix F 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. The NRC staff has determined that a Cumulative Impact Analysis is outside the scope of this GEIS and, as discussed in Section 1.8.3, it will perform site-specific evaluations where detailed cumulative impacts will be addressed. Because the comment made has been considered by the NRC staff and addressed in Chapter 5, no changes were made to the GEIS beyond the information provided in this response.*

### G.5.34.6 References

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

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

## G5.35 Environmental Justice

**Comment: CH06-009; GA01-001; GA10-002; GR16-001**
Commenters expressed concerns about environmental justice. Comments were made about health impacts related to environmental justice populations and overall impacts to low-income and minority populations. A comment was also made that environmental justice language was absent from the GEIS. Another commenter questioned impacts to any group or population.

*Response: The GEIS evaluated impacts to all populations, while the environmental justice analysis focuses on disproportionate impacts to low-income and minority populations. As stated in GEIS Section 6.1, the NRC staff uses NUREG–1748 guidance for assessing environmental justice (NRC, 2003). NUREG–1748 guidance uses Executive Order 12898, which describes environmental justice analysis as "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." The NRC staff evaluated environmental justice in the GEIS using NUREG–1748 guidance and potential disproportionate impacts to low income/minority populations. Environmental justice will be further evaluated as part of the NRC site-specific environmental review of each facility on a case-by-case basis. Specifically, the NRC staff analysis will consider where site-specific demographic information may identify significant impacts that would not otherwise be considered (as discussed in GEIS Section 6.1). If environmental-justice-related concerns arise, these will be analyzed using the guidance in NUREG–1748. Resource areas (health, socioeconomic, physical, and cultural) will be analyzed for disproportionately high and adverse effects to low-income and minority populations. Because the comments were related to site-specific review and information already provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1318-003; AL01-133; AL24-098; GA07-005**
One comment concerned legacy impacts to indigenous peoples and that the GEIS does not address environmental racism in Chapter 6. Another commenter mentioned the people who will be impacted by *in-situ* uranium milling are people who are already having a rough time. One commenter expressed the view that the NRC fails to recognize the impacts of past uranium mining and milling operations on the Navajo Nation, which implicates the NRC's trust duty to the Navajo Nation. Another commenter referred to unfair treatment of Navajo people who served in Vietnam and lack of compensation that implied ISL milling would represent a continuation of such unfair treatment.

*Response: The GEIS environmental justice analysis focuses on potential disproportionate impacts to low-income and minority populations. Environmental justice will be further evaluated on a case-by-case basis as part of the NRC site-specific environmental review of each facility. As part of this evaluation, the NRC staff will consider site-specific demographic information that may identify significant impacts that would not otherwise be considered (as discussed in GEIS*

*Section 6.1). If environmental-justice-related concerns arise, these will be analyzed using the aforementioned guidance.*

*NRC understands and recognizes there are serious legacy issues resulting from the decades of mining activities from the 1940s through the 1970s when waste from uranium mines was not cleaned up after mines were shut down. Many of these abandoned sites are on or near Native American lands. Additional text has been added to the GEIS Chapter 5 to clarify that abandoned uranium mining and milling sites and related environmental contamination and/or underground workings may need to be considered in site-specific cumulative impact assessments to the degree they are found on or near proposed ISL sites and their region of influence on the environment overlaps with that of the proposed ISL facility. Additional responses to comments regarding the history and legacy of uranium mining are provided in Section G5.17.*

*NRC's interaction with tribal governments is guided by the provisions contained in Executive Order 13175, Consultation and Coordination With Indian Tribal Governments, issued by President Clinton on November 6, 2000. As an independent regulatory agency, NRC is not bound by the provisions of the Executive Order but has adopted practices that are consistent with the fundamental principles contained in the Executive Order. To meet these objectives, NRC routinely consults with tribal governments that have a known interest in, or may be potentially affected by, NRC's regulatory actions. These activities include government-to-government meetings and public meetings near tribal areas regarding the development of this GEIS and discussion of other uranium recovery activities in the area. NRC has also developed a report (NRC, 2009) explaining potential involvement for tribal governments in the NRC licensing and NEPA process.*

*Because the comments (other than history and legacy) were general in nature or related to information that would be considered in the site-specific review or that is already addressed in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 012-003; 028-005; CH10-009; CH11-006; GA05-006; GA13-002**
Several commenters expressed concerns about the proximity of uranium mining to Native American land. Comments were made that the locations of uranium mining are sited where Native Americans cannot stop it and that Native Americans will be impacted. Another comment was made that local tribal people will have to leave or face effects of radioactive contamination because the legacy is well documented. A comment was made concerning the proximity of the Crownpoint processing plant to the community and its disproportionate effects relating to the commenter's spiritual beliefs. A comment was also made that ISL companies do not choose where ore bodies are located and that NRC should consider this when preparing its environmental justice review.

*Response: Locations for potential ISL facilities are determined by ISL companies and are based on the presence of uranium ore bodies. The NRC staff is not responsible for siting locations. However, as part of the site-specific environmental review, under NEPA, the NRC staff can evaluate alternative facility locations if determined necessary. The NRC staff would hold consultations with Native American groups as part of the National Historic Preservation Act Section 106 historical and cultural process during site-specific analysis. Concerns associated with facility locations or their proximity to reservation land will be addressed during the consultation period. The scope of the GEIS with respect to legacy impacts is discussed in GEIS Section 1.5. Because the comments were related to site-specific review and information* *already provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: CH06-016**
A comment was made that the environmental justice analysis did not review impacts to Oglala people.

*Response: As discussed in GEIS Sections 3.4.10, 6.1, and 6.4, the NRC staff analyzed environmental justice for potential impacts to Oglala people (Pine Ridge Indian Reservation). Environmental justice will be further evaluated as part of the NRC site-specific environmental review. The NRC staff will hold consultations with parties of demonstrated interest (for example, SHPO, Native American groups, local governments, and additional groups as necessary) as part of the National Historic Preservation Act Section 106 historical and cultural process during site-specific review. Because the comment was related to information already provided and site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1314-020; AL01-002; AL22-089**
One commenter expressed the view that a site-specific EIS is needed for an environmental justice analysis. Another commenter questioned how environmental justice is addressed in ISL licensing. One commenter recommended NRC exercise caution in implementing environmental justice and listen to all concerns.

*Response: The NRC staff will further evaluate environmental justice on a case-by-case basis as part of the NRC site-specific environmental review of each facility. In response to other comments, NRC has determined that its environmental reviews for each new ISL license application will result in the preparation of a site-specific environmental impact statement that supplements the GEIS. This determination was based on the need to defer some impact analysis to the site-specific environmental review (including environmental justice analyses). For its environmental reviews of applications to renew or amend existing ISL licenses, NRC will prepare either a site-specific environmental assessment or environmental impact statement, consistent with NRC's process for making that determination as described in GEIS Section 1.7.1.*

*The NRC staff will also determine the necessary level of environmental review for a specific facility using the guidance in NUREG–1748. If the NRC staff identify site-specific environmental-justice-related concerns, these will be analyzed using the aforementioned guidance. Resource areas (health, socioeconomic, physical, and cultural) will be analyzed for disproportionately high and adverse effects to low-income and minority populations. As appropriate, a public comment period and public meetings would be provided to enhance public participation. Environmental justice evaluations would be made available through the NRC website and ADAMS. Furthermore, the NRC staff will hold consultations with parties of demonstrated interest (for example, SHPO, Native American groups, local governments, and additional groups as necessary) as part of the National Historic Preservation Act Section 106 historical and cultural process during site-specific review. In response to these and other comments, NRC has clarified the sections of the GEIS Chapter 1 that discuss the purpose and need for the GEIS and the use of the GEIS in the NRC licensing process.*

**Comment: 036-116; 036-118; 061-027**
The commenter agreed with the GEIS's use of census data for environmental justice

They mentioned the 80-km [50-mi] radius used for socioeconomic data was not justified based on localized ISL impacts and that a 6.4-km [4-mi] radius would have been sufficient. Another commenter mentioned the 6.4-km [4-mi] radius used for socioeconomic data is too short due to the distance traveled by airborne particles and possible surface and groundwater contamination.

*Response: As stated in GEIS Section 6.1, the NRC staff uses NUREG–1748 guidance for assessing potential environmental justice concerns. In this guidance, a 6.4-km [4-mi] radius is recommended for most rural areas; however, the NRC final policy notes that the distances are intended as guidelines, not requirements. As stated in GEIS Section 6.1, the NRC staff chose an 80-km [50-mi] radius because workers employed by ISL facilities can travel long distances. NRC guidance in NUREG–1748 does allow different radii for site-specific review, which will be evaluated in the NRC site-specific environmental review. Potential impacts to groundwater are discussed in GEIS Sections 4.2.4, 4.3.4, 4.4.4, and 4.5.4, and impacts to air quality are described in GEIS Sections 4.2.6, 4.3.6, 4.4.6, and 4.5.6. Public comments and responses regarding groundwater and air impacts are discussed in Sections G5.22 and G5.26, respectively. In general, a number of measures are taken by ISL licensees to control process solutions including well field balance, well field monitoring, and local well monitoring outside the well fields. As a result, groundwater impacts far beyond the location of ISL operations are not expected. Similarly, air monitoring at the boundary of the facility is expected to be sufficient to detect air effluent concentrations that exceed NRC limits at 10 CFR Part 20. Because the comments were related to information already provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: GR16-003**
A comment was made that the environmental justice analysis needed public participation and requested information on when and where the public participation happened.

*Response: Public participation opportunities have been provided for GEIS scoping and commenting on the Draft GEIS. These are discussed at the beginning of this Appendix in Section G2. Environmental justice will also be evaluated as part of the NRC site-specific environmental review, using the guidance in NUREG–1748 (NRC, 2003). As appropriate, a public comment period and public meetings would be provided to enhance public participation. Furthermore, the NRC staff will hold consultations with parties of demonstrated interest (for example, the SHPO, Native American groups, local governments, and additional groups as necessary) as part of the National Historic Preservation Act Section 106 historical and cultural process during site-specific review. Because the comment was related to site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 011-005; 011-006; 011-007**
One commenter expressed a number of concerns regarding the GEIS environmental justice analysis including that it did not address long-term economies, influx of workers, and lack of worker housing causing wages to be spent elsewhere. The commenter also suggested the GEIS environmental justice analysis did not address impacts to culture and traditions. The commenter claimed the environmental justice approach was weak and that Native Americans do not accept trade-off of dollars for human values.

*Response: As discussed in GEIS Chapter 6, the environmental justice analysis uses the impact analyses and conclusions from GEIS Chapter 4. The objective of the impact analyses, whether in Chapter 4 or Chapter 6, was to evaluate potential impacts. There was no intent to make value judgments about the acceptability of the identified impacts. The Chapter 4 impact analyses for potential socioeconomic impacts address local economic impacts including influx of workers and* *lack of available housing. These analyses evaluated reasonably foreseeable potential environmental impacts whether they were applicable to the present timeframe or the future. More detailed socioeconomic impact assessments could be conducted during the site-specific environmental review if NRC staff evaluation of site-specific conditions found that additional analyses were needed to adequately evaluate potential environmental impacts.*

*Historic and cultural impact analyses are also included in GEIS Sections 4.2.8, 4.3.8, 4.4.8, and 4.5.8, and a variety of cultural and traditional practices that could be impacted by ISL facilities are discussed in the environmental justice analyses in Chapter 6. This includes consumption of native plants, animals, and fish; ceremonial use of land; grazing and foraging activities; and traditional landscapes. The GEIS environmental justice analysis concludes that the site-specific nature of the historic and cultural impacts requires additional site-specific information to complete the impact analysis. That additional information would be evaluated during the NRC site-specific environmental review. Because the comments were related to site-specific review and information already provided, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-117; 036-119; 036-121**
One commenter expressed the view that public and occupational health is not necessary to assess in regard to environmental justice matters, because impacts are considered low. The commenter also stated that radiological impacts are low for every population and do not need to be included in a site-specific environmental justice review. The commenter expressed agreement with the GEIS approach regarding no significant impacts for resource areas equals no disproportionate impacts in the environmental justice analysis.

*Response: While most of the public and occupational impact conclusions in the GEIS are SMALL as suggested by the commenter, potential impacts were characterized as MODERATE for certain accident scenarios evaluated for workers. Environmental justice will be further evaluated as part of the NRC site-specific environmental review of each facility 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 (as discussed in GEIS Section 6.1). Because the comments were based on an incomplete consideration of the impact conclusions in the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 036-120**
A comment was made that environmental justice land use issues in regard to the checkerboard region of New Mexico are incorrect because ISL facility locations are determined by the location of ore bodies.

*Response: The NRC plans to evaluate potential environmental justice concerns as part of the NRC site-specific environmental review of each ISL facility. The location of ore bodies could affect a decision on whether to proceed with a site-specific environmental justice analysis, if the ore bodies and therefore the ISL facility are located in an area that includes no low-income or minority populations within the radius of influence for potential impacts (GEIS Chapter 6). The GEIS analysis shows that such populations exist in the vicinity of the area described by the commenter, and therefore an environmental justice analysis is indicated. As this information is already included in the GEIS, no changes were made in response to the comment.*

**Comment: 1318-005**
A comment was made that the GEIS does not adequately address environmental justice issues for the Navajo Nation.

*Response: The GEIS environmental justice analysis for the Northwestern New Mexico Uranium Milling Region (Section 6.5) concludes that additional site-specific information is needed regarding, for example, historic and cultural resources to complete the analysis. This additional information is expected to be obtained during the site-specific environmental review. During that review, for ISL applications in that milling region, the NRC staff will hold government-to-government consultations with the Navajo Nation as part of the Section 106 historical and cultural process during site-specific analysis. Potential environmental-justice-related concerns will be addressed during the consultation period. The NRC staff will further evaluate potential environmental justice on a case-by-case basis as part of the NRC site-specific environmental review of each facility. As part of these reviews, the NRC staff would evaluate site-specific demographic information that may identify significant impacts that would not otherwise be considered (as discussed in GEIS Section 6.1). Legacy impacts will also be further evaluated in the NRC site-specific environmental review, and cumulative impacts would be assessed as appropriate. Because the comment was related to site-specific review, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1173-060**
A comment was made questioning high population data for Native Hawaiians as an error for Cibola County.

*Response: The number of Native Hawaiians and other Pacific Islanders for Cibola County was correctly stated as 14, but the percentage was incorrectly shown. In response to this comment, GEIS Table 3.5-16 has been revised to show the percentage of Native Hawaiians in Cibola County to be 0.1 percent.*

### G5.35.1 References

NRC. "U.S. Nuclear Regulatory Commission Strategy for Outreach and Communication With Indian Tribes Potentially Affected by Uranium Recovery Sites." 2008. <http://www.nrc.gov/materials/uranium-recovery.html> 16 February 2009.

NRC. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register:* Vol. 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.

## G5.36 Best Management Practices

### G5.36.1 Enforcement of Mitigation Measures and Best Management Practices

**Comment: 018-009; 036-122; 050-027; 963-010; 1173-118; 1321-040; AL14-039**
A number of comments questioned the extent to which mitigation measures and best management practices identified in GEIS Chapter 7 should be required. One commenter thought the best management practices should be adopted because we could not afford not to. Several commenters stated that the NRC should have enforceable, not voluntary, mitigation

measures. Another commenter thought restrictions should be placed on how close an ISL facility can be located to drinking-water sources. One commenter indicated that the discussion of mitigation measures in the GEIS should include references to EPA and state requirements. One commenter requested that the discussion be revised to clarify whether there will be standard license conditions imposed by NRC. This commenter also requested clarification as to whether NRC endorses certain of the potential best management practices and management actions identified in GEIS Table 7.4-1. Finally, one commenter requested that the GEIS use industry standard terms and provide clarification with respect to how NRC uses license conditions to supplement regulations.

*Response: As described in Section 7.4, the intent of Chapter 7 is to provide a general overview of the types of best management practices, mitigation measures, and management actions that have been used historically at ISL facilities to avoid or reduce potential environmental impacts. This overview will then provide a foundation for developing customized management and mitigation plans for a proposed facility or project. As explained in GEIS Section 7.3, these types of practices may be, but are not always, imposed through conditions on the NRC license or as requirements established by other agencies through permits that ISL facilities must obtain (see GEIS, Sections 1.6 and 1.7). NRC establishes license conditions for each individual ISL facility on a site-specific basis. NRC can only establish license conditions within the limits of the authority granted by Congress. State and other federal agencies can also establish permit conditions for individual ISL facilities based on their statutory and regulatory authorities.*

*When a license is granted, the facility is then routinely inspected by NRC staff and by other state and federal agencies for compliance with their respective requirements and conditions. If any violations of NRC requirements or license conditions are identified in NRC inspections, NRC may issue a written notice of violation and, in certain circumstances, can require payment of a civil penalty, injunctive relief or corrective actions. Specific aspects of inspection and enforcement of the terms and conditions of an NRC license for an ISL facility can only be addressed at the site-specific levels, and each enforcement action depends on the circumstances of the case. As stated in GEIS Section 7.4, the listing in Table 7.4-1 is not comprehensive, nor does it imply any NRC endorsement of the different practices, actions, or measures listed. In response to these comments, the text of GEIS Section 7.3 has been revised to clarify the roles of inspection and enforcement in the NRC oversight of ISL facilities, and to include cross-references to the discussion of licensing and permitting in GEIS Sections 1.6 and 1.7.*

### G5.36.2 Completeness of the Mitigation Measures and Best Management Practices

**Comment: 036-123; 1173-020; 1173-021; 1173-071; 1173-119; 1319-003; 1321-013; GA16-007; HC010-002; HC011-005**
Several commenters thought NRC should add items to the summary of best management practices and management actions provided in GEIS Table 7.4-1. Some of these statements were general concerns about the completeness of the listing, and other commenters proposed specific additions to the summary listing. For example, one commenter asked specific questions requesting clarification on best management practices for drilling wells through aquifers that furnish drinking water, stabilization and reclamation activities associated with buried pipelines, spill and leak detection and response, and surface water management issues related to runoff and sedimentation. The same commenter also identified an alternative practice involving respreading topsoil over disturbed areas, as opposed to stockpiling soils for later

reclamation activities. Two commenters identified the use of fine mesh screens over evaporation ponds to minimize mosquitoes and potential impacts to water fowl. Similarly, another commenter noted that GEIS Chapter 7 should include mitigation measures for potential chemical and trapping hazards to wildlife associated with evaporation ponds. One commenter noted that NRC should develop and implement a generic dust mitigation plan for ISL facilities. Finally, one commenter noted that Table 7.4-1 should include the reduction in potential impacts associated with using downflow pressurized ion exchange columns in the processing circuit.

*Response: As described in Section 7.4, the intent of GEIS Chapter 7 is to provide a general overview of the types of best management practices, mitigation measures, and management actions that have been used historically at ISL facilities to avoid or reduce potential environmental impacts. The list in Table 7.4-1 is not intended to be comprehensive, nor does it imply any endorsement of particular measures. It is beyond the intended scope of the GEIS to identify specific practices, actions, and measures that are appropriate for each site. As noted in GEIS Section 7.4, 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 or may not apply to a specific project. During the site-specific safety and environmental review process, the NRC staff evaluates proposed safety and monitoring programs (see GEIS Chapter 8), and identifies practices, actions, and measures necessary to protect public health and safety and the environment based on circumstances relevant to the site in question. If these practices are established as NRC license conditions, they would become the subject of the NRC inspection and oversight of the facility. Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

### G5.36.3 General Comments Related to Best Management Practices and Mitigation Measures

**Comment: 050-074; 1173-120; HC010-003**
One commenter noted that each final site-specific analysis should address the issue of permanent standing water during the decommissioning stage (e.g., as potential source of wildlife exposure and mosquito propagation). Another commenter asked about extended periods of excursion status for some wells, and requested reasons for the frequency and length of excursions, spill frequency, and mitigation measures. One commenter requested that NRC revise the list of practices, actions, and measures in GEIS Table 7.4-1 to identify which reclamation guidelines are to be used with respect to surface water resources.

*Response: The NRC staff agrees that potential issues such as the creation of surface conditions where standing water can collect during decommissioning should be assessed during the site-specific review of decommissioning plans (Section 2.6), if a potential for creating such conditions exists at the site and a potential for environmental impacts is identified. As described in GEIS Section 2.6, decommissioning and reclamation of an ISL facility cannot begin until the NRC staff reviews and approves a decommissioning plan. The licensee must also have NRC-approved procedures in place to respond to inadvertent spills and leaks (see GEIS Section 2.11.2). The NRC describes excursions and excursion monitoring in GEIS Section 2.4 The details of the types of environmental monitoring programs used by licensees to detect and respond to lixiviant excursions are presented in GEIS Section 8.3.1, and additional information is available in NRC guidance in NUREG–1569, Section 5.7.8 (NRC, 2003). Information on historical excursions is summarized in Section 2.11.4. The cause, extent, and duration of* *excursions depend on the circumstances associated with a specific well and aquifer system. As described in Chapter 2 of the GEIS, the NRC staff will establish specific requirements and license conditions related to excursions (e.g., monitoring parameters, monitoring well spacing, reporting requirements) on a case-by-case basis as part of the site-specific safety and environmental reviews. Based on the discussion already presented in the GEIS, and because the focus of these comments is on a site-specific level of detail that is beyond the intended scope of the GEIS, no additional changes were made to the GEIS beyond the information provided in this response.*

*As related to surface water resources, the listing in Table 7.4-1 includes a nonspecific reference to reclamation guidelines in and near floodplains. Other applicable federal and state agencies' reclamation requirements and guidance would also apply to ISL facilities. As described in GEIS Section 7.4, the intent of Chapter 7 is to provide a general overview of the types of best management practices, mitigation measures, and management actions that have been used historically at ISL facilities to avoid or reduce potential environmental impacts. The list in Table 7.4-1 is not intended to be comprehensive, nor does it imply any endorsement of particular measures. As part of its site-specific review for a given facility, the NRC staff would review reclamation plans proposed by the licensee. The text in Table 7.4-1 has been revised to be consistent with the intent of Chapter 7.*

### G5.36.4 References

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

## G5.37 Monitoring

**Comment: NE03-002**
A commenter expressed a concern about what gets released into the air and what steps were being taken to take care of the releases.

*Response: GEIS Section 8.2.1 discusses the airborne radiation monitoring program. NRC Regulatory Guide 4.14 (NRC, 1980) addresses how monitoring should be done, and this document is referenced in GEIS Section 8.2.1. Monitoring should be performed for radon and particulates at a variety of locations near the facility and other specified locations at the permit boundary. GEIS Section 2.4.2.3 also discusses measures taken to limit particulates that enter the air. Because the comment was about information already covered, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 010-003**
One commenter recommended a gamma monitoring program to be added to the airborne radiation monitoring program.

*Response: NRC staff agrees that GEIS Section 8.2, Radiological Monitoring, should include direct radiation monitoring as an element of the environmental monitoring program. Regulatory Guide 4.14 (NRC, 1980) indicates that direct radiation monitoring should be performed. The Regulatory Guide 4.14 provides methods that are acceptable to NRC staff for the conduct of an environmental monitoring program. NRC has revised Section 8.2 to include discussion of direct radiation or gamma monitoring.*

**Comment: 1314-057; 1319-008; HC019-002**
Some commenters suggested long-term monitoring was needed. One commenter wanted to ensure monitoring would occur throughout the life of these projects. Another commenter thought long-term monitoring was needed because of a claim that the ISL industry cannot restore groundwaters, noting irrevocable changes to the aquifer's geochemistry from the injection of the lixiviant. Another commenter thought all aquifers that have the potential to be contaminated should be actively sampled throughout the process.

*Response: GEIS Section 8 discusses the monitoring activities. Monitoring programs are established 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 during operations, aquifer restoration, and decommissioning of an ISL facility (i.e., for the entire life cycle of the facility that is regulated by NRC). Also, as discussed in Section 4.2.4.2.2.2, in order for ISL operations to occur, the uranium-bearing production aquifer must be exempted from being an underground source of drinking water. Following the end of uranium recovery in a well field, the licensee is required to return well field water quality parameters to the standards in 10 CFR 40, Appendix A, Criterion 5(B)(5) or another standard approved by NRC (NRC, 2009). As described in NUREG–1569 (NRC, 2003), a postreclamation stability monitoring program must be described in aquifer restoration plans submitted to NRC for review and approval. Postreclamation stability monitoring is done to ensure that chemical species of concern do not increase in concentration subsequent to restoration. In response to this comment, the reference for NUREG–1569 was included in GEIS Section 2.5 as a source for additional information on groundwater restoration guidance and practices.*

**Comment: 1321-035**
One commenter requested the GEIS should clearly describe the groundwater monitoring program and define the responsibility for monitoring.

*Response: GEIS Section 8.3.1 describes groundwater monitoring and lists several guidance documents that are appropriate for groundwater monitoring. Because the comment was about information already covered, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 1321-047**
A commenter requested the GEIS should describe the requirements for Rn-222 monitoring and specifically the type of monitors used for that purpose.

*Response: GEIS Section 8.2.1 discusses the airborne radiation monitoring program. NRC Regulatory Guide 4.14 (NRC, 1980) addresses how monitoring should be done. Monitoring should be performed for radon and particulates at a variety of locations near the facility and other specified locations at the permit boundary. Providing information on specific types of monitors is beyond the intent and scope of the GEIS. The NRC safety review of an ISL license application and routine inspection of licensed facilities verify that proper monitoring equipment is installed and in working order at operating facilities to ensure compliance with NRC safety regulations. Because the comment was about information already covered by the GEIS or addressed in NRC safety reviews, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: HC019-007**
This commenter requested all sampling locations should be sampled no less than every 15 operational days of an *in-situ* mining operation.

*Response: GEIS Section 8 discusses the monitoring activities. Monitoring programs are established 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. The monitoring section refers to guidance for sampling, which also includes frequency. These frequencies could be adjusted in response to issues/concerns at the site. Because the comment was about information already covered or outside the scope of the GEIS, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: 034-008**
This commenter expressed that monitoring aquatic communities during operations could determine relative health of nearby waterbodies. They also thought the sensitivity of aquatic communities should be described as well as the use of aquatic criteria to measure project impacts. Specifically, the commenter indicated that aquatic criteria such as distribution and abundance should be assessed.

*Response: Ecological monitoring is discussed in GEIS Section 8.4. That section mentions that ecological monitoring can include surveys of habitat, species counts, or other measures of the health of endangered, threatened, and sensitive species. Specific survey requirements are established through consultations with federal agencies such as the U.S. Fish and Wildlife Service or state agencies such as WDEQ or the New Mexico Environment Department. Ecological monitoring (including that of aquatic communities, as appropriate) is based on site-specific conditions, and consultations that might lead to the development of ecological monitoring programs at ISL facilities are conducted during the NRC site-specific environmental review. Regulatory Guide 4.14 (NRC, 1980) provides some guidance on monitoring of surface water bodies and fishes. Because ecological monitoring is already discussed in the GEIS and details of the monitoring programs must be developed based on site-specific considerations, no changes were made to the GEIS beyond the information provided in this response.*

**Comment: HC019-008**
This commenter stated that land owners, mining companies, and government agencies should have access to the water sampling information upon written request to the testing company.

*Response: NRC regulations stipulate that licensees must submit the results of certain monitoring activities, which may include some water sampling information, for the purposes of estimating potential radiation doses to the public from facility operations. Reports submitted to NRC are made available for public inspection in NRC public document rooms and through ADAMS. Additionally, other federal and state agencies may make data submitted to them publicly available. Because the comment was addressed in the above response, no changes were made to the GEIS beyond the information provided in this response.*

## G5.37.1 References

NRC. "Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New uranium Recovery Facilities and (2) The Restoration of Groundwater at Licensed Uranium In Situ Recovery Facilities." Regulatory Information Summary 2009-05. ADAMS Accession No. ML083510622. NRC. April 29, 2009.

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

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

## G5.38 Terrorism and Security

**Comment: 1388-006; GA04-008**
One commenter suggested the GEIS provides no measures of security and safety from for example, terrorism, hazardous materials releases, and water pollution. Another commenter expressed concerns about terrorism on an ISL facility.

*Response: As stated in the Commission's Memorandum and Order CLI–02–24 (NRC, 2002), NRC does not consider NEPA to require the NRC to consider the environmental consequences of a hypothetical terrorist attack on an NRC-licensed facility because the "environmental" effect caused by third-party miscreants is simply too far removed from the natural or expected consequences of agency action to require a study under NEPA CLI–07–08, NRC 124 (NRC, 2007). However, the NRC is devoting substantial time and attention to terrorism-related matters. For example, as part of fulfilling its mission to protect public health and safety and common defense and security pursuant to the AEA, the NRC staff is conducting security assessments of commercial uses of radioactive material. While some elements of security are mentioned in GEIS Chapter 2 (e.g., fencing in Section 2.11.1), security measures are specifically addressed by NRC safety requirements in 10 CFR Part 20, Subpart I. During the NRC safety review of an ISL license application, staff evaluates whether the proposed security measures (e.g., well field fencing, daily inspections, locks for buildings) are sufficient to comply with the NRC requirements (NRC, 2003). As the topic is addressed in the NRC safety review and the aforementioned NRC guidance and policy statements, no additional information on security was included in the GEIS in response to this comment.*

### G5.38.1 References

NRC. "Atomic Safety and Licensing Board, In the Matter of Amergen Energy Company, LLC License Renewal for Oyster Creek Nuclear Generating Station." *Federal Register:* Vol. 72, No. 164. p. 48695. August 24, 2007.

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

NRC. Commission Memorandum and Order CLI–02–24, "In the Matter of Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage installation)." ADAMS Accession Number ML023520349. Washington, DC: NRC. 2002.

## G5.39 Editorial

**Comment: 015-034; 032-011; 036-012; 036-013; 036-024; 036-032; 036-035; 036-042; 036-141; 036-142; 036-143; 036-144;1173-019; 1173-035; 1173-037; 1173-040; 1173-041; 1173-050; 1173-052; 1173-055; 1173-070; 1173-106; 1305-007; 1321-042; AL16-054; AL16-056; AL22-088; CA07-009; CA10-001; CH07-006; SP10-007**
Commenters suggested corrections for typographical errors, misspellings, and grammatical mistakes in the EIS. Several commenters also proposed text to clarify discussions in the EIS.

*Response: Proposed changes were made when appropriate. Where proposed changes were intended to correct inaccuracies or inconsistencies, they were checked for accuracy prior to incorporation in the EIS.*

NRC FORM 335 (9-2004) NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

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Cheyenne, Wyoming 82002

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*


This Generic Environmental Impact Statement (GEIS) was prepared in accordance with NRC regulations (10 CFR Part 51), which implement the National Environmental Policy Act of 1969, as amended (NEPA) provisions. The GEIS provides a starting point for NRC's site-specific NEPA review of a license application for an in-situ leach (ISL) uranium milling facility by assessing the potential environmental impacts associated with the construction, operation, groundwater restoration, and decommissioning of such a facility in four regions of the United States.

In the ISL process, a leaching agent, such as oxygen with sodium bicarbonate, is added to native groundwater 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 metal and minerals from the host rock. Operators of ISL facilities are required to restore the groundwater affected by the leaching operations. The milling process concentrates the recovered uranium into the product known as "yellowcake," which 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.)*

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