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United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1910, Vol. 2
Errata

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

Chapters 5 through 12 and Appendices A through F

Draft Report for Comment

Office of Federal and State Materials and
Environmental Management Programs

Wyoming Department of Environmental Quality
Land Quality Division

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Appendices C, D, and F are provided. Some pages of these appendices inadvertently were not printed in the original printing of Volume 2 of NUREG-1910.

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COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1910, draft, in your comments, and send them postmarked by September 26, 2008, to the following address:

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APPENDIX C

SUMMARY OF CONVENTIONAL URANIUM MILLING TECHNOLOGIES

C. SUMMARY OF CONVENTIONAL URANIUM MILLING TECHNOLOGIES

C1.1 Conventional Mills

Uranium milling techniques have evolved over the years, but the basic requirements are similar to those described in NUREG–0706 (NRC, 1980, Appendix B). Although located in an Agreement State and not regulated by the U.S. Nuclear Regulatory Commission (NRC), recent licensing actions related to conventional mill sites in Utah (White Mesa near Blanding and Shootaring Canyon near Ticaboo) can also provide some updated information [Denison Mines (USA) Corporation, 2007; Plateau Resources, Ltd., 2006]. These facilities have a maximum capacity of about 900–1,800 metric tons [1,000–2,000 short tons] of ore per day. Many of the chemical processes are similar to those used to process ISL solutions; unlike ISL uranium processing, however, additional steps are necessary to prepare the solid uranium ore for recovery and manage solid waste disposal.

In traditional conventional milling operations, the uranium ore is mined from a deposit by surface or underground mining techniques and transported to the mill site for processing (Figure C1.1–1). Depending on economic conditions and license requirements, a conventional mill may also process alternate materials such as contaminated soils for their uranium content [Denison Mines (USA) Corporation, 2007]. The conventional uranium milling process involves several basic steps (Figure C1.1–2).

C1.1.1 Ore Handling and Preparation

This stage of the milling process includes ore blending to ensure uniform physical and chemical characteristics, crushing and grinding, and possibly drying or roasting to improve ore handling and solubility properties.

Ore is trucked to the processing facility. The incoming ore is weighed and analyzed for moisture and uranium content. The ore may be stockpiled to manage the feed into the circuit. Ore is initially screened through a large mesh grizzly and transported by conveyer belt into the grinding stage, usually by discharge into a semiautogenous grinding mill. Water is added to the ore to produce a slurry containing approximately 70 percent solids. The slurry is then pumped through screens into large surge tanks to maintain feed into the leach circuit. Oversize material is recycled back into the semiautogenous grinding mill, and undersize material flows to a storage sump.

C1.1.2 Mill Concentration

This stage of the milling processing includes physical (e.g., washing) or chemical techniques to leach uranium from the slurry, followed by further uranium concentration using techniques such as ion exchange or solvent recovery.

The leaching circuit dissolves uranium minerals from sandstone grains. A two-stage leaching circuit is typically used (Plateau Resources, Ltd., 2006). The ore slurry is pumped from the surge tanks to the first-stage leach circuit where the ore is mixed and agitated with a sulfuric acid or alkaline leach solution, and an oxidant and passed through a series of leach tanks in

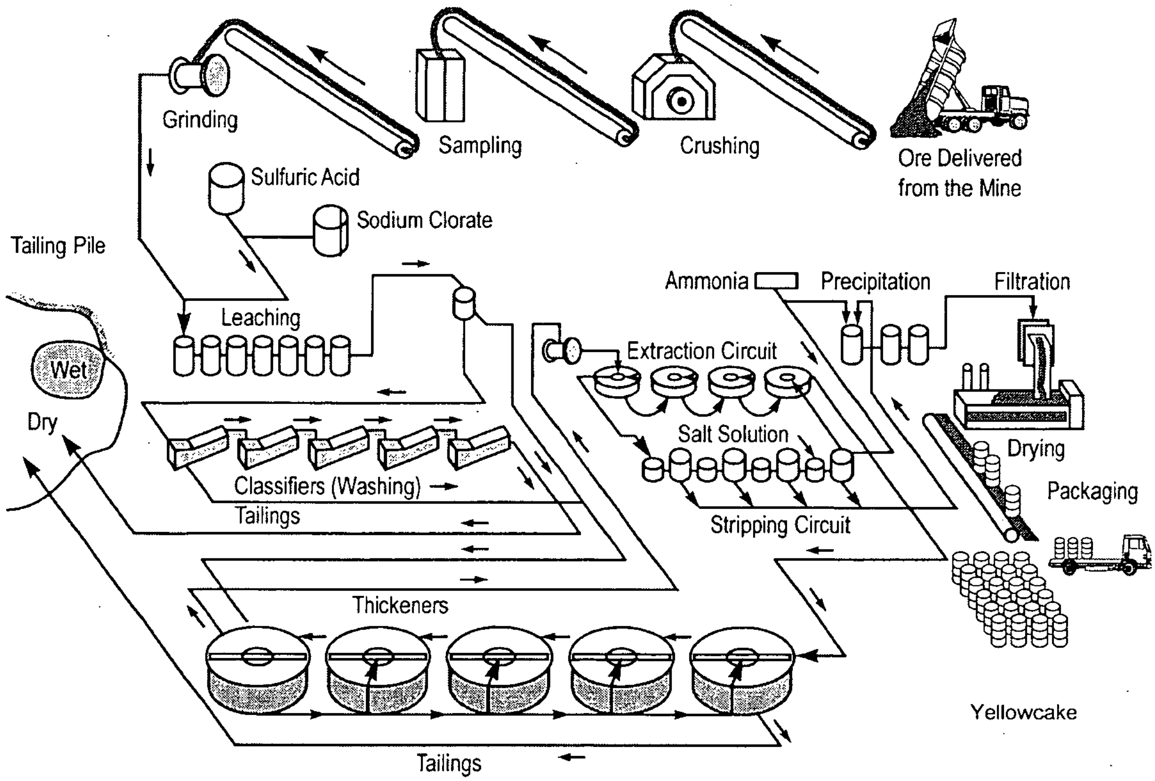

Figure C1.1–1. Schematic of a Conventional Uranium Milling Operation (Energy Information Administration, 1995)

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 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 primary 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 two solutions 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.

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

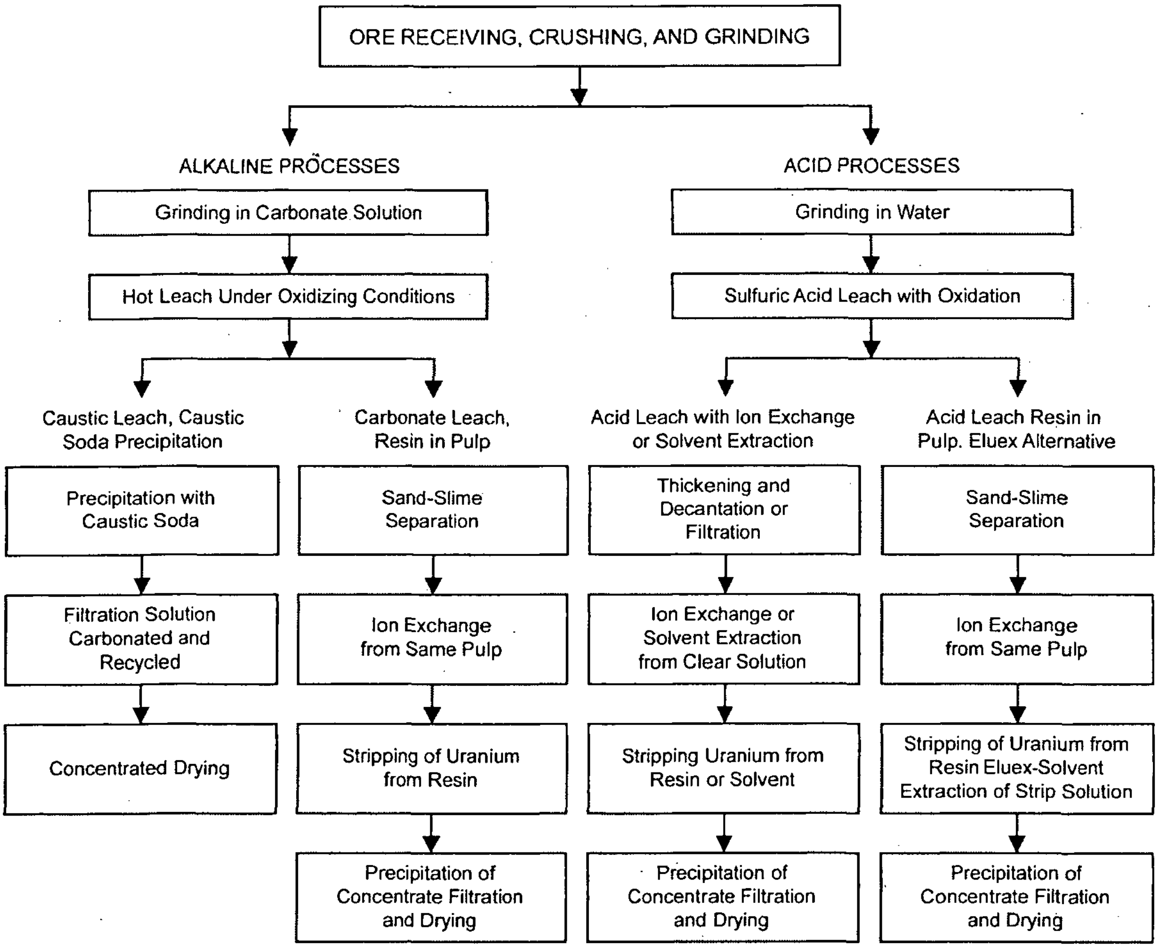

Figure C1.1.–2. Flow Diagram of the Conventional Uranium Milling Process (Energy Information Administration, 1995)

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

This 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

The 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). The 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 the tails 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, the 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 radiation protection (radon caps) (NRC, 2003). Surety estimates for aquifer restoration, decommissioning, and reclamation activities are conducted similarly to those described in Sections 2.5–2.6, 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 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

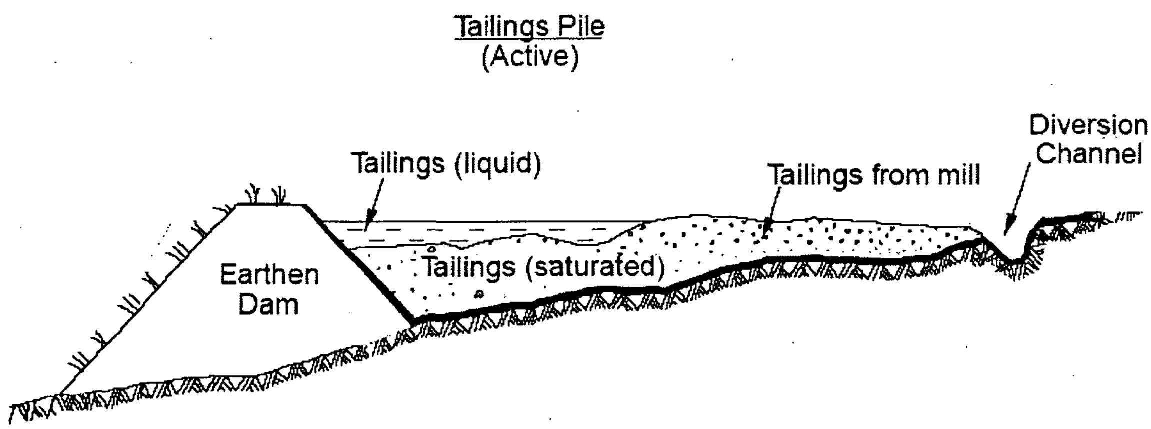

Figure C1.1–3. Schematic Cross Section of an Active Tailings Pile and Tailings Pond (Energy Information Administration, 1995)

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 of 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.

- 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.

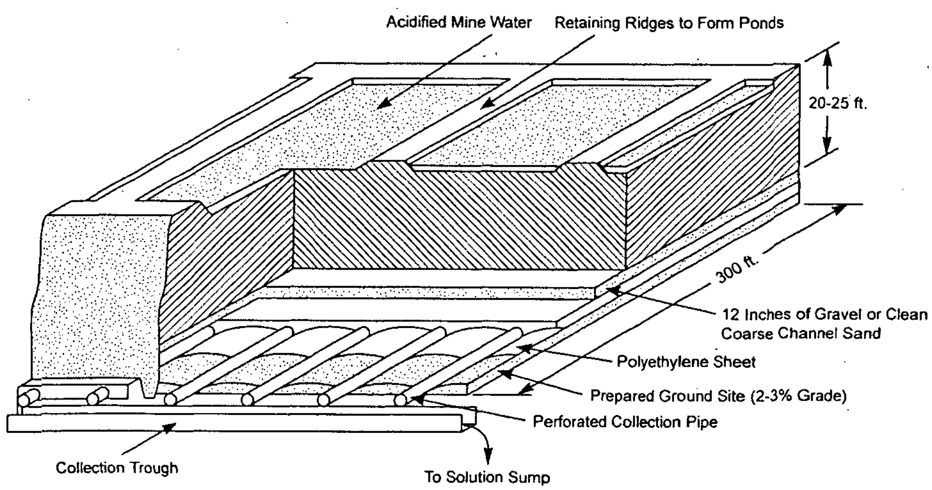

Figure C2.1–1. Schematic Diagram of Typical Heap Leach Pile (NRC, 1980) [1 ft = 0.3048 m; 1 in = 0.39 cm]

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 of 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. Groundwater restoration, decommissioning, reclamation activities, and surety estimates would be conducted similarly as those described previously in Sections 2.5–2.6, although the scope of the effort will vary depending on the size of the heap leach operation and the presence or absence of contamination at the end of operations.

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).

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APPENDIX D

CULTURAL AND HISTORICAL RESOURCE MANAGEMENT PROCESSES

D. CULTURAL AND HISTORICAL RESOURCE MANAGEMENT PROCESSES

D1.1 CULTURAL RESOURCES

Cultural resources are historic properties that include archaeological sites and historical-period structures and features protected under the NHPA of 1966, as amended (16 U.S.C. 470). Cultural resources further include traditional cultural properties that significantly define community practices and beliefs that are important to maintaining community identity. According to Section 106 of the NHPA, federal agencies must account for effects to historic properties that may result from the agencies' undertakings. 36 CFR Part 800 defines the process by which federal agencies comply with the NHPA, as amended. The National Register of Historic Places (NRHP) is a register of historic buildings, objects, sites, and districts as well as archaeological resources. Archaeological resources consist of prehistoric and historical-period sites that contain evidence of past human lifeways and adaptations. Traditional cultural properties, cultural landscapes, ethnographic landscapes, rural historic landscapes, and historic mining landscapes can also be evaluated for listing in the NRHP.

The federal government established the NRHP and devised the way historic properties are eligible and can be nominated to be listed in the NRHP; this process preserves significant historic properties. The listing of a historic property in the NRHP ensures that a property is protected under provisions of the NHPA. In addition, properties deemed potentially eligible for inclusion in the NRHP are given this same protection.

In the context of a federal undertaking, the significance of a cultural resource is judged according to NRHP eligibility criteria. These criteria are defined in Title 36, Part 60, of the Code of Federal Regulations (36 CFR Part 60), which states that

> "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and;
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in pre-history or history."

In addition to these four criteria, there is a general stipulation that the property be 50 or more years old (for exceptions, see 36 CFR 60.4, Criteria Considerations a–g). The importance of this historic information is measured by its relevance to identified research questions that can be addressed through the analysis of particular types (National Park Service, 1991). In addition to research potential, both Native American and Euroamerican cultural resources may possess 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 other criteria, typically 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.

D2.1 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 THPO 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 NEPA 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/EIS as project-specific localities are identified 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 should include consultation and ethnographic interviews with Native American individuals or groups (Tribal Historic Preservation Officers 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 SHPO and/or land managing agency reporting standards that describes the results of the cultural resources inventory is created.

APPENDIX F

DESCRIPTION OF PROCESSES FOR REVIEW OF CUMULATIVE EFFECTS

F. DESCRIPTION OF PROCESSES FOR REVIEW OF CUMULATIVE EFFECTS

F1 GENERAL DESCRIPTION OF THE COUNCIL ON ENVIRONMENTAL QUALITY 11-STEP PROCESS

An example for analyzing potential cumulative effects process can be based on applying the Council on Environmental Quality's (CEQ) 11-step process to the 12 identified resource areas (CEQ, 1997):

- Step 1: Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals. This step is based on identifying typical incremental impacts associated with the construction, operation, aquifer restoration, and decommissioning phases associated with the ISL project.

- Step 2: Establish the geographic scope for the analysis. The scope for the four identified cumulative effects issues and related resource areas consists of the local and regional areas around the proposed ISL project. The specific spatial boundaries are place based and vary with each resource area.

- Step 3: Establish the timeframe for the analysis. The selected timeframe is typically from the initiation of area energy development projects (e.g., 1960s) to the future point in time when the proposed ISL project will have extracted the useable uranium.

- Step 4: Identify other actions affecting the resources, ecosystems, and human communities of concern. As noted in the earlier definition, other actions include past, present, and reasonably foreseeable future actions (RFFAs) that have, or would be expected to have, impacts on the four identified resource areas. Identifying past actions will typically involve reviewing local and regional energy and industrial development projects and various land use activities and changes (e.g., from agricultural usage to residential usage). Present actions may include current planning and license applications related to ISL projects, other energy and industrial development projects, and/or activities leading to land use changes. The RFFAs, which may include the continued operation or expansion of past and present actions, can be defined as

  > Actions identified by analysis of formal plans and proposals by public and private entities that have primary (direct) or secondary (indirect) impacts on the four resource areas. RFFAs also include potential actions that are beyond mere speculation when incorporated in plans or documents by credible private or public entities. RFFAs may also include events forecasted by trends, probable occurrences, policies, regulations, or other credible data that may have bearing on the four resource areas.

- Each identified RFFA should be defined by its anticipated time period of occurrence, probability of occurrence, and geographical location relative to the proposed ISL facility.

- Step 5: Define the pertinent resource areas identified during scoping in terms of how they will respond to change and ability to withstand stresses. In this case, scoping refer 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.

- 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. 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.

- Step 8: Identify the important cause-and-effect relationships between human activities and specific resource areas. 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 above, Step 8 is also related to Step 4, and combining these steps will help establish the "action boundaries."

- Step 9: Determine the magnitude and significance of cumulative effects. 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 actions 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 web sites 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 & 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 & Fish Department—<http://gf.state.wy.us/>. Final 2007 Gray Wolf Management Plan and document on Current & 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 & 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 & 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 & 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, their history, management plans, projects, and NEPA compliance documents such as environmental assessments and EISs.

- BLM—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 web sites 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 web sites 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 RCRA 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 Co., (2) Chadron SP—Dawes Co., and (3) Ft. Robinson SP—Sioux Co.
- 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 & 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.

- BLM—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 web sites 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.

NRC FORM 335 (9-2004) NRCMD 3.7 U.S. NUCLEAR REGULATORY COMMISSION **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*		1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1910, Vol. 2	
2. TITLE AND SUBTITLE Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities Chapters 5 through 12 and Appendices A through F Draft Report for Comment		3. DATE REPORT PUBLISHED	
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8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Programs
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Wyoming Department of Environmental Quality, Land Quality Division (Cooperating Agency)
122 West 25th Street, Herschler Building
Cheyenne, Wyoming 82002

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This Draft Generic Environmental Impact Statement (Draft GEIS) was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 and NRC regulations for implementing NEPA found at Title 10, "Energy," of the U.S. Code of Federal Regulations (CFR) Part 51 (10 CFR Part 51). This Draft GEIS evaluates on a programmatic basis, the potential environmental impacts associated with the construction, operation, ground water restoration, and decommissioning of uranium milling facilities employing the in-situ leach (ISL) process.

In the ISL process, a leaching agent, such as oxygen with sodium bicarbonate, is added to native ground water for injection through wells into the subsurface ore body to dissolve the uranium. The leach solution, containing the dissolved uranium, is pumped back to the surface and sent to the processing plant, where ion exchange is used to separate the uranium from the solution. The underground leaching of the uranium also frees other metals and minerals from the host rock. Operators of ISL facilities are required to restore the ground water affected by the leaching operations. The milling process concentrates the recovered uranium into the product known as "yellowcake" (U3O8). This yellowcake is then shipped to uranium conversion facilities for further processing in the overall uranium fuel cycle.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*	13. AVAILABILITY STATEMENT unlimited
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