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United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1910
Supplement 3

Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming

Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities

Final Report

United States Nuclear Regulatory Commission Official Hearing Exhibit			
In the Matter of:	POWERTECH USA, INC. (Dewey-Burdock In Situ Uranium Recovery Facility)		
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Office of Federal and State Materials and
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Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities

Final Report

Manuscript Completed: May 2011
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Office of Federal and State Materials and Environmental
Management Programs

Office of Federal and State Materials and
Environmental Management Programs

ABSTRACT

The U.S Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source material provided that proposed facilities meet NRC regulatory requirements and would be operated in a manner that is protective of public health and safety and the environment. Under the NRC environmental protection regulations in the *Code of Federal Regulations* (CFR), Title 10, Part 51, which implement the *National Environmental Policy Act of 1969* (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 (SEIS).

In May 2009, the NRC issued NUREG–1910, "Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities." In the GEIS, the NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an *in-situ* leach (ISL) uranium recovery facility [also known as an *in-situ* recovery (ISR) facility] located in four specified geographic regions of the western United States. As part of this assessment, the NRC determined which potential impacts would be essentially the same for all ISR facilities and which would result in varying levels of impacts for different facilities, and would require further site-specific information to determine potential impacts. The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses.

By letter dated October 30, 2007, Lost Creek ISR, LLC (LCI) (referred to herein as the applicant) submitted a license application to NRC for a new source material license for the proposed Lost Creek ISR Project. The Lost Creek ISR Project would be located in Sweetwater County, Wyoming, which is in the Wyoming West Uranium Milling Region identified in the GEIS. The applicant withdrew the application and subsequently resubmitted it along with supporting documentation on March 31, 2008. The NRC staff prepared this SEIS to evaluate the potential environmental impacts from the applicant's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium milling facility at the proposed Lost Creek ISR Project. This SEIS describes the environment that could be affected by the proposed site activities, estimates the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes the applicant's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. The NRC staff then determined relevant sections, findings, and conclusions in the GEIS that could be incorporated by reference, and areas that needed additional analysis. Based on its environmental review, the NRC staff recommends that, unless safety issues mandate otherwise, the source material license be issued as requested.

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EXECUTIVE SUMMARY

BACKGROUND

By letter dated October 30, 2007, Lost Creek ISR, LLC (LCI) (the applicant) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the proposed Lost Creek ISR Project, located in Sweetwater County, Wyoming. The applicant subsequently withdrew the application and later resubmitted it with updated supporting documentation on March 31, 2008. The applicant is proposing to recover uranium using the *in-situ* leach [also known as the *in-situ* recovery (ISR)] process for consistency with the mining industry. The proposed Lost Creek ISR Project includes a processing plant to produce yellowcake slurry, wellfields, deep disposal wells for liquid effluents, and the attendant infrastructure (e.g., pipelines, roads, storage facilities).

The *Atomic Energy Act of 1954* (AEA), as amended by the Uranium Mill Tailings Radiation Control Act of 1978, authorizes the NRC to issue licenses for the possession and use of source material and byproduct material. The NRC must license facilities, including ISR operations, in accordance with NRC regulatory requirements. These requirements were developed to protect public health and safety from radiological hazards and to protect common defense and security. Under the NRC environmental protection regulations in the *Code of Federal Regulations* (CFR), Title 10, Part 51 (10 CFR Part 51) that implement the National Environmental Policy Act of 1969 (NEPA), preparation of an Environmental Impact Statement (EIS) or Supplement to an EIS (SEIS) is required for issuance of a license to possess and use source material for uranium milling [see 10 CFR 51.20(b)(8)].

In May 2009, the NRC issued NUREG–1910, "*Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*" (GEIS). In the GEIS, the NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed Lost Creek ISR Project is located within the Wyoming West Uranium Milling Region identified in the GEIS. The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This final SEIS incorporates by reference information from the GEIS and also uses information from the applicant's license application, other independent sources, and comments received during the public comment period extension, and response to comment review period for the draft SEIS.

On December 11, 2009, the NRC published a Notice of Availability (NOA) for the draft SEIS for the proposed Lost Creek ISR Project in the *Federal Register* (FR) (74 FR 65804). The NOA stated that public comments would be accepted until February 2, 2010. On February 5, 2010, the NRC extended the public comment period to March 3, 2010 (75 FR 6068), in response to requests for extension submitted in comment letters and e-mails. The 81-day period for public comments (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. The NRC staff identified 631 comments on the Lost Creek draft SEIS.

This SEIS includes the NRC staff's analysis, of the environmental impacts from the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures to either reduce or avoid adverse effects. It also includes the NRC staff's recommendation regarding the proposed action.

PURPOSE AND NEED OF THE PROPOSED ACTION

The NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The applicant is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the proposed Lost Creek ISR Project site. The purpose and need for the proposed action is to provide an option that allows the applicant to recover uranium and produce yellowcake slurry at the proposed Lost Creek ISR Project site. Yellowcake slurry is further processed and dried to produce yellowcake. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce various products, including fuel for commercially operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the AEA or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, the NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

THE PROJECT AREA

The proposed Lost Creek ISR Project is located in the northeast portion of Sweetwater County, in south-central Wyoming. The nearest population center, located approximately 24 km [15 mi] northeast of the proposed project site, is Bairoil, a small town with less than 100 people. The city of Rawlins is located approximately 61 km [38 mi] southeast; the city of Rock Springs is located approximately 129 km [80 mi] southwest; the city of Casper is located approximately 145 km [90 mi] northeast; Jeffrey City is located approximately 40 km [25 mi] north; and the town of Wamsutter is approximately 48 km [30 mi] south of the proposed Lost Creek ISR Project. Planned facilities associated with the proposed project include wellfields with injection, production, and monitor wells; header houses; a processing plant with ancillary facilities; an access road network; and pipeline system.

The proposed Lost Creek ISR Project area consists of approximately 1,722 hectares (ha) [4,254 acres (ac)], including site access roads; and the proposed project area is remotely located on public land administered by the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM) and the State of Wyoming. Of this land, 1,463 ha [3,614 ac], or 85 percent, is administered by BLM inclusive of the mineral rights, and 259 ha [640 ac], or 15 percent, is administered by the State of Wyoming. There is no private land on the proposed site. Approximately 115 ha [285 ac] would be disturbed by the proposed action to develop six wellfields, build processing facilities, and to construct access roads.

IN-SITU RECOVERY PROCESS

During the ISR process, an oxidant-charged solution, called a lixiviant, is injected into the production zone aquifer (uranium ore body) through injection wells. The production zone is that portion of the aquifer that has been permanently exempted by the EPA for potable water use. Typically, a lixiviant uses native groundwater (from the production zone aquifer), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As it circulates though the production zone, the lixiviant oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution is drawn to recovery wells by pumping, and then transferred to a processing facility via a network of pipes buried just below the ground surface. At the processing facility, the uranium is

extracted from the solution. The resulting barren solution is then recharged with the oxidant and reinjected to recover more uranium from the wellfield.

During production, the uranium recovery solution continually moves through the aquifer from outlying injection wells to internal recovery wells. These wells can be arranged in a variety of geometric patterns depending on ore body configuration, aquifer permeability, and operator preference. Wellfields are often designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well being located inside a ring of injection wells. Monitoring wells would, then, surround the wellfield pattern area, terminating in the production zone aquifer as well as in both the overlying and underlying aquifers. These monitoring wells are screened in appropriate stratigraphic horizons to detect lixiviant in case it migrates out of the production zone. The uranium that is recovered from the solution would be processed as slurry and shipped via tanker truck offsite to a processing facility to produce yellowcake. The yellowcake would be packaged into NRC-and U.S. Department of Transportation (DOT)-approved 205-L [55 gal] steel drums, and trucked offsite to a licensed uranium conversion facility.

Once production is complete, the production zone groundwater is restored to NRC-approved groundwater protection standards, which are protective of the surrounding groundwater. The site is decommissioned according to a NRC-approved decommissioning plan and in accordance with NRC-approved standards. Once decommissioning is approved, the site may be released for public use.

ALTERNATIVES

The NRC environmental review regulations in 10 CFR Part 51, which implement NEPA, require the NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action. The NRC staff considered a range of alternatives that would fulfill the underlying purpose and need for the proposed action. From this analysis, a set of reasonable alternatives was developed, and the impacts of the proposed action were compared to the impacts that would result if a given alternative were implemented. This final SEIS evaluates the potential environmental impacts of the proposed action and two alternatives, including the No-Action alternative. Under the No-Action alternative, the applicant would neither construct nor operate an ISR facility at the proposed site. A third alternative considered the installation of a dryer to allow production of dry yellowcake at the proposed Lost Creek ISR Project. Alternatives considered and eliminated from detailed analysis include conventional mining and milling at the proposed Lost Creek ISR Project site, conventional mining and heap leach processing at the proposed Lost Creek ISR Project site, and alternate lixiviants. These alternatives were eliminated from detailed study because they either would not meet the purpose and need of the proposed project or would cause greater environmental impacts than the proposed action. This SEIS also discusses alternative wastewater disposal options that were not included in the proposed action.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This final SEIS includes the NRC staff’s analysis, which considers and weighs the environmental impacts resulting from the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Lost Creek ISR Project site and the two alternatives. The final SEIS also describes mitigation measures for the reduction or avoidance of potential adverse impacts that either: (i) the applicant has committed to in its NRC license application, (ii) would be required under other State or Federal permits or processes, or (iii) are

additional measures that the NRC staff identified as having the potential to reduce environmental impacts, but the applicant did not commit to in their application. The final SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts, as well as incorporate the responses to comments received during the public comment period for the draft SEIS.

As discussed in the GEIS and consistent with NUREG–1748 (NRC, 2003), the significance of potential environmental impacts is categorized as follows:

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

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

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

Chapter 4 provides NRC's evaluation of the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek ISR Project. A list of the significance level of impacts by phase of the ISR facility lifecycle is provided, followed by a brief summary of impacts by environmental resource area and ISR facility lifecycle phase.

IMPACTS BY RESOURCE AREA AND ISR FACILITY PHASE

Land Use

Construction: Impacts would be SMALL. Approximately 115 ha [285 ac] of the 1,705 ha [4,420 ac] or approximately 6 percent of the proposed project area would be stripped of vegetation during the construction phase of the Lost Creek ISR Project. Approximately 24 ha [58 ac] of topsoil would be removed to construct the processing plant, storage ponds, and other ancillary facilities. The wellfields would be sequentially developed over the project life resulting in the disturbance of approximately 99 ha [244 ac], which would be fenced to limit grazing access by livestock and recreational activities.

Operation: Impacts would be SMALL. Land use impacts during the operations phase would be similar to, or less than, those during the construction phase since the infrastructure would be in place. Operational areas would remain fenced to limit grazing and recreational activities; however, this fenced area would account for less than one percent of the proposed project area. No new facilities would be constructed that would result in additional land disturbance during operations, although well drilling would continue since the wellfields would be sequentially developed.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to, or less than, those during the operation phase. Wellfield access would be restricted from other uses such as grazing and recreational activities as described for the operations phase. No new facilities would be constructed that would result in additional land disturbance.

Decommissioning: Impacts would be SMALL. Land use impacts during the decommissioning phase would be similar to those during the construction phase. Decommissioning the buildings, wellfields, storage ponds, access roads, and removing potentially contaminated soil would result in a short-term increase in land-disturbing activities. Upon completion of the plugging and abandonment of wells in the wellfield areas, the soil would be reseeded and reclaimed in areas where it had been removed. At the end of decommissioning, because the reclaimed land would be released for other uses and no longer restricted, the land use impact in disturbed areas would be MODERATE until the reestablishment of vegetation; after the reestablishment of vegetation in reclaimed areas, the land would be returned to a condition that could support a variety of land uses and the impact would be SMALL.

Transportation

Construction: Impacts would be SMALL. Low levels of traffic generated by construction activities (relative to local traffic counts) would not significantly increase traffic or accidents on the roads in the region. Short-term impacts on the roadways would be expected because of the limited duration of construction activities. In addition, access roads would have been upgraded to BLM standards.

Operation: Impacts would be SMALL. There would be a small increase in anticipated traffic during the ISR operations phase. The operational transportation impacts evaluated for the proposed project, including the transport of yellowcake slurry, chemical, and waste transport and the applicant’s proposed safety measures, would result in a SMALL impact.

Aquifer Restoration: Impacts would be SMALL. Transportation impacts during this phase would be similar to those during the operations phase. As the rate of uranium recovery gradually decreases through the course of aquifer restoration, the number of yellowcake slurry shipments to offsite drying facilities would also decrease.

Decommissioning: Impacts would be SMALL. The traffic volume during the decommissioning phase would be dominated by material shipments for offsite disposal. Because of the reduced traffic volumes associated with this phase compared to the operations phase, there would be a reduced risk of transportation accidents. Regional transportation impacts would be short-term.

Geology and Soils

Construction: Impacts would be SMALL. Approximately 115 ha [285 ac] of the 1,705 ha [4,220 ac] of the project area would be directly affected by the proposed action from earthmoving activities to construct the processing plant and the settling ponds; to develop the six wellfields including well drilling, installing header houses, and laying pipeline; and to construct access roads. The applicant has proposed to remove vegetation only where necessary and estimates that an area covering approximately 24 ha [58 ac] would be stripped of topsoil, which would be stockpiled and stabilized prior to construction and reclaimed after decommissioning. The applicant has also proposed to mitigate erosion by timely reclamation, installing drainage controls, and installing water bars across reclaimed areas. Finally, the applicant has proposed to mitigate wind erosion by surfacing roads with gravel, limiting traffic speeds, watering unpaved roads, and spreading soil binding agents and implementing timely reclamation.

Operation: Impacts would be SMALL. The removal of uranium from the target sandstone (aquifer) during ISR operations would change the mineralogical composition of uranium-bearing rock formations. However, no significant matrix compression or ground subsidence would be expected during operations. Because the proposed operations would result in small changes in the reservoir pressure, the operations would be unlikely to reactivate the fault. The potential for spills during transfer of uranium-bearing lixiviant to and from the processing plant would be mitigated by implementing onsite standard operating procedures and complying with NRC and WDEQ requirements for spill response and reporting of surface releases.

Aquifer Restoration: Impacts would be SMALL. During aquifer restoration, the process of groundwater sweep, groundwater transfer, groundwater treatment, and recirculation would not remove rock matrix or structure. The formation pressure would be decreased during restoration to ensure that the direction of groundwater flow is into the wellfields to reduce the potential for lateral migration of constituents; however, the change in pressure would not be significant enough to result in matrix compression, ground subsidence, or to reactivate the fault. The spill response and leak detection activities would be the same as described during the operation phase.

Decommissioning: Impacts would be SMALL. Disruption or displacement of existing soils would occur during the decommissioning phase from earthmoving activities, but these reclamation actions would be short term. All production, injection, monitoring wells, and drill holes would be plugged and abandoned in accordance with BLM and WDEQ procedures and regulations. Topsoil would be reclaimed and regarded to the original topography.

Water Resources (Surface Water and Wetlands)

Construction: Impacts would be SMALL. Surface water at the proposed Lost Creek site is ephemeral. Although the proposed activities, which include constructing roads across streambeds, installing overhead electric lines, drilling wells, laying pipeline, and constructing the processing plant, could generate surface water runoff, the applicant’s implementation of BMPs such as stabilizing loose soil, locating power poles outside of an ephemeral channel, and reseeding and mulching soil for stability and following procedures in their Storm Water Pollution Prevention Plan would minimize the potential impacts. No jurisdictional wetlands exist within or near the proposed project area.

Operation: Impacts would be SMALL. The processing plant would be constructed on a bermed, concrete slab to limit potential spills from escaping to the environment. The applicant’s design features such as the use of silt fences, earthen dikes, drainage swales, sediment traps and culvert installation to maintain site surface drainage, among others, and the applicant’s implementation of a storm water management plan would also mitigate the impact on surface water channels from surface water runoff. Workers would check and maintain the injection, production, and monitoring wells for leaks and spills. The applicant’s commitment to conduct operations in accordance with standard operating procedures and a Spill, Prevention, Control and Countermeasures Plan would mitigate the impact on surface water from a spill. The applicant’s adherence to its WDEQ stormwater permit requirements would also mitigate impacts to the surface water channels.

Aquifer Restoration: Impacts would be SMALL. There would be no impact on surface water from aquifer restoration because waste water generated during this phase would be disposed of via deep well disposal permitted by the WDEQ. There would be no permitted surface water

discharge of waste water at the Lost Creek site. Stormwater runoff would be managed as described for the ISR construction phase.

Decommissioning: Impacts would be SMALL. Impacts from decommissioning would be similar to those from construction. Activities to clean up, recontour and reclaim the land surface during decommissioning would mitigate long-term impacts to surface water (if present). The same mitigation measures used during the construction phase to manage surface water runoff would also be used during decommissioning.

Water Resources (Groundwater)

Construction: Impacts would be SMALL. The primary impact on groundwater would be from consumptive use of groundwater, introduction of drilling fluids and muds into the environment during well installation, discharge of pumped water to the surface during hydrologic testing, and from surface spills of fuels and lubricants. These impacts would be mitigated by the applicant's implementation of management practices (BMPs) and by following the guidelines in the Spill, Prevention, Control & Countermeasures plan that would require an immediate cleanup response to prevent soil contamination or infiltration to groundwater.

Operation: The impact would range from SMALL to MODERATE. The impact from spills and leaks would be SMALL. The depth and presence of numerous aquitards could prevent the migration of spills into the uppermost aquifer. The two storage ponds would be designed and built to NRC standards to mitigate the likelihood of pond failure impacting groundwater quality. Impacts on water levels in three surrounding private stock wells would result in a MODERATE impact because the water levels would be affected. The applicant has committed to replace affected wells with new wells completed in deeper sands that are not impacted by ISR operations to mitigate the impact. Water levels in the affected wells would recover with time after ISR operations and restoration activities are complete.

The establishment of an inward hydraulic gradient in the wellfields along with the applicant-installed monitoring network to detect potential vertical and horizontal excursions would limit the potential for undetected groundwater excursions that could degrade groundwater quality. Because the ore production zone is overlain and underlain by impermeable shale layers, this further ensures the hydraulic isolation of the ore production zone, which helps to minimize potential groundwater contamination above and below the ore production zone.

Liquid effluent generated form operation of the proposed Lost Creek ISR Project would be disposed of via five Class I disposal wells permitted by the WDEQ in accordance with the WDEQ Water Quality and Regulations for Underground Management of Hazardous or Toxic Waste (Chapter 8, Section 6). The potential environmental impacts on deep aquifers below the ore production aquifers from injection of liquid effluent would be SMALL, based on the technical analysis and WDEQ conclusions that supported the issuance of the deep injection well permit.

Aquifer Restoration: The impact would range from SMALL to MODERATE. Groundwater restoration would be initiated once a wellfield is no longer being used to produce uranium and could no longer impact both groundwater quality and water levels. The applicant's estimates of groundwater consumptive use during aquifer restoration considered that both aquifer restoration and ISR operations could be ongoing since the applicant plans to sequentially develop the wellfields. The modeling results showed that the groundwater hydraulic head could be drawndown as much as 45 m [148 ft] at a distance of 8 km [5 mi] from the centroid of

production. Three steps would occur during restoration: groundwater sweep, groundwater treatment, and recirculation. During all processes, hydraulic control of the former production zone would be maintained; this would be accomplished by maintaining an inward hydraulic gradient through a production bleed. During groundwater sweep, water would be pumped from the wellfield (without reinjection), resulting in an influx of “fresh” baseline water into the affected (mined) portion of the aquifer, but also resulting in potentially large drawdown of wells occurring near the project area. The water removed from the aquifer during the sweep is first passed through an ion-exchange system to recover the uranium. This would result in drawdown in nearby surrounding wells. During this phase, disposal of waste fluids via deep well injection would occur as described for ISR operations. The goal of aquifer restoration would be to restore groundwater quality in the ore production zone to pre-extraction baseline conditions. If the aquifer cannot be restored to baseline conditions, then the NRC would require that either the production zone be returned to maximum contaminant levels in Table 5C of 10 CFR Part 40, Appendix A, or to NRC-approved alternate concentration limits. Post-restoration groundwater quality would be protective of public health and the environment.

Decommissioning: Impacts would be SMALL. Potential impacts during this phase would be similar to those during the construction phase. Groundwater consumptive use would be less than that of the operation and restoration phases. All monitoring, injection, and production wells would be plugged and abandoned in accordance with the Wyoming UIC program requirements. Wells would be filled with cement and clay and then cut below plough depth to ensure groundwater does not flow through the abandoned wells. Abandoned wells would be properly isolated from the flow domain. NRC review and approval of the wellfield restoration would ensure that the restoration standards are met and are protective of public health and safety.

Ecological Resources (Wildlife)

Construction: Impacts would be MODERATE for protected species and species of concern, and SMALL for other wildlife species. Habitat fragmentation, wildlife displacement, and direct or indirect mortalities would be possible from construction activities at the proposed Lost Creek ISR Project. Mitigation measures such as the guidelines issued by the Wyoming Game and Fish Department (WGFD), BLM, the Governor of Wyoming, and commitments in the applicant’s Wildlife Protection Plan and Wildlife Monitoring Plan could limit these impacts. Impacts to Greater sage-grouse (*Centrocercus europhasianus)*, raptors, migratory birds, livestock, and big game species could also be reduced by the applicant’s adherence to a mitigation and monitoring plan. Removal of sagebrush would impact small mammals and sagebrush-dependent birds. One Federally-listed candidate species dependent on sagebrush, the Greater sage-grouse, can be found within the proposed project area.

Operation: Impacts would be SMALL. Impacts would be similar to but less than those experienced during the construction phase because fewer earthmoving activities would occur and traffic would be less. The applicant’s implementation of mitigation measures, such as wellfield perimeter and storage pond fencing, fence diverters, netting, mosquito control, leak detection and a Spill, Prevention, Control and Countermeasure, and wildlife protection and monitoring plans, would reduce operation impacts as discussed in SEIS Section 4.6. The applicant would reseed disturbed areas with WDEQ-approved seed mixtures to reestablish habitat.

Aquifer Restoration: Impacts would be SMALL. The infrastructure would already exist during aquifer restoration activities, which would result in estimated ecological impacts comparable to that of the operation phase. Less vehicular traffic would occur during the aquifer restoration

phase than during operations because there would be fewer yellowcake slurry shipments. Therefore, the aquifer restoration phase would produce fewer disturbances to wildlife from traffic and noise.

Decommissioning: Impacts would be MODERATE for protected species and species of concern, and SMALL for other wildlife species. Wildlife and livestock would be temporarily displaced from land and by soil disturbance, but would likely return after decommissioning and reclamation are completed and vegetation and habitat are reestablished.

Ecological Resources (Vegetation)

Construction: Impacts would be MODERATE. Approximately 115 ha [285 ac] would be disturbed by construction of the processing plant, storage ponds, main access roads, and wellfields. To stabilize soils and support the ecosystem, vegetation would be reestablished at disturbed areas with approved BLM and WDEQ native seed mixture as soon as conditions allow. Surface disturbance could increase the occurrence of invasive and noxious weeds within the proposed project area. The applicant has committed to perform annual vegetation surveys and to implement eradication measures for invasive plant species, which would reduce impacts on vegetation. No Federally or State-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats are located within the proposed license area.

Operation: Impacts would be SMALL. Surface disturbance would increase the susceptibility of the project area to invasive and noxious weeds; however, the applicant's proposed mitigation measures—to conduct vegetation surveys and to implement eradication measures—would reduce the impact. Limiting vehicular access to specific roads would also reduce vegetation disturbance. Additionally, the applicant would reseed disturbed areas with a WDEQ- and BLM-approved seed mixture, as soon as conditions allow, to prevent the establishment of competitive species. The estimated impacts on vegetation from spills around well heads and leaks from pipelines would be SMALL if spill prevention and control procedures and BMPs are followed.

Aquifer Restoration: Impacts would be SMALL. The infrastructure would be in place; therefore, no substantial earthmoving activities would occur. Aquifer restoration activities would result in estimated ecological impacts similar to those of the ISR operation phase. Adherence to WGFD and BLM seasonal guidelines regarding land disturbance and vehicular traffic would further mitigate potential impacts on affected species.

Decommissioning: Impacts would be MODERATE. Impacts from decommissioning would be similar to those described for construction of the facility with respect to increased land disturbance and traffic. Decommissioning activities would be short term; however, complete reclamation of vegetation would be long term and could impact sage-grouse populations until the reestablishment of usable habitat. Adherence to the applicant's reclamation plan and other agency-recommended seasonal guidelines would reduce the length of time to restore sagebrush habitat.

Air Quality

Construction: Impacts would be SMALL. Air emissions during the construction phase of the proposed Lost Creek ISR Project would primarily consist of fugitive dust and emissions from equipment running diesel and gasoline-fueled combustion engines, such as drill rigs, water

trucks, bulldozers, and light-duty passenger trucks. The site conditions, and proposed activities, at the proposed Lost Creek ISR Project site are consistent with the conclusions stated in the GEIS for air quality. The air quality within the proposed Lost Creek ISR Project study area would not be substantially affected by project construction because of (i) the temporary nature of the activity; (ii) the limited footprint of the construction area relative to the project area; (iii) the relatively low volume of traffic and heavy equipment compared with conventional uranium mining activities; and (iv) the low background concentrations of pollutants (the site is in attainment with the National Ambient Air Quality Standards). The applicant's implementation of BMPs, following BLM and WDEQ guidelines, would ensure that fugitive dust emissions from construction equipment would be minimized. Residents of the Town of Bairoil who live on the unpaved, transportation route could experience intermittent, MODERATE impacts on air quality from fugitive dust emissions. However, the effect would be localized and short-term and the overall impact from transportation would be SMALL.

Operation: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during construction. Operating ISR facilities would not be major point source emitters of regulated nonradiological pollutants, and emissions would be well below *Clean Air Act* (CAA) thresholds for major sources of air pollution and therefore would be unlikely to change the present status of attainment with the National Ambient Air Quality Standards. Further, the state construction permit did not classify the proposed facility as a major source that would require permitting under the CAA Title V permitting program. Residents in the Town of Bairoil who live on the unpaved transportation route, could experience intermittent, MODERATE impacts on air quality from fugitive dust emissions. However, the effect would be localized and short-term and the overall impact from transportation would be SMALL.

Aquifer Restoration: Impacts would be SMALL. Air quality impacts from aquifer restoration would be similar to, but less than, those during operations because the infrastructure used for aquifer restoration would be the same as that used for operations. Additionally, the volume of fugitive dust and exhaust emissions from vehicles and equipment during this phase would likely be less than during operations because a smaller number of vehicles would be used. Residents in the Town of Bairoil who live on the unpaved transportation route, could experience intermittent, MODERATE impacts on air quality from fugitive dust emissions. However, the effect would be localized and short-term and the overall impact from transportation impact would be SMALL.

Decommissioning: Impacts would be SMALL. Decommissioning activities would be similar to those of construction. The volume of emissions levels would likely decrease as decommissioning progresses, and therefore, the overall impacts would be similar to, or less than, those associated with construction, would be short-term, and would be reduced through the applicant's implementation of BMPs such as dust suppression. Residents in the Town of Bairoil who live on the unpaved transportation route, could experience intermittent, MODERATE impacts on air quality from fugitive dust emissions. However, the effect would be localized and short-term and the overall impact from transportation impact would be SMALL.

Noise

Construction: Impacts would be SMALL. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the wellfields, drill the wells, develop the necessary access roads, and build the production facilities would generate noise that would be audible above ambient (background) levels. The sound from construction activities would return to background levels at a distance of approximately 300 m [1,000 ft]. Therefore, there

would be no audible noise at the location of the nearest resident located in the Town of Bairoil {24 km [15 mi]} northeast of the proposed project area; however there could be a temporary MODERATE noise impact to those living along transportation routes in Bairoil from the passage of traffic. Traffic noise could affect sage-grouse leks located in the vicinity of transportation routes. However, since the effect would be localized and intermittent, the overall noise impact would be SMALL.

Operation: Impacts would be SMALL. Overall noise impacts within the proposed project area during the operation phase would be compounded based on the overlapping nature of each of the phases with respect to noise, but would be SMALL because of the distance between the nearest resident {located in the Town of Bairoil 24 km [15 mi]} northeast of the site and the proposed project area; however, there could be a temporary MODERATE noise impact to those living along transportation routes in Bairoil from the passage of traffic. However, since the effect would be localized and intermittent, the overall noise impact would be SMALL.

Aquifer Restoration: Impacts would be SMALL. The impact from noise generated during the aquifer restoration phase would be less than that during the operation phase because of the distance between the proposed project area and the nearest resident located in the Town of Bairoil {24 km [15 mi] northeast of the site} and because vehicular traffic would be limited to supply delivery and staff accessing the site resulting in fewer trips. There would be less project-related traffic along transportation routes through the Town of Bairoil; however, there would continue to be a temporary, MODERATE impact to those living along the transportation routes in this town. However, since the effect would be localized and intermittent, the overall noise impact would be SMALL.

Decommissioning: Impacts would be SMALL. General noise levels during decommissioning and reclamation would be similar to, or less than, those levels experienced during construction. Noise levels would be temporary, and once decommissioning and reclamation activities are complete, noise levels would return to ambient levels, with only occasional vehicular traffic for long-term monitoring activities. There would be no change in background noise at the location of the nearest resident, 24 km [15 mi] northeast of the proposed project area in the Town of Bairoil.

Historical and Cultural Resources

Construction: Impacts would be MODERATE. Construction of the proposed project would affect archaeological sites and isolated finds from excavation activities. Three archaeological sites have been recommended as eligible for the NRHP. One of the sites is located within one of the proposed wellfields and could not be avoided by construction activities. Mitigation measures outlined in a formal treatment plan would be implemented if a license is granted. NRC, BLM, the State Historic Preservation Office, Eastern Shoshone Tribe, Northern Arapaho Tribe, and the applicant have developed a Memorandum of Agreement (MOA) to address the implementation of the treatment plan. The BLM classification for the near-surface deposits within the proposed project area indicates that the fossil potential ranges from MODERATE to unknown, but could be reduced to SMALL if no ground disturbing activities occurred in unsurveyed areas.

Operation: Impacts would be SMALL. It is expected that potential impacts to historic, cultural, and archaeological resources from operations would be less than during construction because less land disturbance would occur during this ISR phase. However, should any new historical or cultural resources be encountered during operation, work would stop, and appropriate

federal and state officials would be notified per license condition and the MOA. Impacts to paleontological resources could occur from routine maintenance if ground-disturbing activities are involved and if the occurrence of significant vertebrate or invertebrate fossil resources are confirmed.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration impacts to historic and cultural resources would either be similar to, or less than, impacts from operations since activities during this ISR phase would generally be limited to the existing infrastructure and previously disturbed areas and no ground-disturbing activities occurred outside the surveyed areas. None of the proposed aquifer restoration activities would affect paleontological resources since no earthmoving activities would be performed.

Decommissioning: Impacts would be SMALL. It is expected that decommissioning and reclamation activities would focus on previously disturbed areas, and that historic and cultural resources within the potential area of effect would already be known. Impacts on paleontological resources would be unlikely, since the proposed decommissioning activities would not expose potential fossil-bearing strata.

Visual/Scenic Resources

Construction: Impacts would be SMALL. Short-term (6–8 months for the processing facility; 18–24 months per wellfield) visual impacts would result from vegetative disturbance, road building, drilling, laying of pipeline, and facility construction, which could generate a MODERATE impact from fugitive dust emissions. However, the processing plant and drill rigs would not be visible from the public road network, which is lightly traveled. Dust suppression and coloration of well covers would further reduce the overall visual and scenic impacts from project construction. Further, in the long term (i.e., greater than one year), dust and equipment emissions would decrease as major construction activities are completed. Finally, the proposed activities at the Lost Creek ISR Project would be consistent with the BLM visual classification of this area.

Operation: Impacts would be SMALL. The visual impact during operations would be less than that associated with construction because the infrastructure would be in place. Although the operations at the proposed site would last an estimated eight years, and each wellfield would operate sequentially for approximately two years, the use of BMPs (e.g., dust suppression) as well as limiting building height and painting buildings to blend into the natural landscape would further reduce the visual contrast during operations. Finally, the proposed activities at the Lost Creek ISR Project would be consistent with the BLM visual classification of this area.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities would take place sequentially in the wellfields and last approximately two years per wellfield. There would be no modifications to either scenery or topography during aquifer restoration. As a result, the visual impact would be similar to that experienced during operations.

Decommissioning: Impacts would be SMALL. Similar equipment that was used and activities that occurred during construction would also be used and occur during decommissioning resulting in a similar visual impact. Like the ISR construction phase, there could be MODERATE short-term visual impacts from dust and equipment emissions. Reclamation would return the visual landscape to its pre-extraction condition, except for the main access roads needed for long-term site monitoring. The applicant’s implementation of mitigation measures (e.g., dust suppression) would further reduce the visual impact from decommissioning.

Socioeconomics

Construction: Overall, impacts would be SMALL. Because of the short duration (6–8 months for the processing plant; 18–24 months per wellfield) and small size (i.e., 94 workers) of the construction workforce, the demographic impacts would be SMALL. Workers would be paid at rates typical for the region; although the number of construction workers would cause a short-term increase in the demand for temporary (rental) housing in Sweetwater County, the available housing has kept pace with the population increase. Although the proposed project would create employment opportunities, the short duration and small number of jobs generated by the proposed action would have a SMALL impact on socioeconomic conditions. Although construction of the proposed ISR facility at Lost Creek would generate tax revenue in the local economy through the purchase of goods and services and contribute to county and state tax revenues, the proposed action would have a small socioeconomic impact because of the small size of the construction workforce and the short duration of this ISR phase.

Operation: Overall, impacts would be SMALL. Because of the small size of the operations workforce, the impact on demographic conditions would be SMALL; there would be a SMALL impact on local incomes since the average annual worker salaries would be comparable to current salaries in the area; the impact on housing could range from SMALL for the region to MODERATE for nearby communities because of the small size of the operations workforce; although the proposed action would generate jobs, some of these positions would likely be filled by people moving into the area rather than providing opportunities for people living in Sweetwater County; therefore, operations at Lost Creek would not noticeably affect employment conditions in the county; the local economy would experience a SMALL beneficial impact from the purchase of local goods and services and an increase in sales and income tax revenues; an increase in the demand for schools would have a SMALL impact because the schools could accommodate a small increase; there would be a small increase in the demand for health and social services from workers and their families relocating to the area.

Aquifer Restoration: Overall, impacts would be SMALL. The socioeconomic impact during aquifer restoration would be less than operations because fewer workers would be employed reducing the need for housing, education, and health and social services, and no specialized skills would be required.

Decommissioning: Impacts would be SMALL. The socioeconomic impact during the decommissioning of the facility would require fewer workers than ISR construction, operations, and aquifer restoration. Based on this information and given the short duration of the decommissioning activities (six to eight months for the processing plant; 18 – 24 months per wellfield), the socioeconomic impact would be SMALL.

Environmental Justice

All Phases: No minority or low-income populations were identified in the vicinity of the proposed Lost Creek ISR Project. Therefore, there would be no disproportionately high and adverse impacts to minority and low-income populations from the construction, operation, aquifer restoration, and decommissioning of the proposed ISR facility at Lost Creek.

Public and Occupational Health and Safety

Construction: Impacts would be SMALL. Other than during well construction when drilling mud

that may have contacted the ore zone is brought to the surface, the only other radiation exposure pathway during the construction period would be through worker exposure to, inhalation of, or ingestion of naturally occurring radionuclides within the disturbed soil. However, the radionuclide concentration in soil is low. Therefore, exposure from the inhalation of fugitive dust would be SMALL. Further, the nearest resident is located 24 km [15 mi] northeast of the site. Construction equipment would likely be diesel powered and would exhaust particulate diesel emissions. The impacts and potential human exposures from these emissions would be SMALL because of the short duration of the release and because the emissions would readily disperse into the atmosphere.

Operation: Impacts would be SMALL. Radiological impacts during normal operations would be SMALL. The applicant evaluated worker doses at 17 boundary locations at the proposed Lost Creek ISR Project and determined that the highest dose would be 0.03 mSv [3.01 mrem] per year total effective dose equivalent, which is 3 percent of the 1mSv [100 mrem] per year dose limit for a member of the public as specified in NRC regulations. No routine releases of radioactive liquids would occur at the proposed facility. Radiological and nonradiological impacts from accidents would be SMALL for workers if the applicant's radiation safety and incident response procedures in an NRC-approved radiation protection plan are followed, and SMALL for the public due to the site's remote location. The non-radiological public and occupational health and safety impacts from normal operations and accidents, due primarily to risk of chemical exposure, would be SMALL if handling and storage procedures are followed.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities involve activities similar to those during operations (e.g., operation of wellfields, treatment of liquid effluent and disposal) the impact on public and occupational health and safety would be similar to that described for the ISR operations phase. The radiation dose would be less than that associated with operations and there would be a localized, SMALL impact on workers and the general public (primarily from radon gas). The nonradiological public and occupational health and safety impacts from normal aquifer restoration and accidents, due primarily to risk of chemical exposure would be SMALL if handling and storage procedures are followed. The reduction or elimination of some operational activities would further reduce the magnitude of potential worker and public health impacts and safety hazards

Decommissioning: Impacts would be SMALL. The potential impact decreases as both radiological and non-radiological hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to pre-operational conditions. To ensure safety of the workers and the public during decommissioning, NRC requires licensed facilities to submit a decommissioning plan for review. During all phases, the plan would also need to show that workers and public doses would be compliant with 10 CFR Part 20 limits. An approved plan would also provide as low as reasonably achievable (ALARA) provisions to further ensure that best safety practices are being used to minimize radiation exposures.

Waste Management

Construction: Impacts would be SMALL. Construction activities at the ISR facility would be relatively small-scale, and sequential wellfield development would generate low volumes of construction waste. Most of the solid wastes expected to be generated at the proposed Lost Creek ISR Project during the construction phase would be piping and general construction debris including paper, wood, plastic, and scrap metal. These nonhazardous solid wastes would be disposed of at a licensed solid waste facility. Hazardous construction wastes, such as organic solvents, paints, used oil, and paint thinners would be disposed of in accordance with

the requirements in the *Resource Conservation and Recovery Act* (RCRA). No radioactive wastes would be generated during this ISR phase.

Operation: Impacts would be SMALL. Operational wastes would primarily be liquid waste streams consisting of process bleed (generally 1 to 3 percent of the process flow rate). Additionally, liquid effluent would be generated from well development, flushing of depleted eluent 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 would ensure that proper practices, as well as obtaining appropriate permits, are implemented to comply with safety requirements to protect workers and the public. The applicant possesses an Underground Injection Control (UIC) permit from the WDEQ for five disposal wells to dispose of the liquid effluents through deep well disposal. The applicant estimates that approximately 61 to 77 m^3 [80 to 100 yd^3] of solid byproduct material would annually be generated during operations and stored onsite until shipment to a licensed disposal facility. Nonhazardous solid waste such as facility trash, tires, septic solids, piping, valves, and instrumentation, would be reused, recycled, or disposed of at a nearby landfill, which has available disposal capacity.

Aquifer Restoration: Impacts would be SMALL. Water from aquifer restoration would be treated through a combination of ion exchange and reverse osmosis and reinjected into the production aquifer to limit the volume of water permanently withdrawn. Concentrated liquid effluent generated by these activities would be disposed of via deep well disposal.

Decommissioning: Impacts would be SMALL. The goal of decommissioning is to reduce potential impacts by removing contaminants to allowable (regulatory) levels and restoring the property and lands to preoperational conditions. The applicant proposes to recycle much of the process equipment and materials or to reuse it at other ISR sites. The applicant would remove sludge from the storage ponds and liners and dispose of this material at a licensed facility. The volume of nonhazardous waste that would be generated from decommissioning would result in an annual solid waste disposal volume of approximately 528 m^3 [690 yd^3], which is less than that evaluated in the GEIS and would be less than one percent of the annual waste disposal at the Sweetwater County landfill. A preoperational agreement with a licensed disposal facility to accept byproduct material would ensure the availability of sufficient disposal capacity for decommissioning activities. If hazardous waste is generated by decommissioning activities, it would be handled in accordance with applicable standards.

CUMULATIVE IMPACTS

The cumulative impact on the environment that results from the incremental impact of the proposed licensing action when added to other past, present, and reasonably foreseeable future actions was also considered, regardless of what agency (federal or nonfederal) or person undertakes such other actions. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Lost Creek ISR Project would not contribute perceptibly to increases in cumulative impacts, due primarily to the extensive exploration taking place in the area for uranium, oil, and gas, and from coal mining.

SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the proposed action would generate primarily regional and local costs and benefits. The regional benefits of building the proposed project would be increased

employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed Lost Creek ISR Project are, for the most part, limited to the area immediately surrounding the site. The NRC staff determined that the benefit from constructing and operating the facility would outweigh the environmental and social costs.

COMPARISON OF ALTERNATIVES

Under the No-Action alternative, the NRC would not issue a license to LCI to construct, operate, restore the aquifer and decommission the proposed Lost Creek ISR Project. The land would be available for other uses. There would be no incremental increase in traffic on local roads attributable to the proposed action. No land disturbing activities associated with the proposed action would occur to disrupt grazing patterns, vegetation, historic and cultural resources nor would there be increased fugitive dust and diesel emissions associated with the proposed project. The groundwater would be unaffected since no wells would be drilled to either extract uranium or to dispose of liquid effluent. There would be no socioeconomic impact attributable to the proposed action.

The other alternative considered, the production of dried yellowcake at the proposed Lost Creek ISR Project site, would result in impacts comparable to those from the proposed action because the footprint of the proposed facility (buildings and wellfields) would not change. The production of dry yellowcake would result in a smaller transportation impact because there would be less local truck traffic compared to the proposed action. The addition of the yellowcake dryer would not change the facility footprint because the facility as designed for the proposed action includes space for the dryer. The estimated air quality impacts would be SMALL because the dryer would operate under a negative pressure.

FINAL RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action. Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that the source material license be issued as requested. This recommendation is based upon (i) the license application, including the environmental report the applicant submitted and the applicant supplemental letters and responses to NRC requests for additional information; (ii) consultation with Federal, State, Tribal, and local agencies; (iii) NRC independent review; (iv) NRC consideration of comments received on the draft SEIS; and (v) the assessments summarized in this SEIS.

ABBREVIATIONS/ACRONYMS

Ac	acres
AADT	annual average daily traffic count
ADAMS	Agencywide Documents Access and Management System
ACL	Alternate Concentration Limit
AEA	*Atomic Energy Act*
ALARA	as low as reasonably achievable
AML	appropriate management level
AMSL	above mean sea level
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
AQD	Air Quality Division
ARPA	Archaeological Resources Protection Act of 1979
AUM	annual unit months
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	best management practice
CAA	*Clean Air Act*
CBM	coal bed methane
CFR	*Code of Federal Regulations*
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	*Code of Federal Regulations*
CO	carbon monoxide
CR	County Route
CWA	*Clean Water Act*
dB	decibels
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENSR	ENSR Corporation
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERP	emergency response plan
ESA	*Endangered Species Act of 1973*
ESTHPO	Eastern Shoshone Tribal Historic Preservation Office
FHWA	Federal Highway Administration
FONSI	finding of no significant impact
FO	Field Office
FR	*Federal Register*
FSME	Office of Federal and State Materials and Environmental Management Programs
FWS	U.S. Fish and Wildlife Service

GCRP	U.S. Global Change Research Program
GEIS	Generic Environmental Impact Statement
GHG	greenhouse gas
gpm	gallons per minute
ha	hectares
HDPE	high-density polyethylene
HMAs	herd management areas
I	Interstate
ISL	*in-situ* leach
ISR	*in-situ* recovery
kph	kilometers per hour
LCI	Lost Creek ISR, LLC
LQD	Land Quality Division
Lpm	liters per minute
MBHFI	Migratory Birds of High Federal Interest
MBTA	*Migratory Bird Treaty Act*
MCL	Maximum Contaminant Level
MIT	mechanical integrity test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	miles per hour
MSDS	material safety data sheets
NAAQS	National Ambient Air Quality Standards
NATHPO	Northern Arapaho Tribal Historic Preservation Office
NCDC	National Climatic Data Center
NCRP	National Council for Radiation Protection
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966, as amended
NMSS	Nuclear Materials Safety and Safeguards
NO	nitrogen oxides
NOAA	National Oceanographic and Atmospheric Administration
NOA	Notice of Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ORV	off-road vehicles
OSHA	Occupational Safety and Health Administration
OMB	Office of Management and Budget

PA	Programmatic Agreement
Pb	lead
PDR	Public Document Room
PM	particulate matter
PR	passive gamma radiation samplers
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PVC	polyvinyl chloride
RAI	Request for Additional Information
RCRA	*Resource Conservation and Recovery Act*
RFO	Rawlins Field Office
RMP	Resource Management Plan
ROD	Record of Decision
ROI	region of influence
RTV	Restoration Target Value
SDWA	*Safe Drinking Water Act*
SEIS	Supplemental Environmental Impact Statement
SEO	State Engineer's Office
SER	Safety Evaluation Report
SERP	Senior Executive Review Panel
SGIT	Sage-Grouse Implementation Team
SHPO	State Historic Preservation Office
SO	sulfur oxides
SR	State Route
SWCSWD	Sweetwater County Solid Waste District
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TEDE	Total Effective Dose Equivalent
TDS	total dissolved solids
THPO	Tribal Historic Preservation Office
TPQ	Threshold Planning Quantity
TQ	Threshold Quantity
TR	Technical Report
TSCA	*Toxic Substances Control Act*
TSS	total suspended solids
TSD	Treatment, Storage, or Disposal
UCL	upper control limits
UIC	underground injection control
UMTRCA	*Uranium Mill Tailings Radiation Control Act*
US (U.S.)	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USDW	underground source of drinking water

USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compounds
VRM	Visual Resource Management
WDE	Wyoming Department of Education
WDEQ	Wyoming Department of Environmental Quality
WDOE	Wyoming Department of Employment, Research, and Planning
WDOR	Wyoming Department of Revenue
WGFD	Wyoming Game and Fish Department
WNDD	Wyoming Natural Diversity Database
WQD	Water Quality Division
WUS	Waters of the United States
WS	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System

1 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) prepared this Supplemental Environmental Impact Statement (SEIS) in response to an application Lost Creek ISR, LLC [LCI (referred to herein as the applicant)] submitted on October 30, 2007, to develop and operate the proposed Lost Creek *In-Situ* Uranium Recovery (ISR) Project (herein referred to as Lost Creek ISR Project), located in Sweetwater County, Wyoming (LCI, 2007a,b). The applicant subsequently withdrew the application and later resubmitted it along with supporting documentation on March 31, 2008 (LCI, 2008a–d). Figure 1-1 shows the geographic location of the proposed project. The applicant is a wholly owned subsidiary of UR-Energy USA, Inc. This site-specific SEIS supplements the Generic Environmental Impact Statement (GEIS) for *In-Situ* Leach Uranium Milling Facilities (herein referred to as GEIS) in accordance with the process described in GEIS Section 1.8 (NRC, 2009a) and as detailed in Section 1.4.1 of this chapter.
The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, Energy, of the *U.S. Code of Federal Regulations* (10 CFR), Part 51. These regulations implement the requirements of the *National Environmental Policy Act of 1969* (NEPA), as amended (Public Law 91-190), which requires the Federal government to assess the potential environmental impacts of major federal actions that may significantly affect the human environment.

The GEIS used the terms "*in-situ* leach (ISL) process" and "11e.(2) byproduct material" to describe this uranium milling technology and the waste stream generated by this process. For the purposes of this SEIS, ISR is synonymous with ISL. The SEIS also uses the term "byproduct material" instead of "11e.(2) byproduct material" to describe the waste stream generated by this milling process to be consistent with the definition in 10 CFR 40.4.

In May 2009, the applicant notified NRC that it had exceeded the limits on construction as defined in 10 CFR 40.32(e) (LCI, 2009). Subsequently, by letter dated July 2, 2009, the applicant submitted an exemption request to NRC from the "commencement of construction" provisions of 10 CFR Part 40.32(e) for certain activities described in its request. NRC prepared a technical evaluation report (TER) and environmental assessment (EA) with a finding of no significant impact (FONSI) (75 FR 17167, April 5, 2010) before granting the exemption request by letter dated April 6, 2010 (NRC, 2010a) for certain specified activities that included leveling and surfacing the area around the proposed plant and maintenance building, constructing the plant and maintenance building (excluding construction of areas where radioactive materials are processed) installing household septic systems, fences, power lines and upgrading existing road access.

1.2 Proposed Action

On March 20, 2008, LCI initiated the proposed federal action by submitting an application for an NRC source material license to construct and operate an ISR facility at the proposed Lost Creek ISR Project site and to conduct aquifer restoration, site decommissioning, and reclamation activities. Based on the application, the NRC's federal action is the decision to either grant or deny the license. The applicant's proposal is discussed in detail in SEIS Section 2.1.1.

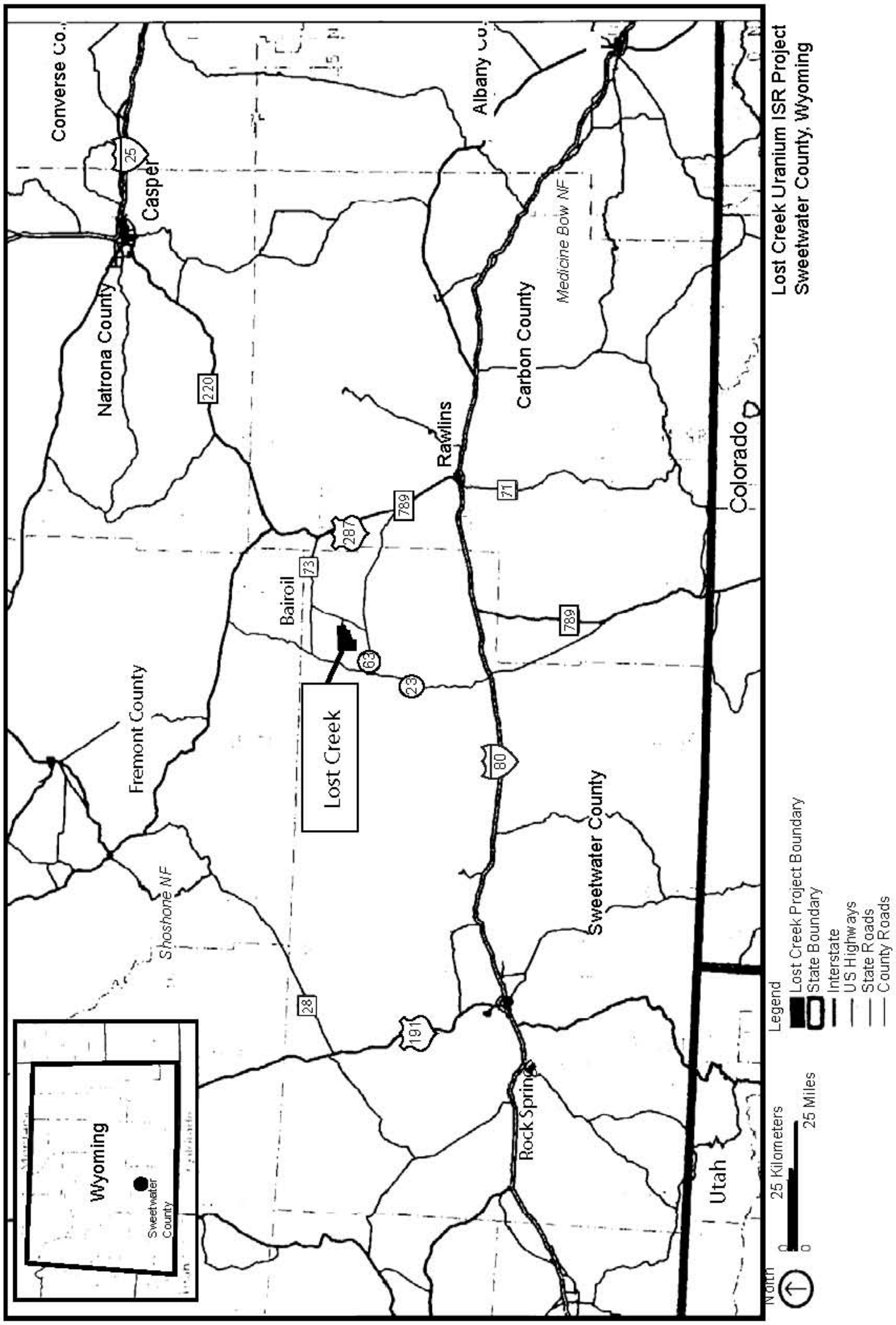

Figure 1-1. Project Location
Source: (LCI, 2008a)

1.3 Purpose and Need of the Proposed Action

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, Domestic Licensing of Source Material. The applicant is seeking an NRC source material license to authorize commercial-scale ISR at the proposed Lost Creek ISR Project site. The purpose and need for the proposed action is to provide an option that allows the applicant to recover uranium and to produce yellowcake slurry at the Lost Creek ISR Project site. Yellowcake slurry is further processed and dried to produce yellowcake. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce various products, including fuel for commercially operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the *Atomic Energy Act of 1954* (AEA), as amended, or findings in NEPA, environmental analysis that would lead NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

1.4 Scope of the Supplemental Environmental Analysis

The NRC staff prepared this SEIS to analyze the environmental impacts (i.e., direct, indirect, and cumulative impacts) of the proposed action and of reasonable alternatives to the proposed action. The scope of this SEIS considers both radiological and nonradiological (including chemical) impacts associated with the proposed action and its alternatives. This SEIS also considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and the irreversible and irretrievable commitments of resources.

1.4.1 Relationship to the GEIS

As described in SEIS Section 1.1, this SEIS supplements the GEIS, published as a final report in May 2009 (NRC, 2009a). The final GEIS assessed the environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility that could be located in four specific geographic regions of the western United States. The proposed Lost Creek ISR Project is located in one of the regions, the Wyoming West Uranium Milling Region. Table 1-1 summarizes the expected environmental impacts by resource area in the Wyoming West Uranium Milling Region based on the GEIS analyses.

The NRC staff considers the GEIS scoping process to be sufficient for the purposes of defining the scope of this SEIS. NRC accepted public comments on the scope of the GEIS from July 24, 2007, to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming. Additionally, NRC held eight public meetings to receive comments on the draft GEIS, published in July 2008. Three of these meetings were held in the State of Wyoming. Comments on the draft GEIS were accepted between July 28, 2008, and November 8, 2008. Comments received during scoping and on the draft GEIS were made available on the NRC website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of the scoping meeting and draft GEIS comment meetings in Wyoming are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report was provided as GEIS Appendix A and GEIS Appendix G provides responses to public comments (NRC, 2009a).

Table 1-1. ISL GEIS Range of Expected Impacts in the Wyoming West Uranium Milling Region

Resource Area	Construction	Operation	Aquifer Restoration	Decommissioning
Land Use	S to L	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S	S to M	S	S
Groundwater	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S to L	S	S
Air Quality	S	S	S	S
Noise	S to M	S to M	S to M	S
Historical and Cultural Resources	S to L	S to L	S to L	S to L
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S to M	S to M
Public and Occupational Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S
S: SMALL impact M: MODERATE impact L: LARGE impact Source: NRC, 2009a				

This SEIS was prepared to fulfill the requirement at 10 CFR 51.20(b)(8) to prepare either an Environmental Impact Statement (EIS) or supplement to an EIS for the issuance of a source material license for an ISR uranium recovery facility (NRC, 2009a). The GEIS provides a starting point for NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. As described in the GEIS, the GEIS provides criteria for each environmental resource area to assess the significance level of impacts (i.e., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific conditions at the proposed Lost Creek ISR Project. This SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions concerning environmental impacts. The extent to which NRC incorporates the GEIS impact conclusions depends on the consistency between (i) the applicant's proposed facilities and activities, and conditions at the Lost Creek ISR Project site and (ii) the reference facility description, and activities, and information in the GEIS. NRC determinations regarding environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are described in SEIS Chapter 4. GEIS Section 1.8.3 describes the relationship

between the GEIS and the conduct of site-specific reviews as documented in this SEIS (NRC, 2009a).

1.4.2 Public Participation Activities

As part of the preparation of this SEIS, NRC staff met with Federal, State, and local agencies and authorities during the course of an expanded visit to the proposed Lost Creek ISR Project site and vicinity in January 2009 (NRC, 2009b). The purpose of these meetings was to gather additional site-specific information to assist the NRC environmental review of the proposed action and to determine whether site-specific information was consistent with that considered in the GEIS. As part of information gathering, the NRC staff also contacted potentially interested Native American tribes and local authorities, and public interest groups in person and via e-mail and telephone.

NRC staff published a Notice of Opportunity for Hearing on the proposed Lost Creek ISR Project license application in the *Federal Register* (FR) on July 10, 2008 (73 FR 39728). No hearing requests were received. NRC staff published a Notice of Intent to prepare this SEIS on September 3, 2009 (74 FR 45656).

On December 11, 2009, NRC published a Notice of Availability (NOA) for the draft SEIS for the proposed Lost Creek ISR Project in the Federal Register (74 FR 65806). The NOA stated that public comments be submitted by February 2, 2010. Members of the public were invited and encouraged to submit comments electronically, by mail, or by facsimile. On February 5, 2010, NRC extended the public comment period to March 3, 2010 (75 FR 6065), in response to requests for extension submitted in comment letters and e-mails. The 81-day period for public comments (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations.

The NRC staff identified 631 comments from the 23 documents commenting on the Lost Creek draft SEIS. Appendix B details how NRC staff systematically identified and responded to each comment. A response is provided in Appendix B for each comment or group of comments identified and indicates whether the SEIS was modified in response to the comment.

In addition to the opportunities provided through the NEPA process, NRC provided multiple opportunities for public involvement during the NRC staff's safety review. Specifically, the NRC staff held six meetings or teleconferences with the applicant from 2006 through 2010. Each of these activities included an opportunity for public comment.

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Lost Creek ISR Project license application, NRC staff conducted an independent, detailed, comprehensive evaluation of the environmental impacts from construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Lost Creek ISR Project site and from reasonable alternatives. As described in GEIS Section 1.8.3, the GEIS: (i) evaluated the types of environmental impacts that may occur from ISR uranium milling facilities, (ii) identified and assessed generic impacts (i.e., the same or similar) at all ISR facilities (or those with specified facility or site characteristics), and (iii) determined the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS would be addressed in site-specific reviews, certain

resource areas would require a more detailed site-specific analysis, because the GEIS determined a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result, depending upon site-specific conditions (see Table 1-1).

Based on the GEIS analyses, this SEIS provides a more detailed analysis of the following resource areas:

- Land Use
- Transportation
- Geology and Soils
- Transportation
- Surface Water
- Groundwater
- Terrestrial Ecology
- Threatened and Endangered Species
- Air Quality
- Noise
- Historic and Cultural Resources
- Socioeconomics
- Public Health and Safety
- Waste Management

Furthermore, certain site-specific analyses not conducted in the GEIS (e.g., assessment of cumulative impacts and analysis of environmental justice) were considered in this SEIS. Additionally, NRC describes the effects from implementing the proposed action on global climate change by estimating the facility's greenhouse gas emissions, and also describes the effects of global climate change on the proposed action based on a 10-year licensing period.

1.4.4 Issues Outside the Scope of the SEIS

Some issues and concerns raised during the scoping process on the GEIS (NRC, 2009a, Appendix A) were determined to be outside the scope of the GEIS. These issues and concerns (e.g., general support or opposition for uranium milling, impacts associated with conventional uranium milling, comments regarding the alternative sources of uranium feed material, comments regarding energy sources, requests for compensation for past mining impacts, and comments regarding the credibility of NRC) are also outside the scope of this SEIS.

1.4.5 Related NEPA Reviews and Other Related Documents

A number of NEPA documents (EAs) and EISs and other documents were reviewed and used in the development of this SEIS. The related NEPA reviews are described next:

- **NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities, Final Report (NRC, 2009a)**. As described previously, this GEIS was prepared to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in one of four different geographic regions of the western U.S. including the Wyoming West Uranium Milling Region, where the proposed Lost Creek ISR Project would be located. The environmental analysis in this SEIS both tiers and incorporates by reference from the GEIS.

- **NUREG–0706, Final Generic Environmental Impact Statement on Uranium Milling (NRC, 1980)**. This EIS provided a detailed evaluation of the impacts and effects of anticipated conventional uranium milling operations in the United States through the year 2000, including an analysis of tailings disposal programs. NUREG–0706 concluded the environmental impacts from underground mining and conventional milling would be more severe than using ISR technology. As described in SEIS Section 2.2.1, conventional mining and milling were considered, but eliminated from detailed analysis at the proposed Lost Creek ISR Project.

- **NUREG–1508, Final Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico (NRC, 1997)**. This EIS evaluated the use of ISR technology at the Church Rock and Crownpoint sites at Crownpoint, New Mexico. Alternative uranium mining methods were not evaluated, because the uranium ore located at the proposed sites was too deep to be extracted economically and the final EIS concluded underground mining would have more significant environmental impacts than ISR recovery.

- **NRC's Safety Evaluation Report**. The NRC staff prepared a Safety Evaluation Report (SER) for the proposed Lost Creek ISR Project that evaluates the applicant's proposed facility design, operational procedures, and radiation protection programs and whether the applicant's proposed action can be accomplished in accordance with the applicable provisions in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The SER also provides the NRC staff analysis of the applicant's initial funding estimate to complete site decommissioning and reclamation.

- **Bureau of Land Management (BLM) Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Lost Creek *In-Situ* Uranium Recovery Project in Sweetwater County, Wyoming (76 FR 7877)**. The BLM published a NOI to prepare an EIS for the Lost Creek ISR Project, which is located on public lands administered by the BLM and to initiate public scoping. Three Native American Tribes were invited to be cooperating agencies in the BLM EIS process.

- **Lost Creek ISR, LLC Lost Creek Project Application for Wyoming Department of Environmental Quality (WDEQ) Permit to Mine (LCI, 2010)**. The applicant submitted an original application for a permit to mine to WDEQ-LQD in December, 2007 which laid out the applicants initial plans to extract uranium at the Lost Creek site. The permitting of such a facility allows for limited work to gain additional knowledge through drilling, testing, and collection of baseline data.

- **Wind Dancer Natural Gas Development Project EA (BLM, 2004)**. This EA was prepared for the Wind Dancer Natural Gas Development Project that would explore and develop natural gas resources within the jurisdiction of the BLM Rawlins Field Office. This EA was prepared to analyze impacts associated with the construction, drilling, production, maintenance, and reclamation of natural gas wells northwest of Rawlins, Wyoming. Because of its proximity to the Lost Creek site, it was considered in the analysis of cumulative impacts.

- **Stewart Creek-Lost Creek Excess and Stray Wild Horses Removal (BLM, 2006)**. The Great Divide Resource Management Plan, as amended, identifies three wild horse herd management areas (HMAs) within which wild, free-roaming horses would be managed in a

humane, safe, efficient, and environmentally sound manner. Two of the HMAs overlap the proposed Lost Creek license area and would be directly affected by the proposed action. The EA analyzed the impacts associated with the BLM's proposal to remove excess and stray wild horses from the Stewart Creek and Lost Creek Wild Horse HMAs and nearby areas (North of Interstate-80 and West of Highway 287.

- **Rawlins Field Office Planning Area Resource Final EIS (BLM, 2008)**. This 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 eastern Sweetwater Counties, Wyoming. This EIS identifies activities occurring in the region surrounding the Lost Creek site that could either affect or be affected by the proposed Lost Creek project.

- **Red Desert Complex Wild Horse Gather (BLM, 2009)**. Antelope Hills, Crooks Mountain, Green Mountain, Stewart Creek and Lost Creek Wild Horse HMAs, 4700 (WYD03), BLM Rawlins, and Lander Offices prepared this EA to disclose and analyze the environmental consequences of gathering excess wild horses in the Red Desert Wild Horse HMA Complex. The HMAs included in this complex are Lost Creek, Stewart Creek, Green Mountain, Crooks Mountain, and Antelope Hills. This document describes the overpopulation of wild horses in the Great Divide Basin in which the Lost Creek site is located.

1.5 Applicable Regulatory Requirements

NEPA establishes national environmental policy and goals to protect, maintain, and enhance the environment and provide a process for implementing these specific goals for those Federal agencies responsible for an action. This SEIS was prepared in accordance with NEPA requirements, NRC-implementing regulations in 10 CFR Part 51, and other regulations that were in effect at the time of writing. GEIS Appendix B summarizes other Federal statutes, implementing regulations, and Executive Orders that are potentially applicable to environmental reviews for the construction, operation, aquifer restoration, and decommissioning of an ISR facility. GEIS Sections 1.6.3.1 and 1.7.5.1 summarize the State of Wyoming's statutory authority pursuant to the ISR process, relevant state agencies that are involved in the permitting of an ISR facility, and the range of state permits that would be required (NRC, 2009a).

1.6 Licensing and Permitting

NRC has statutory authority through the AEA, as amended by the Uranium Mill Tailings Radiation Control Act to regulate uranium ISR facilities. In addition to obtaining an NRC license, uranium ISR facilities must obtain the necessary permits from the appropriate Federal, State, local and Tribal governmental agencies. The NRC licensing process for ISR facilities was described in GEIS Section 1.7.1. GEIS Sections 1.7.2 through1.7.5 describe the role of the other Federal, Tribal, and State agencies in the ISR permitting process (NRC, 2009a). This section of the SEIS summarizes the status of the NRC licensing process at the proposed Lost Creek ISR Project site and the status of the applicant's permitting with respect to other applicable Federal, Tribal, and State requirements. Section 1.6.1 describes the NRC licensing process, and Section 1.6.2 describes the status of other required permits.

1.6.1 NRC Licensing Process

By letter dated March 20, 2008, the applicant submitted a final (revised) license application to NRC for the proposed Lost Creek ISR Project (LCI, 2008a,b). As described in GEIS Section 1.7.1, NRC initially conducts an acceptance review of a license application to determine whether the application is complete enough to support a detailed technical review. The NRC staff accepted the Lost Creek ISR Project license application for detailed technical review by letter dated June 10, 2008 (NRC, 2008a).

The NRC's detailed technical review of the license application is composed of both a safety review and an environmental review. These two reviews are conducted in parallel (see GEIS Figure 1.7-1). The focus of the safety review is to assess compliance with the applicable regulatory requirements in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51.

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with the proposed licensing actions. NRC published a Notice of Opportunity for Hearing related to the Lost Creek license application on July 10, 2008 (73 FR 39728; NRC, 2008b). No request for a hearing was received.

1.6.2 Status of Permitting With Other Federal, Tribal, and State Agencies

In addition to obtaining a source material license from NRC prior to conducting ISR operations at the proposed Lost Creek ISR Project site, the applicant is required to obtain permits and approvals from other Federal and State agencies to address (i) the underground injection of solutions and liquid effluent from the ISR process, (ii) the exemption of all or a portion of the ore zone aquifer from regulation under the *Safe Drinking Water Act*, and (iii) the discharge of storm water during construction and operation of the ISR facility.

Table 1-2 lists the status of the required permits and approvals.

1.7 Consultations

As a Federal agency, NRC is required to comply with consultation requirements in Section 7 of the *Endangered Species Act of 1973* (ESA), as amended, and Section 106 of the *National Historic Preservation Act of 1966* (NHPA), as amended. The GEIS took a programmatic look at the environmental impacts of ISR uranium milling within four distinct geographic regions and acknowledged that each site-specific review would include its own consultation process with relevant agencies. Section 7 (ESA) and Section 106 (NHPA) consultations conducted for the proposed Lost Creek ISR Project are summarized in Sections 1.7.1 and 1.7.2. Copies of the consultation correspondence are provided in SEIS Appendix A. Section 1.7.3 describes NRC coordination with other Federal, State, and local agencies conducted during the development of the SEIS.

1.7.1 Endangered Species Act of 1973 Consultation

The ESA was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the ESA requires consultation with the U.S. Fish and Wildlife Service (FWS) to ensure that actions it authorizes, permits, or

Table 1-2. Environmental Approvals for the Proposed Lost Creek ISR Project

Issuing Agency	Description	Status
Wyoming Department of Environmental Quality		
	UIC Class III Permit (WDEQ, Title 35-11)	Class III UIC Permit application submitted December 2007; WDEQ approval in conjunction with approved Permit to Mine estimated third quarter FY11
	Underground Injection Control Class I (Deep Disposal Wells) (WDEQ, Title 35-11)	Final permit issued May 2010
	Storm Water Discharge Permit	Issued January 2010
	Permit to Mine	Application under review (submitted December 2007); estimate permit receipt third quarter FY11
	Mineral Exploration Permit (WDEQ, Title 35-11)	Drill notice received
	Air Quality Permit	Air Quality Permit Application (AP-10490) (submitted June 2008; issued January 2010)
	Permit to Construct Waste Ponds	Permit received from State Engineer's Office June 2010
U.S. Bureau of Land Management	Plan of Operation	Submitted November 2009. BLM NOI to prepare an EIS (February 2011)
U.S. Nuclear Regulatory Commission	Source and Byproduct Materials License (10 CFR Part 40)	Application under review (submitted March 2008; accepted June 2008)
U.S. Environmental Protection Agency	Aquifer Exemption Permit for Class I Injection Wells (40 CFR 144, 146)	Not required because receiving aquifer contains greater than 10,000 ppm TDS and is not classified as a USDW
	Aquifer Reclassification for Class III Injection Wells (WDEQ, Title 35-11)	Application submitted in conjunction with Permit to Mine
	Permit application to construct holding (storage) ponds (40 CFR 61.07)	Submitted to EPA November 3, 2010; rejected by EPA January 6, 2011.
Sweetwater County	Permit to Construct Sanitary Leach Field	Application submitted June 2009; approved December 2009.
Sweetwater County Planning and Zoning Commission	County Development Permits	Approved December 2009
Board of County Commissioners of Sweetwater County	Certificate of Approval and Acceptance	December 2009
Wyoming Department of Environmental Quality and State Engineer's Office	Permit to Appropriate Groundwater for Mine Units	Applications for permits submitted as needed
	Permit to Appropriate Groundwater for Mine Units	Applications for permits submitted as needed
Source: LCI, 2011.		

otherwise carries out would not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

By letter dated October 3, 2008, NRC staff initiated consultation with FWS requesting information on endangered or threatened species or critical habitat in the proposed Lost Creek ISR Project area. NRC received a response dated November 12, 2008, from the FWS Ecological Services Wyoming Field Office that: (i) listed the threatened and endangered species that may occur in the project area; (ii) discussed obligations to protect migratory birds; (iii) noted the negative impacts that can result from the land application of ISR wastewater; and (iv) recommended avoidance of wetland and riparian areas and protection of sensitive species, such as the mountain plover (*Charadrius montanus*) and Greater sage-grouse (*Centrocercus urophasianus*) (FWS, 2008).

NRC staff also met with the FWS Rawlins Office on January 13, 2009, to discuss site-specific issues (NRC, 2009b). The Rawlins Office staff expressed concern about the potential impacts to sage-grouse, a FWS wait-list species for consideration as either threatened or endangered, and typical sage-grouse mitigation measures were discussed. NRC has regularly communicated with the Wyoming Game and Fish Department (WGFD) concerning the protection of sage-grouse and received meeting summaries from the chairman of the Governor's Sage-Grouse Implementation Team (SGIT).

1.7.2 National Historic Preservation Act of 1966 Consultation

Section 106 of the NHPA requires that Federal agencies take into account the effects of their undertakings on historic properties and allow the Wyoming State Historic Preservation Officer (SHPO) to comment on such undertakings.

NRC initiated consultation with the Wyoming SHPO by letter dated October 3, 2008, requesting information from the SHPO to facilitate the identification of historic and cultural resources that could be affected by the proposed project (NRC, 2008c). A response from the Wyoming SHPO, dated October 23, 2008, stated, to their knowledge, that while several cultural resource surveys were conducted in the area, a majority of the proposed project area had not been surveyed (Wyoming SHPO, 2008). On January 12, 2009, NRC staff met with a representative of the Wyoming SHPO office to discuss site-specific issues, including the detailed cultural resources study conducted by the applicant, the Wyoming SHPO review process, cumulative impacts to historic sites, and best management practices (BMPs) (NRC, 2009b). NRC staff met again, with the WY SHPO on June 25, 2009, to discuss protocol for archaeological sites found eligible for inclusion in the National Register of Historic Places (NRHP). Of the three NRHP eligible sites identified, one site would be adversely affected by the proposed action. By letter dated June 30, 2009, NRC forwarded BLM's treatment plan for this site to the WY SHPO (NRC, 2009c). The letter also stated that a Memorandum of Agreement (MOA) would be executed between the consulting parties.

NRC staff consulted and executed a MOA among the Wyoming SHPO, BLM, Northern Arapaho Tribe, Eastern Shoshone Tribe, and the applicant. The MOA was finalized in October 2010 and is presented Appendix E.

NRC also consulted with potentially affected Native American Tribes as part of the Section 106 consultation process per 36 CFR 800.2(c). These interactions are detailed in Section 1.7.3.3, of the SEIS.

1.7.3 Coordination With Other Federal, Tribal, State, and Local Agencies

The NRC staff interacted with Federal, Tribal, State, and local agencies and/or entities during preparation of this SEIS to gather information on potential issues, concerns, and environmental impacts related to the proposed ISR facility at the Lost Creek ISR Project site. The consultation and coordination process included discussions with BLM, the Bureau of Indian Affairs (BIA), Tribal governments (Eastern Shoshone and Northern Arapaho), the Wyoming Department of Environmental Quality (WDEQ) Land Quality Division (LQD), the Wyoming State Engineer's Office (SEO), and local organizations (Sweetwater County, Town of Bairoil). (NRC, 2009b)

1.7.3.1 Coordination With the Bureau of Land Management

BLM is responsible for administering the National System of Public Lands and the federal minerals underlying these lands. BLM is also responsible for managing split estate situations where federal minerals underlie a surface that is privately held or owned by state or local government. In these situations, operators on mining claims, including ISR uranium recovery operations, must submit a plan of operations and obtain BLM approval before beginning operations beyond those for casual use {for surface disturbance of more than 2 ha [5 ac]}.

While BLM was not a cooperating agency on the preparation of this SEIS [the Memorandum of Understanding (MOU) between NRC and BLM (75 FR 1088) had not been signed at the commencement of the NEPA process], NRC staff coordinated with the BLM staff during the SEIS preparation. BLM provided NRC staff with guidance provided; clarification regarding mineral leases administered on BLM lands; and expressed concerns related to water quality and hydrology, cumulative effects, and socioeconomic impacts (NRC, 2009b).

NRC met with personnel from the BLM Rawlins Field Office from the state office in Cheyenne, and from the Casper FO in January 2009 (NRC, 2009b). During the visit, BLM clarified how mineral leases are administered on BLM lands and expressed concerns related to water quality and hydrology at ISR sites, the cumulative effect from other energy operations (coal, oil and gas, wind energy, and operating ISR facilities) in the vicinity of the proposed ISR sites located in the area, and the socioeconomic impact on the communities surrounding the proposed ISR sites. BLM also provided guidance documents on typical BLM mitigation measures to protect cultural resources and sage-grouse.

Since the January 2009 meetings, the NRC staff has regularly consulted with the Wyoming BLM offices regarding progress on the staff's environmental review for the proposed Lost Creek ISR Project. NRC shared its preliminary SEIS sections with the Rawlins FO to consider in its development of a NEPA document for the applicant's Plan of Operation and has copied BLM on NRC correspondence with the applicant.

In addition to corresponding with the Wyoming BLM Offices for the proposed Lost Creek ISR Project, NRC staff held quarterly teleconferences to discuss environmental issues relating to all uranium recovery projects, current and planned.

1.7.3.2 Coordination With the Bureau of Indian Affairs

The BIA's mission is to enhance the quality of life; promote economic opportunity; and protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives. BIA is

responsible for the administration and management of more than 27 million ha [66 million ac] of land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives.

NRC staff met with BIA staff in Fort Washakie, Wyoming, on January 15, 2009 (NRC, 2009b). NRC staff briefed BIA on potential ISR facilities proposed in Wyoming and discussed how BIA and Indian tribes would be involved in the NRC environmental review process. BIA stated that tribal governments should be consulted for any proposed projects in the state. BIA also recommended that tribal elders be involved in cultural and historic surveys. The two tribes BIA identified with potential interest in the Lost Creek ISR Project were the Eastern Shoshone and Northern Arapaho.

1.7.3.3 Interactions With Tribal Governments

In response to guidance from the WY SHPO and BIA to implement requirements in Executive Order 13175, "Consultations and Coordination with Indian Tribal Governments," the NRC staff initiated discussions with potentially affected Native American tribes that possess heritage and cultural interest to the proposed Lost Creek ISR Project area. By letter dated January 28, 2009, to the NRC informed the Eastern Shoshone and Northern Arapaho Tribes of the proposed Lost Creek ISR Project (NRC, 2009d).

For reference, consultation letters are presented in Appendix A. The Eastern Shoshone and Northern Arapaho Tribal Historic Preservation Officers (THPOs) were informed of an eligible prehistoric site discovered in the project area and are aware of the progress of the proposed Lost Creek ISR Project. The THPO from the Eastern Shoshone Tribe visited the prehistoric site and determined that while it held no interest to the tribe, they requested to be a signatory on an MOA for the protection of the eligible prehistoric sites. The Northern Arapaho THPO also requested to be invited as signatory to the MOA. The signed MOA (NRC, 2010a) is included as SEIS Appendix E.

1.7.3.4 Coordination With the Wyoming Department of Environmental Quality

NRC staff met with WDEQ in Cheyenne, Wyoming, on January 12, 2009, to discuss the WDEQ role in the NRC environmental review process for ISR facilities (NRC, 2009b). Topics discussed during the meeting included the WDEQ storm water program, air quality review and permitting, and noise quality. WDEQ also clarified its classification of deep injection wells. The WDEQ expressed concern regarding reclamation and restoration and noted that groundwater quality should be returned to baseline conditions. WDEQ requested early involvement in the NRC review of applications for proposed ISR projects in the state. It also emphasized coordination with BLM when ISR projects are located on BLM lands.

NRC staff also met with personnel from the WDEQ-LQD Lander office on January 14, 2009 (NRC, 2009b). The WDEQ-LQD explained the UIC Class III well application process and noted that WDEQ would require wellfield packages and groundwater restoration standards for future ISR operations. WDEQ-LQD staff also stated their position that the parameters in groundwater affected by ISR operations need to be restored to original background levels and expressed concern about potential excursions. Two additional meetings were held with NRC and WDEQ staff (June and September 2009) to discuss groundwater issues.

1.7.3.5 Coordination With the Wyoming Game and Fish Department

WGFD is responsible for controlling, propagating, managing, protecting, and regulating all game and nongame fish and wildlife in Wyoming under Wyoming Statute (W.S.) 23-1-301-303 and 23-1-401. Regulatory authority given to WGFD allows for the establishment of hunting, fishing, and trapping seasons, as well as the enforcement of rules protecting nongame and state-listed species.

NRC staff met with a representative of the Lander Regional WGFD office on January 14, 2009. The main issue discussed was sage-grouse because the proposed project area is located within a WGFD-designated sage-grouse core population area, (i.e., an area containing mating and nesting habitat for the sage-grouse). The project area also includes habitat for a variety of big game animals, raptors, migratory birds, and small mammals that may be affected by the proposed Lost Creek ISR Project. The WGFD's interest also includes impacts to migratory behavior patterns, long-term population sustainability and the effects of local hunting on big game, impacts to nesting raptors, and the loss of sage-grouse core population areas. As discussed in SEIS Section 1.7.3.1, the NRC staff was in regular communication with both WGFD and SGIT before the sage-grouse management guidelines were finalized. The Governor of Wyoming accepted the recommendations of SGIT and on August 18, 2010, issued Executive Order (E.O.) 2010-4 (Wyoming Office of the Governor, 2010) and stipulations for the protection of sage-grouse.

1.7.3.6 Coordination With the Wyoming State Engineer's Office

NRC staff met with the Wyoming SEO on January 12, 2009, to discuss well permitting. The Wyoming SEO was primarily concerned that proposed ISR facilities may degrade the water quality, and that potential groundwater contamination should be constrained to the project site. They also expressed the need for applicants to ensure that there was close, professional supervision of well construction.

1.7.3.7 Coordination With the Wyoming Governor's Planning Office

NRC staff met with the Wyoming Governor's Planning Office on January 13, 2009, and again on June 25, 2009 (NRC, 2009b,c). The Wyoming Governor's Planning Office briefed the NRC on the BLM Resource Management Plan for the Buffalo region. It stated that it is a cooperating agency with BLM and is involved with anything related to natural resources, particularly BLM resource management plans, and with the Wyoming SHPO and WDEQ. It informed NRC of the statewide conservation and management efforts for sage-grouse and noted that the governor has created a management plan for the protection of sage-grouse. It emphasized that potential ISR facilities need to be geographically flexible to protect the sage-grouse core population areas.

1.7.3.8 Coordination With the Wyoming Community Development Authority

NRC staff met with the Wyoming Community Development Authority on January 13, 2009, to discuss housing availability for employees of future potential ISR facilities (NRC, 2009b). It noted that employees would typically look for housing in the communities surrounding ISR projects and this might include hotels, apartments, or single-family homes.

1.7.3.9 Coordination With Localities

NRC staff interacted, by phone and face-to-face with representatives from Sweetwater County, from the Fremont County Planning Department, and the Lander Chamber of Commerce on January 13, and January 14, 2009, to discuss site-specific issues for the proposed Lost Creek ISR Project. Meetings held in the both the Sweetwater and Fremont County offices focused on local economies, housing availability, and community services. Representatives from the Town of Bairoil, the closest community to the Lost Creek ISR Project area, were also present at the Sweetwater County meeting (NRC, 2009b).

1.8 Structure of the SEIS

As noted in Section 1.4.1 of this document, the GEIS (NRC, 2009a) evaluated the broad impacts of ISR projects in a four-state region where such projects are anticipated, but did not reach site-specific decisions for new ISR projects. The NRC staff evaluated the extent to which information and conclusions in the GEIS could be incorporated by reference into this SEIS. The NRC staff also determined whether any new and significant information existed that would change the expected environmental impact beyond what was evaluated in the GEIS.

SEIS Chapter 2 describes the proposed action and reasonable alternatives considered for the proposed Lost Creek ISR Project, Chapter 3 describes the affected environment, and Chapter 4 evaluates the environmental impacts from implementing the proposed action and alternatives. Cumulative impacts are discussed in Chapter 5, while Chapter 6 describes the environmental measurement and monitoring programs proposed for the Lost Creek ISR Project. A cost-benefit analysis is provided in Chapter 7, and the environmental consequences from the proposed action and alternatives are summarized in Chapter 8.

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2 *IN-SITU* URANIUM RECOVERY AND ALTERNATIVES

This chapter describes the proposed action and alternatives for issuance of a U.S. Nuclear Regulatory Commission (NRC) license to Lost Creek *In-Situ* Uranium Recovery *In-Situ* Uranium Recovery (ISR), LLC [LCI (the applicant)] for the construction, operation, aquifer restoration, and decommissioning of the Lost Creek ISR Project. These alternatives include a consideration of the No-Action alternative as required by the *National Environmental Policy Act* (NEPA). Under the No-Action alternative, LCI would not construct, operate, restore the aquifer of, or decommission the proposed Lost Creek ISR Project. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impact of the proposed action and alternatives.

Section 2.1 describes the alternatives considered for detailed analysis, including the proposed action. Section 2.2 describes those alternatives that were considered but eliminated from detailed analysis. Section 2.3 compares the predicted environmental impacts of the proposed action and other alternatives. Section 2.4 sets forth the final NRC staff recommendation on the proposed federal action. Section 2.5 provides references cited for this chapter.

2.1 Alternatives Considered for Detailed Analysis

NRC staff used a variety of sources to determine the range of alternatives to consider for detailed analysis in this final Supplemental Environmental Impact Statement (SEIS). Those sources included the application, including the Environmental Report (ER) (submitted by LCI); the scoping and comments on the draft NUREG–1910, the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS); the information gathered during the NRC staff's site visit in January 2009; comments on the draft SEIS; and multidisciplinary discussions held among NRC staff and various stakeholders. This SEIS evaluates the potential environmental impacts from three alternatives: the Proposed Action (Alternative 1) (SEIS Section 2.1.1), the No-Action (Alternative 2) (SEIS Section 2.1.2), and the Dry Yellowcake (Alternative 3) (SEIS Section 2.1.3).

2.1.1 The Proposed Action (Alternative 1)

Under the proposed action, LCI is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the Lost Creek ISR Project site as described in the license application. The proposed Lost Creek ISR Project includes several facilities and wellfields, also referred to as mine units, which are described in the following sections. The schedule for the proposed action is shown in Figure 2-1. The applicant's proposed action includes disposal via a Class I injection well discussed in SEIS Section 2.1.1.1; however, alternative wastewater disposal options for the proposed action are discussed in SEIS Section 2.1.1.2.

2.1.1.1 Proposed ISR Facility Including Deep Well Injection

The proposed Lost Creek ISR Project includes several facilities and wellfields, which are described in the following sections. The general ISR process is described in GEIS Chapter 2 (NRC, 2009). The schedule for the proposed action is shown in Figure 2-1.

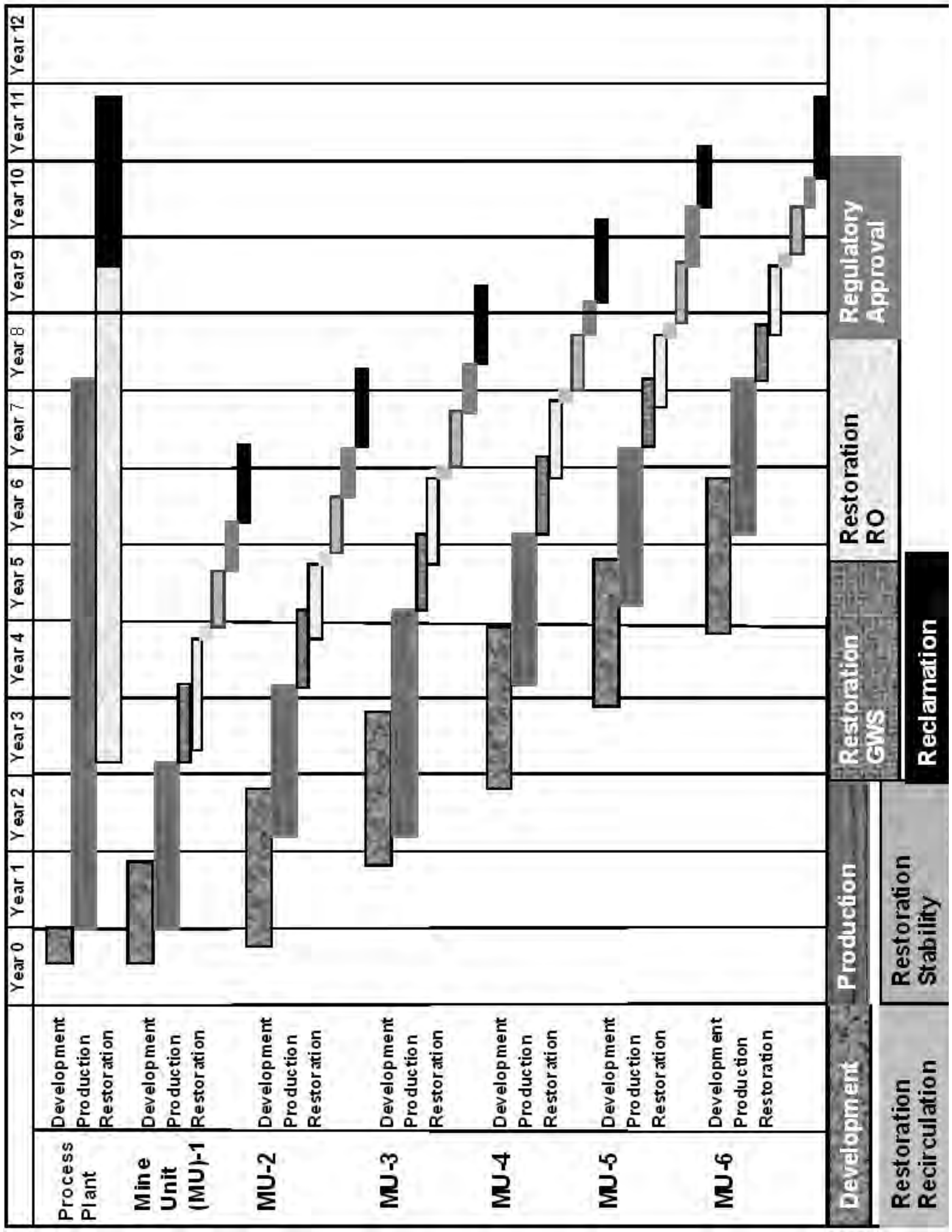

Figure 2-1. Project Schedule
Source: Modified from LCI (2008b)

2.1.1.1.1 Site Description

The Lost Creek ISR Project is located in the Great Divide Basin in the northeastern corner of Sweetwater County, Wyoming, within Township 25N, Range 92W, Sections 16–19 including parts of Sections 20, 30, and 31, and Range 93W, Sections 24, 25, and half of 13 (Figure 2-2). The project site covers approximately 1,722 ha [4,254 ac], including the surface area necessary to develop access roads to the site. Approximately 1,463 ha [3,614 ac] are federally owned Bureau of Land Management (BLM) land, and the State of Wyoming, Office of State Lands and Investment owns 259 ha [640 ac] (Figure 2-2).

The project area is located approximately 113 km [70 mi] southeast of the City of Lander, 145 km [90 mi] southwest of the City of Casper, and approximately 65 km [40 mi] northwest of the City of Rawlins (Figure 1-1). The nearest population center, located 25 km [15 mi] northeast of the project area, is Bairoil, a small town with fewer than 100 people. The principal access to the Lost Creek site from the northwest is via U.S. Highway 287 (U.S. 287)/Wyoming Highway 789 [State Route (SR) 789] to Jeffrey City, then south on Wamsutter-Crooks Gap Road [County Road (CR) 23]. Access from Casper to the northeast is via SR 220 through Alcova to join U.S. 287/SR 789 south at Muddy Gap to the settlement of Lamont. From this point on U.S. 287, the project area can be accessed by following SR 73 west to Bairoil Road and then heading south on Sooner Road (BLM Road 3215) or to the Wamsutter-Crooks Gap Road. Access from the south is via Wamsutter-Crooks Gap Road north from Interstate 80 at Wamsutter (Figure 2-3).

The proposed ISR project is situated near Battle Spring Draw, which drains to Battle Spring Flat, approximately 15 km [9 mi] southwest of the site. Topography at the site is relatively flat, sloping about 20 m per km [100 ft per mi] southeast toward Battle Spring Draw, which is oriented northeast-southwest along the southeast side of the site. Elevations at the site range from about 2,150 to 2,070 m [7,050 to 6,790 ft] above mean sea level. The existing environment surrounding the proposed site is detailed in SEIS Chapter 3.

2.1.1.1.2 Construction Activities

As described in GEIS Section 2.3, general construction activities associated with ISR include drilling wells, clearing and grading associated with road construction and building foundations, trenching, and laying pipelines (NRC, 2009). Construction activities necessary for the development of the proposed Lost Creek ISR Project include (i) site preparation, (ii) buildings such as header houses in the wellfields, administrative offices, process circuits, a groundwater restoration facility, and shop facilities at the processing plant site, (iii) access roads, (iv) wellfields, and (v) other structures and systems.

2.1.1.1.2.1 Site Preparation

The majority of site preparation is related to the processing plant and its ancillary features. An area approximately 90 m × 170 m [300 ft by 550 ft], comprising approximately 1.5 ha [3.8 ac], would need to be leveled and surfaced for the processing plant and its appurtenant structures (maintenance building, storage areas, parking). Vegetation would be removed and topsoil stripped to a depth of 0.3 m [1 ft] over this area. The topsoil would be stockpiled for reuse in accordance with Wyoming Department of Environmental Quality (WDEQ) guidelines.

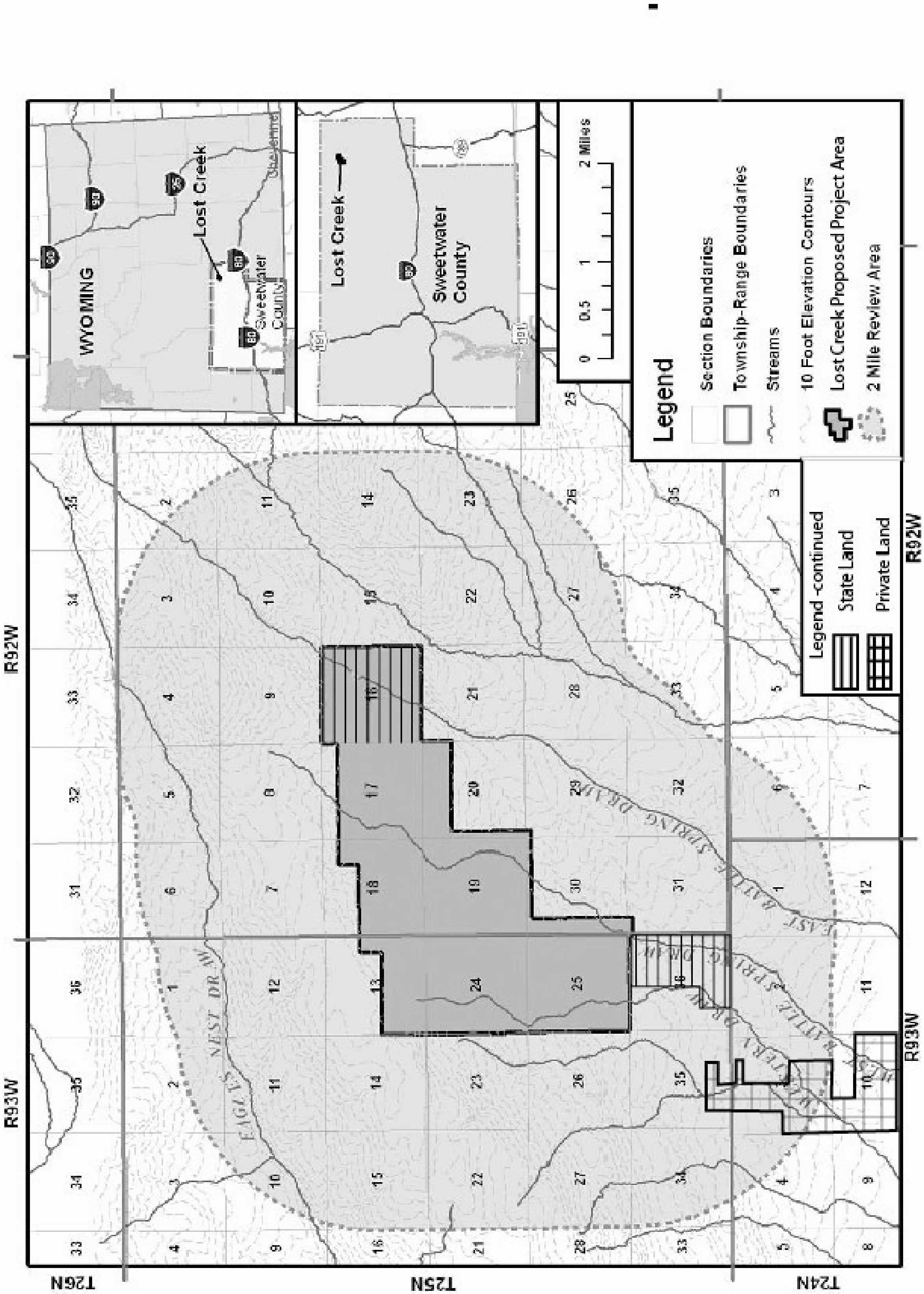

Figure 2-2. Land Ownership
Source: Modified from LCI (2008b)

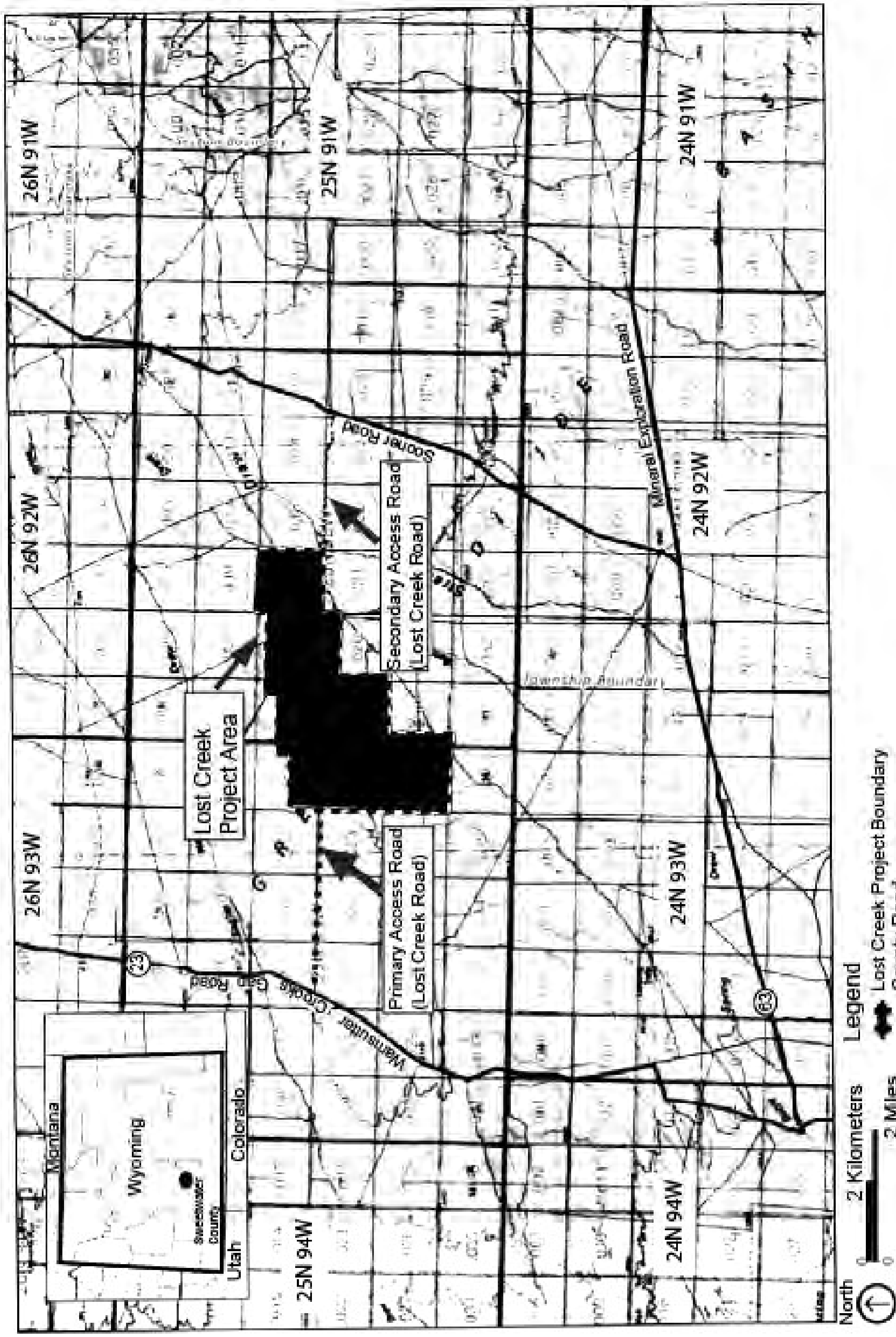

Figure 2-3. Site Access
Source: Modified from LCI (2008a)

All suitable material removed from excavations would be used, to the extent practicable, to level fill areas in the construction of the 1.5-ha [3.8-ac] pad area. All "placed" materials would be compacted in accordance with engineering specifications, and pad surfacing would be compacted gravel, a minimum of 7.6 cm [3 in] thick. (LCI, 2010a; 2008a,b)

The applicant estimates that approximately 115 ha [285 ac] of surface area would be disturbed by facility and infrastructure construction (e.g., access roads, processing plant buildings, wells) during the project life (LCI, 2010a; 2008a,b). Earthmoving equipment, such as rubber tire scrapers and front-end loaders, would be used during construction. The applicant states that about 26,3300 m^3 [34,400 yd^3] of topsoil, as well as subsoil, salvaged during construction activities would be stored in designated topsoil stockpiles located onsite, just northeast of the proposed plant site and done so to minimize loss of material (LCI, 2010b). Topsoil from building sites, permanent storage areas, main access roads, and chemical storage areas prior to construction would also be salvaged in accordance with WDEQ-Land Quality Division requirements (LCI, 2008b).

Heavy equipment expected to be used during construction includes forklifts, backhoes, geophysical logging trucks, flat bed trailers, reel trailers, water trucks, a mechanical integrity testing truck, and cementers. The applicant states that because of a lack of unemployed construction labor in the vicinity of the proposed Lost Creek ISR Project, and the temporary nature of the work, the majority of the workforce would be non-local, commuting from towns and cities outside of the Rawlins/Bairoil area. (LCI, 2008a)

2.1.1.1.2.2 Buildings and Storage (Holding) Ponds

The processing plant and storage ponds are shown in Figure 2-4. The processing plant generates yellowcake slurry by extracting uranium from wellfield solutions via an ion-exchange resin. The uranium is eluted off the resin using a brine solution, precipitated from the brine solution using hydrogen peroxide, and dewatered using a filter press. The structure would be a 49 m by 79-m [160 ft by 260-ft] metal building with a ridge height of 12.5 m [41 ft] and eave heights of 6.7 m [22 ft]. The building would house both uranium processing equipment and office space. Major process equipment housed in the processing plant would include the ion-exchange circuit and the lixiviant[1] make-up circuit the elution/precipitation circuit, and would also include space for a yellowcake drying facility (currently not proposed). Bulk chemical storage tanks containing hydrogen peroxide, caustic soda, sodium chloride, soda ash mix, and a bicarbonate mix would be contained inside the processing plant. Carbon dioxide and hydrochloric acid tanks would be located outside the processing plant (Figure 2-5). An office area would be physically separated from the processing area and would consist of two floors. Other space {12.2 × 24.4 m [40 × 80 ft]} in the processing plant would include change rooms, restrooms, and an onsite laboratory.

The applicant proposes to have at least two auxiliary buildings: (i) a maintenance building consisting of a preengineered steel structure {16.8 × 41.2 m [55 × 135 ft] with a 4.6-m [15-ft] outside wall height} located adjacent to the processing plant and (ii) a driller's shed for storage

[1]A lixiviant is defined as a leachate solution composed of native groundwater and chemicals (such as sodium carbonate/bicarbonate, ammonia, or sulfuric acid) added by the ISR facility operator. In the ISR process, the lixiviant is pumped underground for the purpose of mobilizing (dissolving) uranium from a uranium ore body (NRC, 2009).

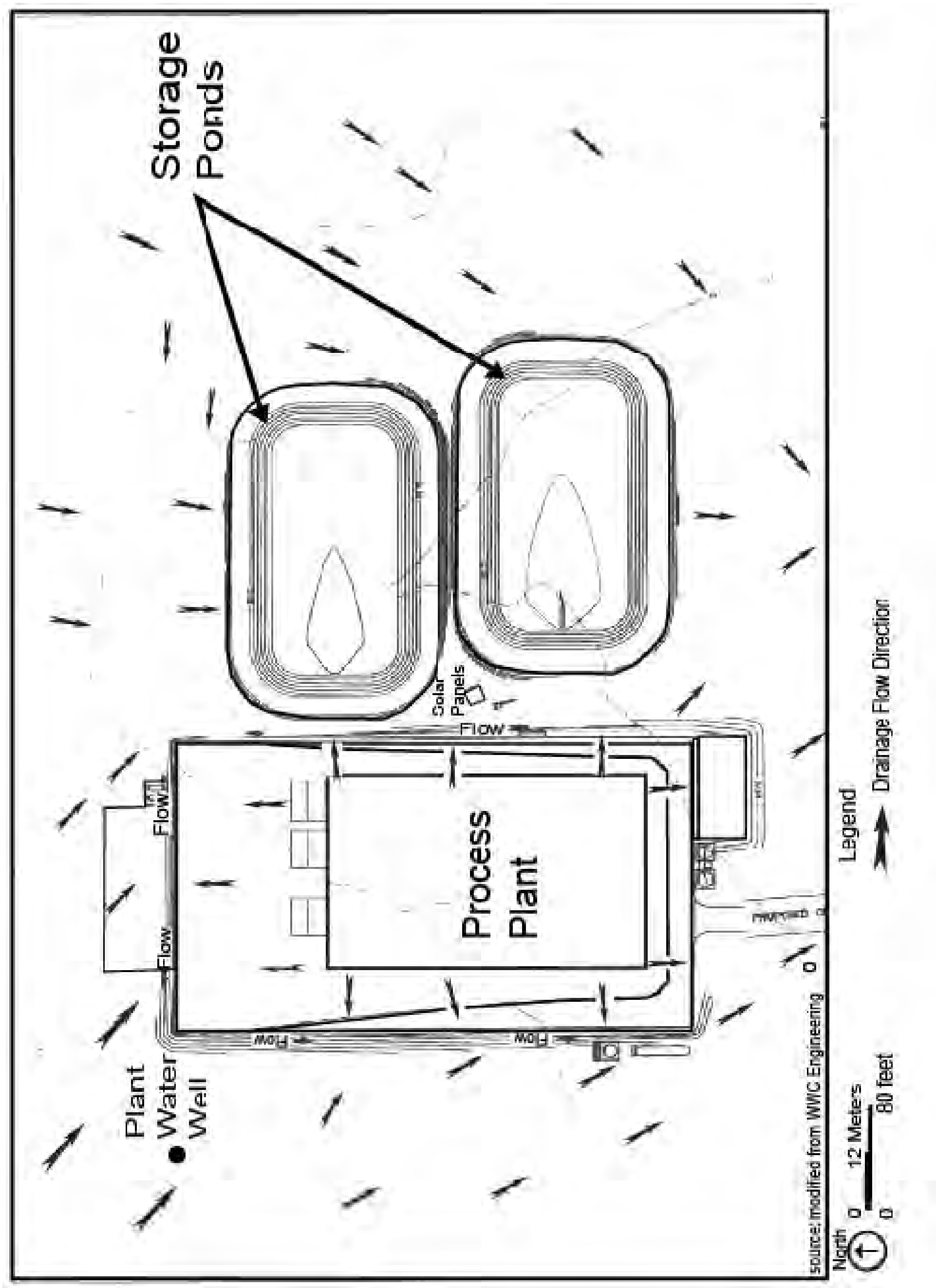

Figure 2-4. Process Facility Layout
Source: Modified from LCI (2008a)

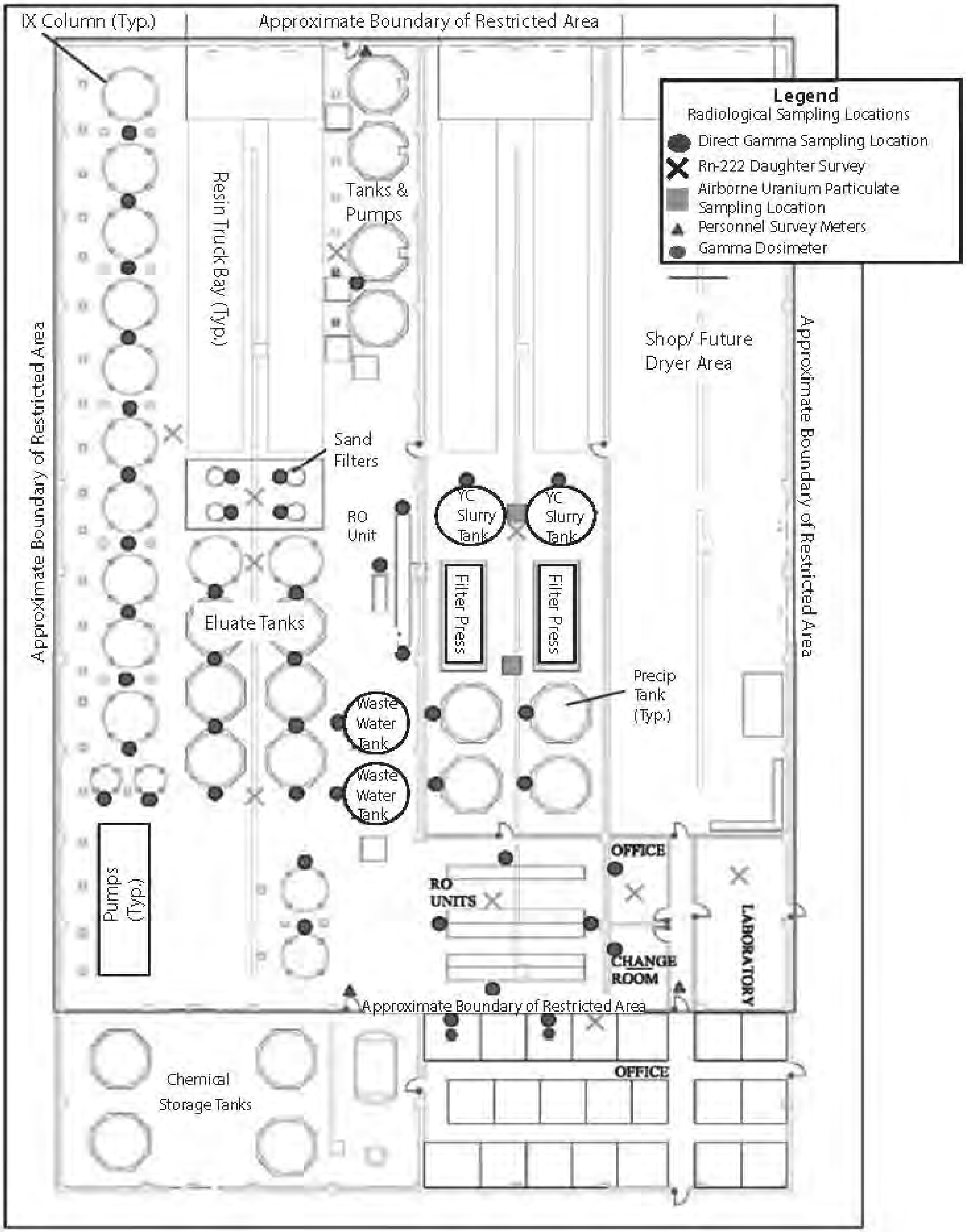

Figure 2-5. Internal Processing Plant Floorplan
Source: Modified from LCI (2008b)

of control equipment and tools, and storage of inventories {12.2 × 12.2m [40 × 40 ft], with a 4.3-m [14-ft] outside wall height}.

The processing plant would be constructed on a concrete slab with curbs to contain spills and prevent liquid releases to the environment. The concrete slab (floors) would be designed to support the full weight of any vessel and its contents and would be designed to meet all building codes and standards. Outside vessel storage locations, including fuel (gasoline, diesel, and hydrochloric acid), would be constructed with curbed secondary containment for tanks. The applicant's proposed engineering and controls and operational monitoring program are designed to allow spills and leaks to be quickly detected and minimized (LCI, 2008b). Leaks from vessels and equipment, including water from equipment washdown, would drain to a sump where the liquid effluent would collect for appropriate treatment and disposal (LCI, 2010a; 2008a,b).

LCI also proposes to construct two storage ponds (also referred to as holding ponds) in Blue Gulch, a tributary to Battle Spring Draw (Figure 2-4) (LCI, 2008b; Wyoming State Engineer's Office, 2010). These ponds would provide temporary storage capacity for liquid byproduct material such as groundwater produced during aquifer restoration, affected groundwater from well development and sample collection, and liquid process wastes such as production bleed, eluant bleed, and yellowcake wash water. The design dimensions for each pond are 155 ft × 260 ft [47.2 m × 79.2 m] with a surface area of about .39 ha [0.96 ac]. The proposed capacity of each pond is about 2.8 million L [750,000 gal], and the maximum depth would be about 2 m [6 ft]; LCI would retain about 1 m [3 ft] of freeboard between the top of the water surface and the inside crest of the pond embankment. Finally, the ponds would be designed with a double geosynthetic liner and a leak detection system, with a series of monitoring wells installed to detect leaks into the surrounding sediments. LCI would monitor the leak detection system and the monitoring wells with a frequency established by NRC license condition. Storage ponds of this type are also permitted by the State, and LCI received Permit No. 13595R from the Wyoming State Engineer's Office on May 28, 2010 (Wyoming State Engineer's Office, 2010). The permit establishes a total capacity limit for the system of about 5.6 million L [4.58 ac-ft].

2.1.1.1.2.3 Access Roads

The proposed Lost Creek ISR Project area lies between Wamsutter-Crooks Gap Road (CR 23) to the west and Sooner Road (BLM Road 3215) to the east (Figure 2-3), both maintained gravel roads. Principal site access would be from the west, off the Wamsutter-Crooks Gap Road by upgrading an existing two-track dirt road. This road would cross the proposed project area and connects CR 23 and BLM 3215. The upgrade would result in an all-season, gravel-surfaced road (LCI, 2008a, 2009a) called Lost Creek Road (Figure 2-3). This primary access road would run easterly from Wamsutter-Crooks Gap Road at the boundary between T25N-R93W Sections 16 and 21 for approximately 7.6 km [4.7 mi] to the plant site. It would then continue east for approximately 7.2 km [4.5 mi] to join BLM 3215 (Sooner Road) between T25N-R92W Sections 13 and 24. Lost Creek Road would be crowned and ditched with a 6-m [20-ft]- wide driving surface consisting of 15.4 cm [6 in] of compacted road base. The grade from the centerline to the road edge would be developed at 2 percent (LCI, 2008a, 2009a). Each ditch would be approximately 1.8 m [6 ft] in width with 3:1 side slopes, resulting in an overall cross-sectional width of about 9.8 m [32 ft]. Approximately 8 ha [20 ac] of land surface would be disturbed to develop these two main access roads (LCI, 2010a; 2008a,b). At least three culverts would be required: one at the intersection with CR 23 and two near the plant site where the road crosses ephemeral channels. The need for culverts between the plant and Sooner

Road has not yet been determined, though at least two culverts are anticipated, at the crossings of Battle Spring Draw and Stratton Draw. Also, the eastern portion of Lost Creek Road to Sooner Road may not be improved to the degree that the western section to Wamsutter-Crooks Gap Road will be, because traffic from Sooner Road would be mostly commuting site workers in light-duty vehicles. The maximum distance these commuters would travel before reaching a paved surface would be 31 km [19 mi] to SR 73 at Bairoil. All access (main roads into the site) and maintenance roads (site roads) would be constructed in accordance with the, county, and/or state standards.

2.1.1.1.2.4 Wellfields

Wellfields are the areas at the surface above the ore zones the applicant delineated to reach the uranium deposit. The applicant has stated that the licensed area would be divided into six wellfields, each about 20 ha [50 ac] in area. Disturbed areas (wellfields and access roads) are estimated to be approximately 103 ha [254 ac] for the total Lost Creek ISR Project (LCI, 2010a; 2008a,b). The ore zones, at depth, where the leaching solutions (lixiviant) would be injected and recovered have been divided into six (overlying) surface areas (Figure 2-6). The ore zones lie approximately 91 to 213 m [300 to 700 ft] below the ground surface in long, narrow trends varying from a [few hundred to several thousand feet] long and from 15 to 76 m [50 to 250 ft] wide. LCI estimates the yellowcake (uranium oxide–U_3O_8) content is approximately 500,000 kg [1.1 million lb], at an ore grade of 0.076 percent. Additionally, an estimated 4.5 million kg [9.8 million lb] of U_3O_8 at a grade of 0.058 percent is believed to be present. Prior to the initiation of operations in a new wellfield, the applicant would be required by license condition to submit a hydrologic test data package to the NRC for review and approval.

2.1.1.1.2.4.1 Injection and Production Wells

Injection and production (or recovery) wells are used to inject the lixiviant and to recover uranium-enriched (or pregnant) lixiviant for subsequent processing. GEIS Figure 2.3-1 shows a schematic diagram of a wellfield with typical injection/production well patterns. The applicant has stated that, depending on the ore deposit geometry, it will use three basic well patterns: a five spot, single line drive, or staggered line drive (LCI, 2009a) (Figure 2-7). While the conventional five-spot pattern consists of four injection wells surrounding a central production well, cell dimensions vary depending on the characteristics of the formation and the ore body. The applicant is anticipating the spacing of the injection wells to range from 23 to 46 m [75 to 150 ft] (LCI, 2008a).

The injection and production wells (Figures 2-8 and 2-9), when completed, may be used for either injection or production. The applicant considers that such a design allows for changes in the solution flow patterns to improve uranium recovery and to restore groundwater by the most efficient means. The applicant would conduct water sampling in completed production and injection wells in accordance with requirements of an NRC license condition.

The applicant stated that the permit area will be divided into six wellfields. Each wellfield would comprise about 20 ha [50 ac] and consist of a number of injection and production wells, with the well pattern determined based on ore geometry. Small groups of injection and production wells are monitored and controlled through a small building called a header house. Each wellfield will be subdivided into operational areas defined by header house locations, with each header house controlling approximately 40 injection wells and 20 production wells (LCI, 2008b). The applicant states that each wellfield would contain about 10 header houses, for a total number of about 400 injection and 200 production wells per wellfield (LCI, 2008b, 2010b). The actual

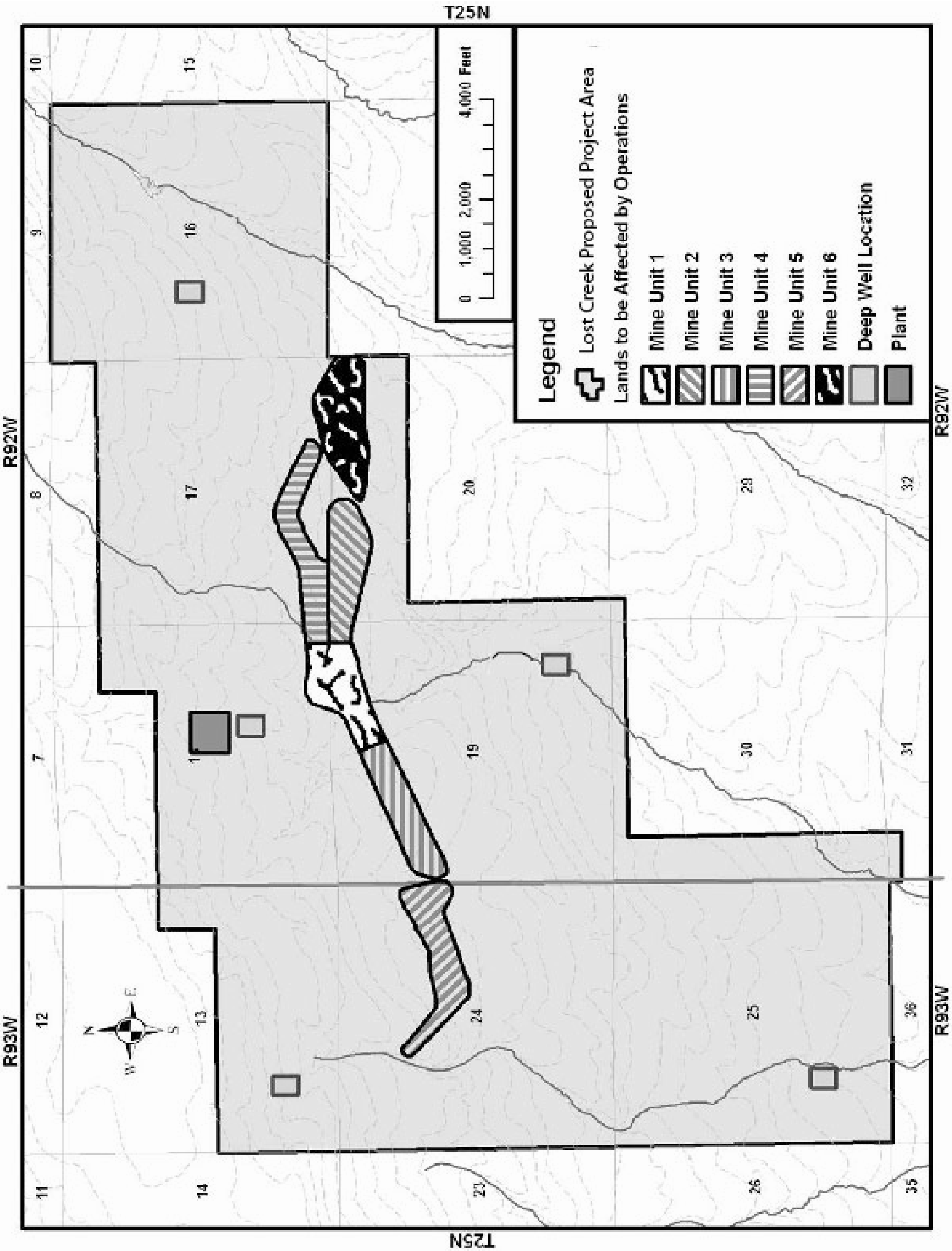

Figure 2-6. Project Wellfields (Mine Units)
Source: Modified from LCI (2008b)

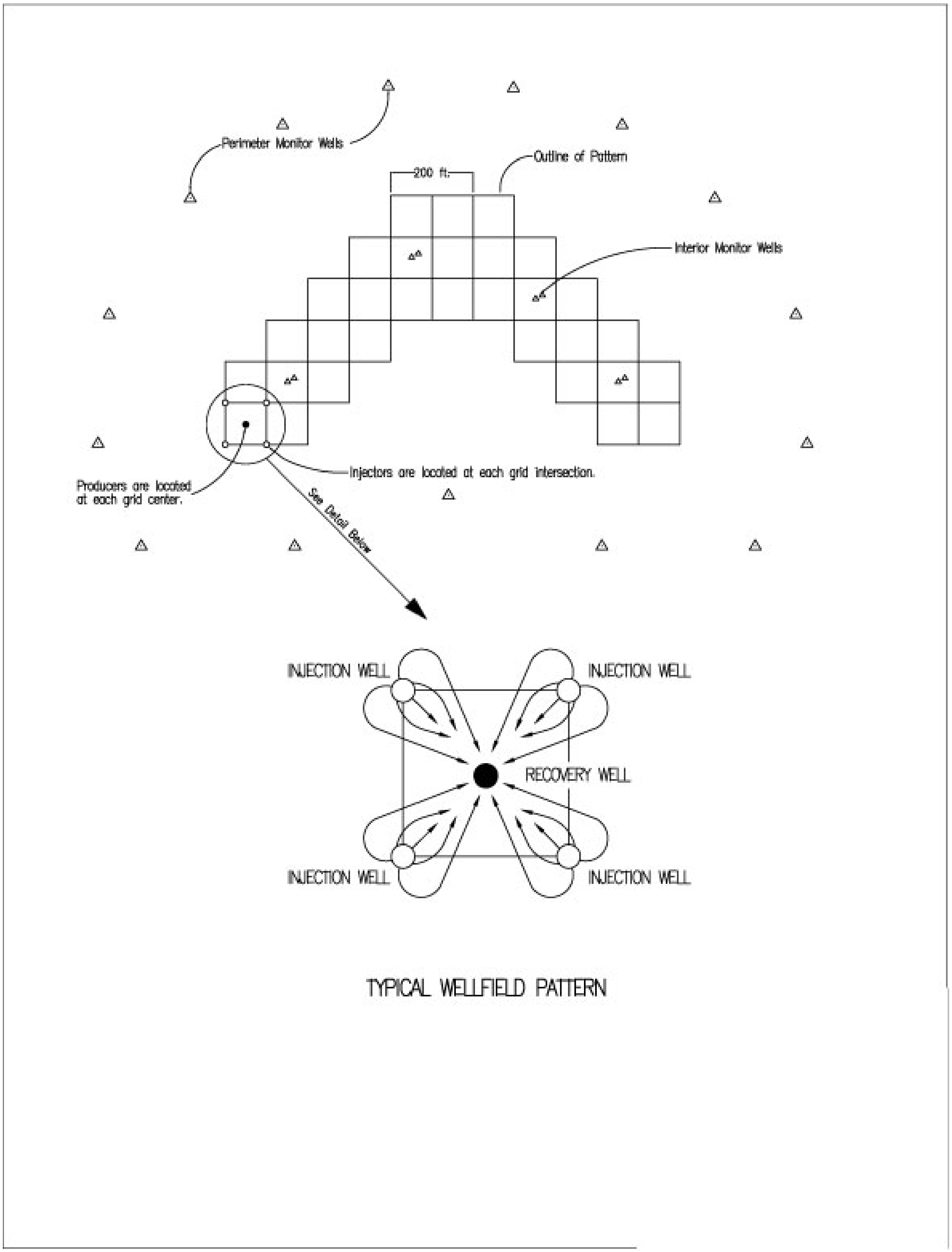

Figure 2-7. Solution Flow Patterns
Source: Modified from LCI (2008a)

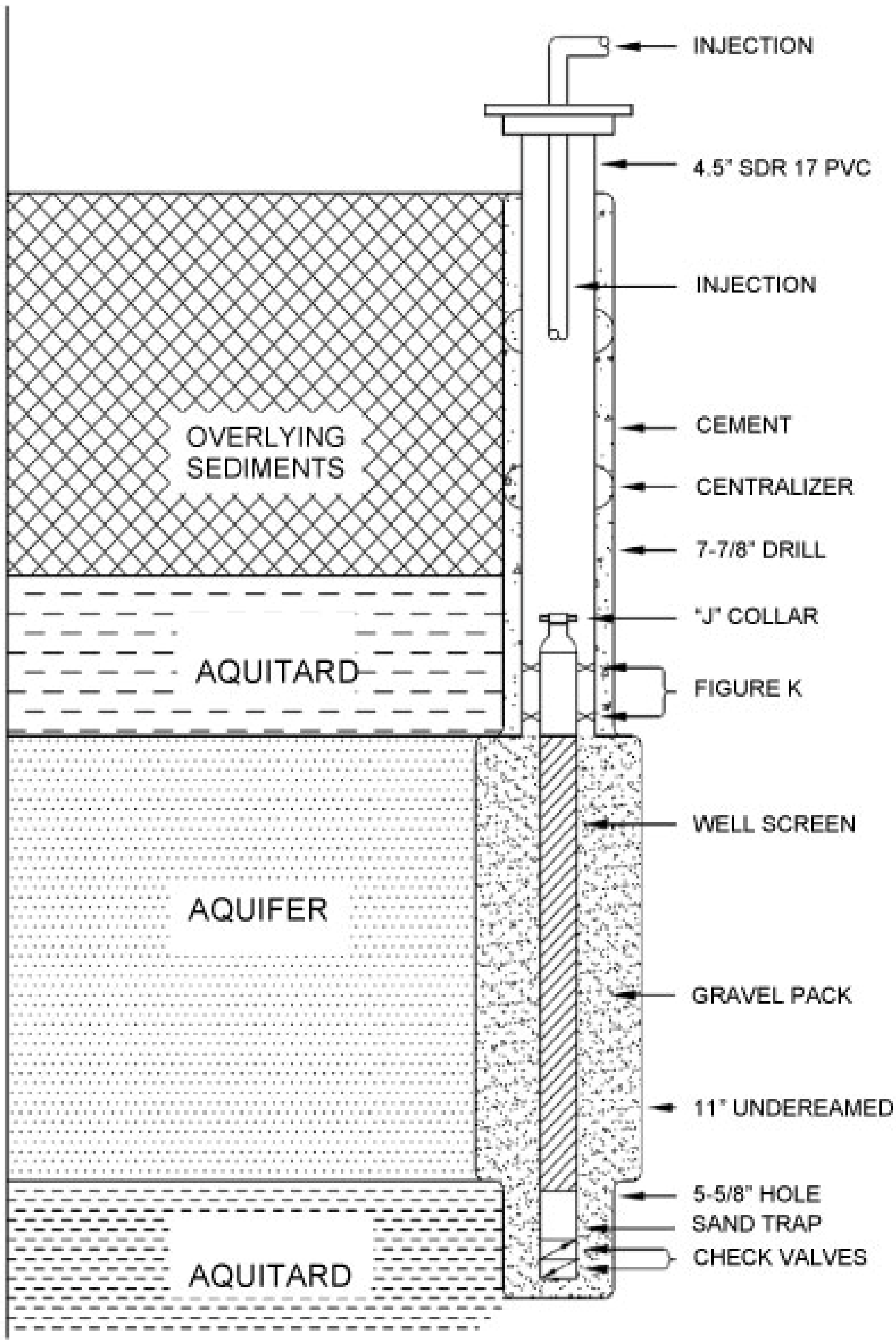

Figure 2-8. Injection Well Construction
Source: Modified from LCI (2008a)

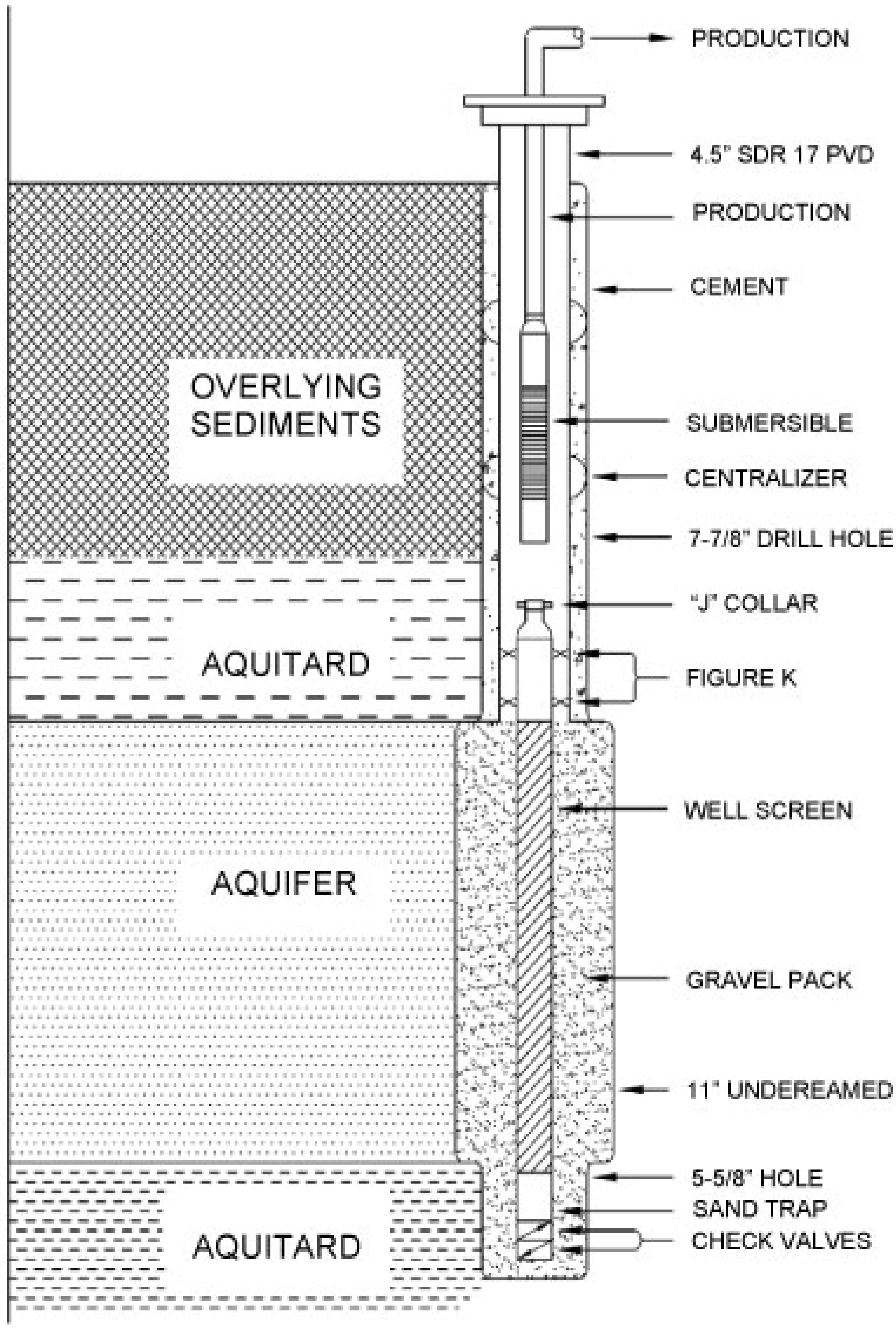

Figure 2-9. Production Well Construction
Source: Modified from LCI (2008a)

number and location of header houses, however, would depend on the well placement needed to develop the ore deposits within each wellfield.

An underground injection control (UIC) program WDEQ administers regulates the design, construction, testing, and operation of all injection and production wells. WDEQ has primary regulatory authority for such actions as delegated by the U.S. Environmental Protection Agency (EPA). Wells for uranium extraction are classified under the UIC program as Class III wells. The proposed operation would therefore require a UIC permit from WDEQ to use Class III injection wells. Before ISR operations could begin at any wellfield, the applicant would be required by license condition to provide NRC with copies of the permits for its UIC Class I wells as well as documents clearly delineating the approved aquifer exemption areas and boundaries for the Class III wells. -Portions of the aquifers designated for uranium recovery must be exempted as an underground source of drinking water (USDW) in accordance with the *Safe Drinking Water Act* (SDWA) under 40 CFR Part 146. EPA must approve aquifer exemptions.

2.1.1.1.2.4.2 Monitoring Wells

As NRC license conditions require, the applicant would install and sample horizontal and vertical excursion monitoring wells at each wellfield, as dictated by underlying geologic and hydrogeologic characteristics. To detect whether an excursion of production fluids (such as lixiviant) into the surrounding aquifers has occurred, the monitoring results will be compared against the NRC-approved background water quality conditions. Horizontal monitoring wells would be situated in a ring around the wellfield and completed in the targeted mineralized (ore body) zone. Vertical monitoring wells for overlying and underlying aquifers immediately above and below the mineralized horizon would be installed at a minimum density of about one for every 1.6-ha [4-ac] wellfield area; NRC staff would review and approve any lesser density proposed by the applicant. To detect horizontal excursions, the spacing between the mineralized zone perimeter monitoring wells will be required by NRC license condition to be no more than 152 m [500 ft], although spacing and distance could be less depending on the geometry and geology of the deposit. For example, for production units that abut the Lost Creek Fault, the applicant would be required by license condition to submit a plan to NRC for review and approval documenting the location and screened horizon of monitoring wells to monitor for potential excursions across the fault into upper and lower aquifers on the opposite side of the fault. The monitoring well density may be adjusted as the project progresses, to account for geologic features that can affect fluid flow, to improve understanding of the geometry of the ore body, and to adjust for surface topography variations.

2.1.1.1.2.4.3 Well Construction and Testing

In developing each wellfield, the applicant states that the production, injection, and monitoring wells would be drilled to the targeted depth using a rotary drilling rig with native mud to lubricate the drill bit and bring cuttings to the surface. A drilling fluid would be added to control the drilling mud viscosity (LCI, 2010a). Temporary mud pits would be constructed while each well was being drilled. The applicant estimates that the total amount of land disturbed by mud pit construction would be about 7.7 ha [19 acres] throughout the life of the proposed Lost Creek ISR Project, but these pits would typically be reclaimed with stockpiled soil and revegetated within weeks of their initial construction (LCI, 2008a). All well casings would be constructed of polyvinyl chloride (PVC) pipe. Casing centralizers would be used to make sure casings are centered in the drill hole, and cement would be used to stabilize, strengthen, and prevent the vertical migration of solutions. The well would finally be completed by enlarging the wellbore

diameter below the casing (underreaming) the desired interval (mineralized zone) and fitted with a slotted liner or screen assembly.

Each well would be tested for mechanical integrity before operation (LCI, 2008b). The mechanical integrity test (MIT) verifies that the well casing does not fail, causing water loss during injection or recovery operations. The test is designed to detect imperfections in the casing sections and inadvertent damage resulting from underreaming and to ensure the completeness of the connections between casing sections and sealing materials. The test involves sealing off the bottom and top of the casing with an inflatable packer or some other suitable device and pressurizing the column to a specified pressure for 10 minutes. The MITs would be required by NRC license condition. Results would be recorded and submitted to both NRC and WDEQ for inspection. Any well that fails (cannot hold at least 95 percent of the pressure) would be repaired, and if irreparable, the well would be plugged and abandoned.

2.1.1.1.2.4.4 Pipelines

The applicant states (LCI, 2008a) that a network of process pipelines and cables would be installed as part of the underground infrastructure located (i) between the processing plant and the header houses for transporting lixiviant, (ii) between the header houses and wellfields for injecting and recovering lixiviant, and (iii) between the central processing facility and wastewater disposal sites (e.g., deep injection wells) (see Figure 2-6).

The applicant proposes to use high-density polyethylene (HDPE) pipe, PVC pipe, stainless steel pipe, or an equivalent in its wellfield piping system (LCI, 2008b). While the typical pressure rating for HDPE and PVC piping materials proposed for use is between 1,103 and 1,379 kilopascal gauge [160 and 200 pounds per square inch gauge (psig)], the applicant would operate its wellfield piping at 1034 kilopascal [150 psig]. The applicant proposes burying individual well lines and the trunk lines to the processing plant to prevent freezing (LCI, 2008a). Flow meters and control valves would be installed in individual well lines and linked to the processing plant and header houses to monitor the individual well flow rates and pressures. The applicant estimates that each injection and production well within a given wellfield would require about 76 m [250 ft] of surface piping (LCI, 2010b). Assuming about 600 wells per wellfield (see Section 2.1.1.1.2.4.1), each wellfield would have about 45,700 m [150,000 ft] of piping.

2.1.1.1.2.4.5 Header Houses

As described previously in Section 2.1.1.1.2.4.1, a structure called a header house would be constructed in each wellfield (up to 10 per wellfield). A header house monitors and controls (using meters, valves, and pumps) the amounts of lixiviant (both injected and recovered) through a system of pipes connected to the injection and recovery wells. Approximately 20 production and 40 injection wells would be connected to each header house. These would all be linked back to the processing plant for overall monitoring and control. The header houses merely contain these meters and control valves. As required by license condition, the applicant would inspect all wellfields, pipelines, and header houses periodically to ensure that controls are operating as anticipated.

2.1.1.1.2.5 Other Structures and Systems

The applicant plans to dispose of liquid effluent generated during uranium recovery operations via Class I UIC disposal wells. On May 28, 2010, the applicant received a 10-year permit for up

to five Class I disposal wells from WDEQ, which has EPA-authorized UIC permitting authority (WDEQ, 2010). Under the terms of the permit, the applicant can inject liquid wastes including operation bleed streams, yellowcake wash water, sand filter and ion exchange wash water, on-site laboratory waste water, reverse osmosis brine, groundwater restoration and groundwater sweep solutions, plant washdown water, wash waters used in cleaning or servicing the waste disposal system equipment, and stormwater generated by uranium recovery activities into the Fort Union Formation within specified intervals at depths of about 1,871 to 2,923 m [6,139 to 9,590 ft] below the ground surface (WDEQ, 2010). Well construction, operation, MIT techniques, and plugging/abandoning method requirements are defined in the permit, as are the nature of the waste streams and the anticipated chemistry of discharges to the disposal wells. Under the terms of the WDEQ permit, LCI will be prohibited from injecting certain materials into these wells. For example, hazardous wastes as defined by EPA or WDEQ could not be injected into these wells (WDEQ, 2010). In addition, the permit also establishes a maximum total injection rate of 946 liters per minute (Lpm) [250 gallons per minute (gpm)] {i.e., 189 Lpm [50 gpm] for each of the 5 permitted wells}.

The proposed processing plant and maintenance buildings would be constructed with individual septic systems, with tanks and leach fields. The tanks would consist of a minimum of one chamber providing primary treatment. The septic systems would be for domestic wastes only, with no process waste disposal (LCI, 2008a). Both systems were designed according to percolation tests and submitted to the Sweetwater County Engineer’s Office (see Table 1-2).

The Lost Creek facility would be serviced by electric power from a transmission line off the Crooks Gap-Wamsutter Road. A 3,300-m [10,800-ft]-long 34.5-kV overhead line would connect the Rocky Mountain Power line to a metering point on the western boundary of the proposed project area, along the proposed western access road. The line would service the processing plant, maintenance building and drillers shed, and the wellfield header houses.

A fence is proposed to enclose the entire processing plant and maintenance building compound {230 × 260 m [750 × 850 ft]}. There would be three main components to the fence: (i) two gates (one remotely operated), (ii) a 30.5 × 2.4-m [100 × 8-ft] chain link fence on either side of the main gate, and (iii) a standard livestock fence for the remaining portion of the processing plant and maintenance compound. Security at the Lost Creek facility would involve (i) maintaining control of NRC-licensed material, (ii) providing a safe and secure workplace, (iii) managing records that contain sensitive and/or confidential information, and (iv) ensuring safe and secure transportation of NRC-licensed material. Security cameras would be placed at strategic locations throughout the processing plant, particularly at the security gate and locations where source and byproduct material are stored. Signage would warn site personnel and the general public of the potential for exposure to radionuclides prior to entering.

In addition, each wellfield and storage pond would be fenced and have signage to prevent inadvertent entry by people and animals. During production, site personnel would inspect active wellfields at least once per shift. Visitors to wellfields would be required to register and receive training, in addition to being supervised.

2.1.1.1.2.6 Construction Workers and Equipment

The proposed project would employ approximately 94 people during construction. It is anticipated that most employees would commute from larger communities in Wyoming, such as Casper, Rawlins, and Rock Springs, but some (if they are specialized in a particular trade) could come from out of state.

The equipment necessary to construct the ISR facility would include both company-owned and contractor-owned equipment. Company-owned equipment would include forklifts, graders, backhoes, geophysical logging trucks, generators, water trucks, and cement mixers. Contractor-owned equipment would include mostly drill rigs but could also include erection cranes and trenching equipment.

2.1.1.1.2.7 Schedule

The applicant estimates it would take approximately 18 to 24 months to construct each wellfield. The processing plant and supporting facilities would take about 6 - 8 months to construct at the beginning of the project, and overlap with the initial development of Wellfield 1 (LCI, 2008a). Main access roads would be constructed at the same time as the processing plant, and secondary wellfield access roads would be constructed as necessary as each wellfield is developed (LCI, 2010a; 2008a,b). A complete schedule showing all the development phases of the proposed Lost Creek ISR Project is presented in Figure 2-1.

2.1.1.1.3 Operation Activities

As discussed in GEIS Section 2.4, the ISR process involves two primary operations. First, uranium mobilization occurs in underground aquifers when lixiviant is injected into the ore body and recovering solutions that are uranium laden (NRC, 2009). Then the uranium-laden solutions (referred to as pregnant lixiviant) would be pumped from the production wells to ion-exchange systems within surface facilities to recover the uranium and prepare it for shipment (NRC, 2009). The applicant anticipates the workforce requirements during the operations period will be about 89 people, which includes wellfield and processing plant personnel with specialized skills. These workers would likely be non-local, but because of the longer-term nature of operations jobs, workers from out-of-state would relocate to the Rawlins/Bairoil area to minimize commuting (LCI, 2008a).

In its license application, LCI proposed to conduct operation activities consistent with those described in the GEIS (LCI, 2010a). The following sections describe the proposed operations at the Lost Creek ISR Project.

2.1.1.1.3.1 Uranium Mobilization and Processing

Figures 2-10 and 2-11 show a typical ISR layout and a general flow schematic for the ISR process. Uranium mobilization at the proposed Lost Creek ISR Project site would use the following steps: (i) injection of lixiviant into the production zone; (ii) oxidation and complexation of the uranium underground; (iii) extraction or production of the pregnant lixiviant from the subsurface; and (iv) excursion monitoring. (LCI, 2008a)

2.1.1.1.3.1.1 Lixiviant Chemistry

The uranium in the (ore body) aquifer exists in a chemically reduced insoluble form. The selected lixiviant must leach uranium from the host rock and keep it in solution during groundwater pumping from the host aquifer. The composition of the lixiviant is designed to reverse the natural geochemical conditions that led to the original deposition. When uranium is oxidized, it easily complexes with bicarbonate anions in the groundwater and becomes mobile. The uranium-bearing solution would migrate through the pore spaces in the sandstone and be recovered by production wells.

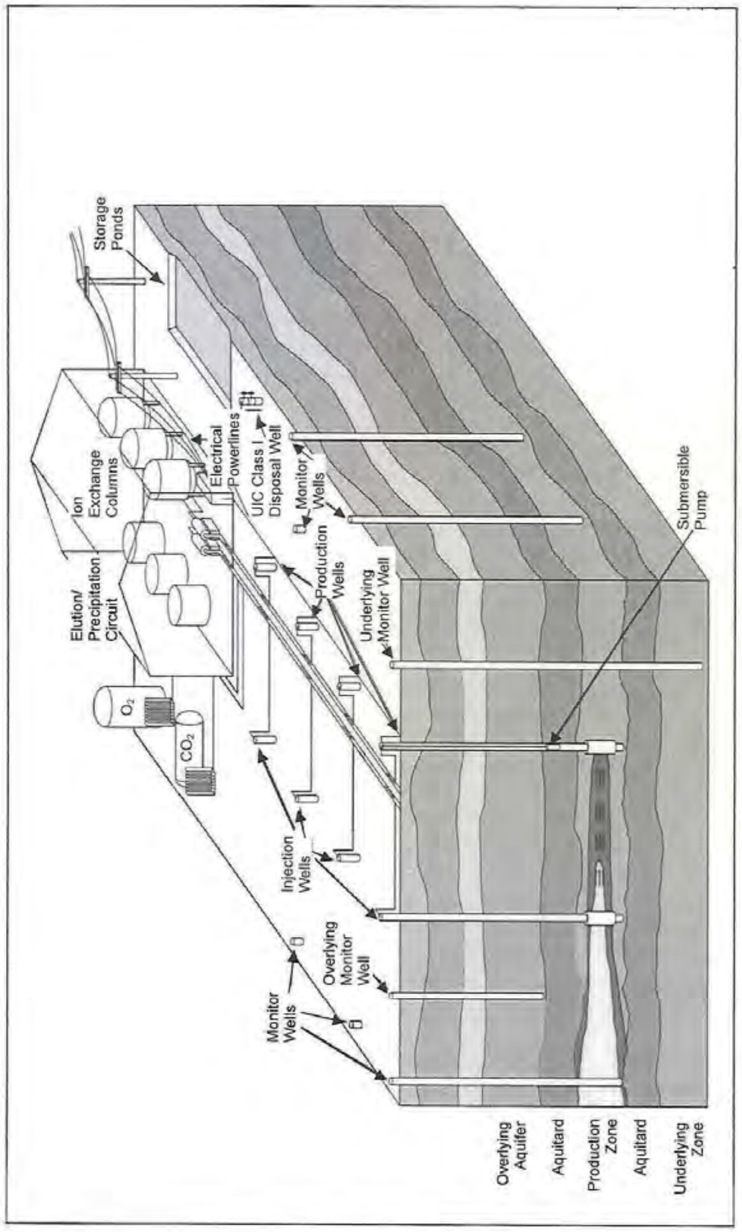

Figure 2-10. Typical ISR Layout
Source: Modified from LCI (2008b)

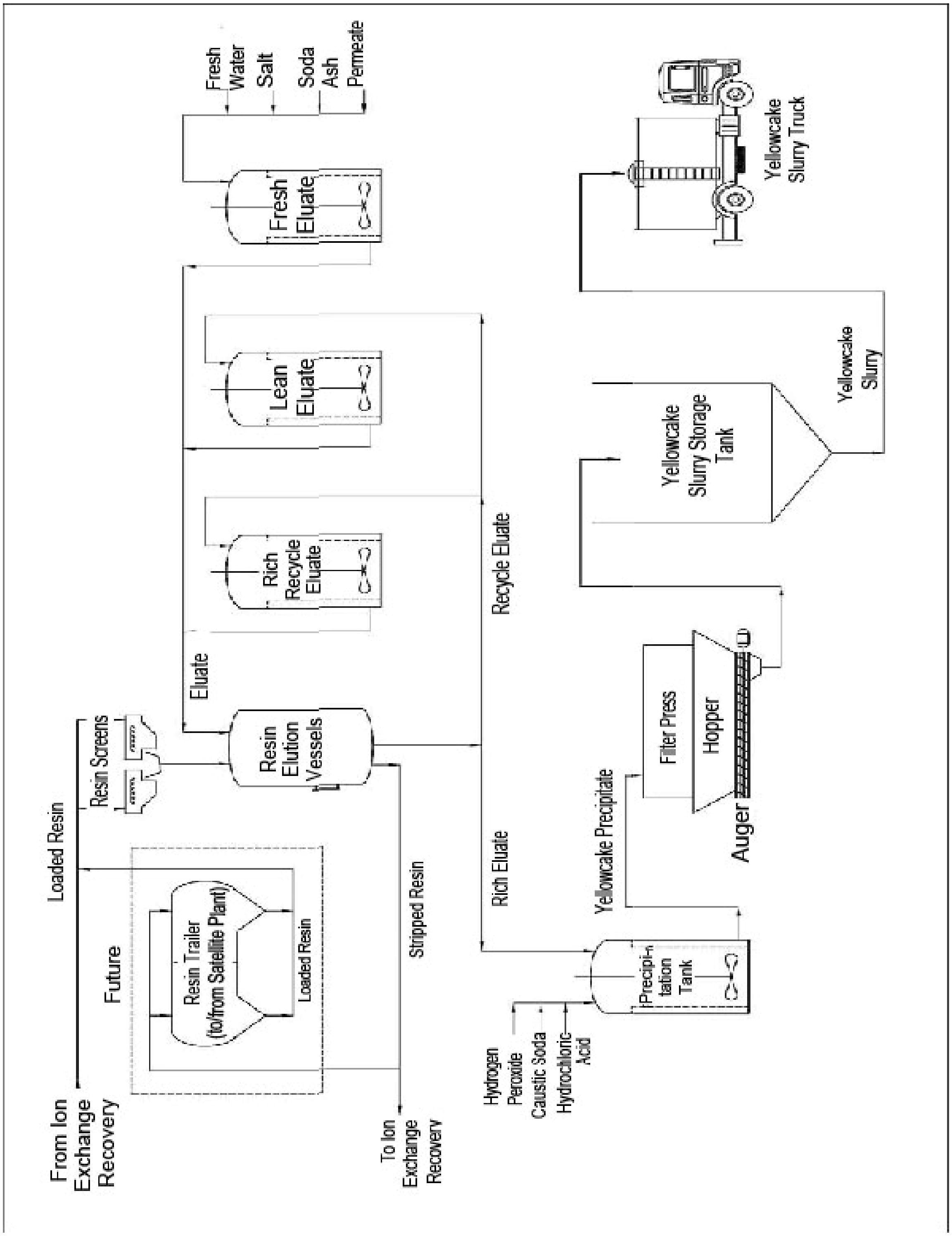

Figure 2-11. Process Flow Diagram
Source: Modified from LCI (2008a)

The lixiviant solution to be used at the proposed Lost Creek ISR Project is established by license condition, and is composed of a dilute carbonate/bicarbonate aqueous solution because of its selectivity for uranium and minor reaction with the gangue minerals (LCI, 2010a; 2008a,b). During injection, oxygen or hydrogen peroxide would be added to oxidize the uranium underground. Carbon dioxide would be provided to both keep the pH around neutral and to provide another source of carbonate and bicarbonate ions. Finally, sodium carbonate and sodium bicarbonate may be added to adjust the carbonate/bicarbonate concentration of the solution. The oxidized uranium would react with the lixiviant and form either a soluble uranyl tricarbonate complex or a bicarbonate complex.

2.1.1.1.3.1.2 Lixiviant Injection and Recovery

At the proposed Lost Creek ISR Project, the applicant would inject lixiviant into the ore body via injection wells. The solution would oxidize and dissolve uranium from the ore horizon that would then be recovered via production wells. The applicant estimated that the overall production flow rates would be approximately 22,700 Lpm [6,000 gpm] (LCI, 2010a; 2008a,b). The applicant would pump uranium-enriched pregnant solution from production wells to the processing plant for uranium extraction by ion exchange. The resulting barren lixiviant would then be chemically refortified with carbonate/bicarbonate and oxidant and reinjected into the production zone to repeat the leaching cycle. Given the estimated production flow rates and the anticipated uranium concentration of the pregnant lixiviant, the applicant has designed the process plant to manage 909,000 kg [2 million lb] per year of yellowcake slurry. The processing plant will not contain a dryer, and the yellowcake slurry will be shipped off site to a licensed facility for further processing. However, the applicant expects to produce approximately 455,000 kg [1 million lb] of yellowcake (U_3O_8) per year for a period of at least 8 years (LCI, 2010a; 2008a,b). This production rate is established by license condition as the maximum throughput for the processing plant.

Uranium mobilization at the proposed Lost Creek ISR Project would produce water containing byproduct material that must be properly managed. As described in GEIS Section 2.4.3, the production wells at an ISR facility would extract slightly more water than is reinjected into the host aquifer, which creates a net inward flow of groundwater into the production zone. This excess water, referred to as production bleed, would be byproduct material that must be properly managed and disposed (NRC, 2009). The applicant would be required by license condition to maintain an inward hydraulic gradient in each wellfield starting when lixiviant was first injected into the extraction zone and continuing until the initiation of aquifer stabilization. The production bleed would be withdrawn as a small portion of the barren solution from the ion-exchange circuit and then disposed of via the five permitted deep disposal wells (WDEQ, 2010). Production bleed is detailed in SEIS Section 2.1.1.1.3.3.

2.1.1.1.3.1.3 Excursion Monitoring

GEIS Section 2.4.1.4 describes how ISR operations can potentially affect the groundwater quality near a site when lixiviant moves from the production zone away from the injection wells, resulting in either a vertical or lateral excursion (NRC, 2009). Excursion monitoring is performed to monitor water flow to avoid a potential excursion. Excursions can be caused by improper water balance between injection and recovery rates, undetected high permeability strata or geological faults, improperly plugged and abandoned exploration boreholes, discontinuity within the confining layers, poor well integrity, or hydrofracturing of the ore zone or surrounding units (NRC, 2009). NRC regulations at 10 CFR Part 40, Appendix A, Criterion 7, require licensees to have an operational monitoring system to detect excursions. NRC guidance defines an

excursion as occurring when two or more excursion indicators in a monitoring well exceed the upper control limits (UCLs) (NRC, 2003a). NRC license conditions would require the applicant to conduct sampling of monitoring wells twice each month to detect whether excursions may have occurred. If an excursion is detected, the applicant would notify NRC and take several steps to confirm the excursion through additional sampling. If the excursion was confirmed, then the applicant would notify WDEQ and NRC and begin to take corrective actions to retrieve the excursion. As described in NRC guidance (Section 5.7.8.3), licensees typically retrieve horizontal excursions back into the production zone by adjusting the flow rates of the nearby injection and production wells to increase process bleed in the exclusion area.

If an excursion was confirmed in groundwater monitoring wells at the proposed Lost Creek ISR site, then the applicant would be required by license condition to notify NRC within 24 hours, and the well on excursion would be monitored every 7 days until the excursion indicators were at or below the respective UCLs. The applicant would be required to provide a report to NRC within 60 days of confirming the excursion, describing the excursion event, the corrective actions taken, and the results. If an excursion could not be recovered within 60 days of confirmation, the applicant would be required to either terminate lixiviant injection within the wellfield until aquifer cleanup was complete, or increase the surety for the project by an amount sufficient to cover the full third-party cost of correcting and cleaning up the excursion. Beyond 60 days, the applicant would be required to monitor the excursion status of the well on a weekly basis and quarterly report the results. The applicant proposed an operational groundwater monitoring program to detect and correct conditions that could result in an excursion affecting groundwater quality near the wellfields (LCI, 2010a; 2008a, b). The program would include monitoring process variables such as flow rates and operating pressures of operating wells (injection, production, and monitoring) and the main pipelines going to and from the processing plant and header houses. The monitoring well network was previously described in SEIS Section 2.1.1.1.2.4.2. During the safety review, NRC staff identified additional issues that could be resolved after wellfield testing was complete. These issues would require by NRC license condition that the applicant submit hydrologic data packages for NRC review and approval. The proposed monitoring program is detailed in SEIS Chapter 6.

At the proposed Lost Creek ISR Project, uranium would then be recovered from the pregnant lixiviant and processed into yellowcake slurry in a multistep process. These steps include ion exchange, elution, and precipitation. These uranium processing activities are shown graphically in Figure 2-11. This process is described in the following subsections.

2.1.1.1.3.1.4 Ion Exchange

At the proposed Lost Creek ISR Project, the pregnant lixiviant, estimated to be about 40–50 ppm of uranium concentration, would be pumped from the wellfields to the ion-exchange systems at the processing plant for uranium extraction. The Lost Creek processing plant would be designed to process up to 22,700 Lpm [6,000 gpm] of lixiviant through the ion-exchange circuit. The ion-exchange system proposed for Lost Creek would consist of pressurized, “downflow” vessels (columns) that are internally screened to maintain resin in place but allow the lixiviant to flow through the vessel. When the resins in the ion-exchange columns become saturated with uranium, the column would be taken offline for the elution circuit. The solution leaving the ion-exchange circuit would normally contain less than 5 ppm of uranium. After the uranium-saturated resins have left the ion-exchange systems, the resulting barren lixiviant would then be chemically refortified with carbonate/bicarbonate and oxidant and reinjected into the wellfield to repeat the leaching cycle. The ion-exchange process is shown graphically in Figure 2-12.

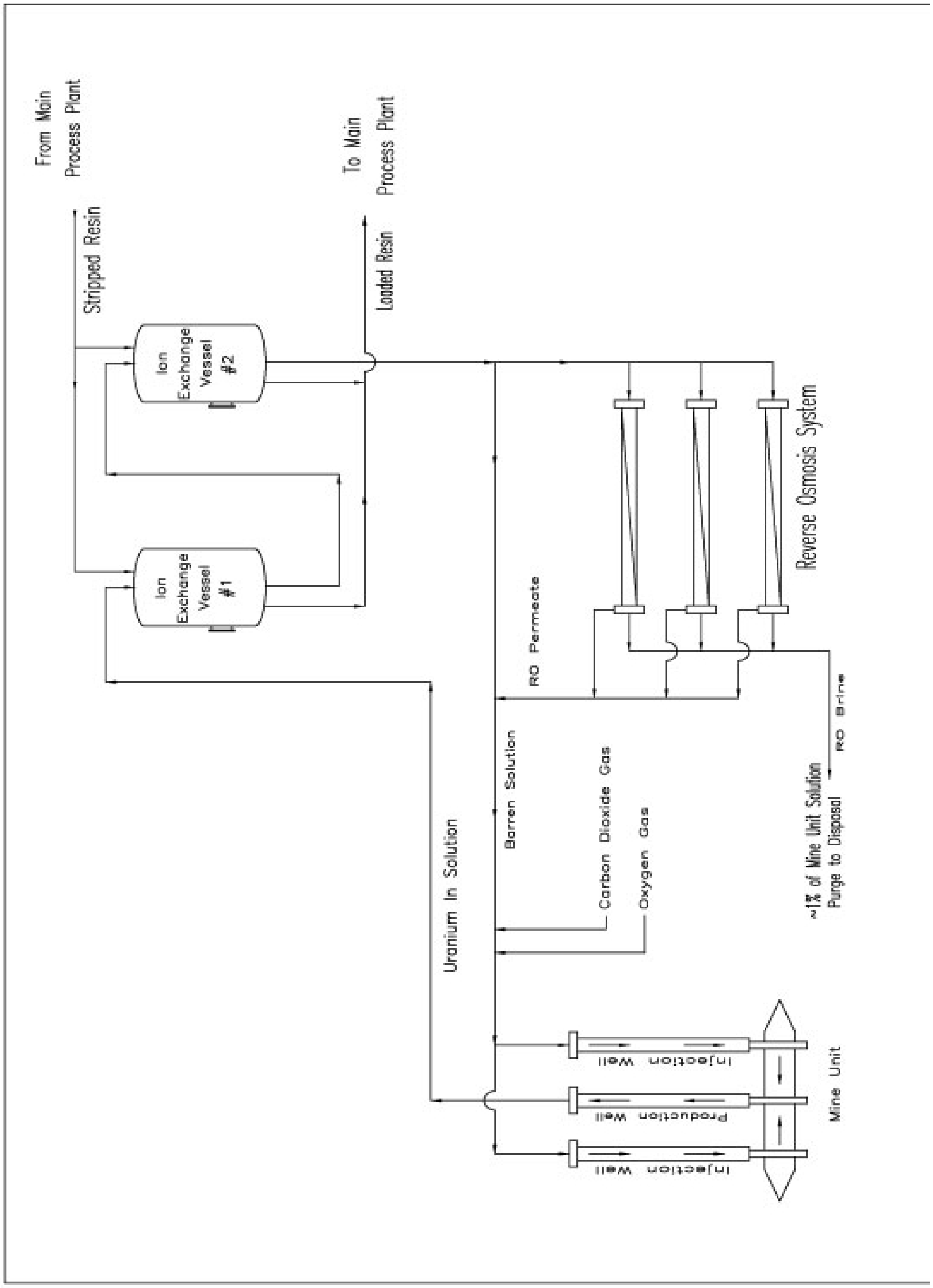

Figure 2-12. Ion Exchange Process Flow Diagram
Source: Modified from LCI (2008a)

2.1.1.1.3.1.5 Elution

GEIS Section 2.4.2.2 describes a typical elution circuit at ISR facilities (NRC, 2009). At the Lost Creek ISR processing plant, the elution circuit would be designed to accept the loaded resin from the ion-exchange circuit and (i) pass the resins over vibrating screens with wash water to remove entrained sand and other fine particles and (ii) move the resins by gravity from the screens into downflow elution vessels for uranium recovery and resin regeneration. The uranium would be eluted (stripped) from the loaded ion-exchange resin in the elution vessel by applying an aqueous solution or brine composed of sodium chloride {90 g/L [0.75 lb/gal]} and sodium carbonate {20 g/L [0.17 lb/gal]}. The process generates an "eluate" that has a concentration of 10–20 g/L [0.083–0.17 lb/gal] of U_3O_8 (LCI, 2008b).

2.1.1.1.3.1.6 Precipitation and Filtration Circuit

The precipitation/filtration circuit at the processing plant would be initiated when the eluant is treated slowly with hydrochloric acid to lower the pH and break the carbonate portion of the dissolved uranium complex. Hydrogen peroxide would be used to precipitate out the uranium as uranyl peroxide. A caustic soda solution (sodium hydroxide) would then be added to elevate the pH, promoting the growth of uranyl peroxide crystals and making the slurry safer to handle in subsequent process steps. Following precipitation, the precipitated uranium would be washed to remove excess chlorides and other soluble contaminants, and dewatered and filtered to form yellowcake slurry (30 to 50 percent solids). The processing facility for the proposed Lost Creek ISR does not include a yellowcake dryer as part of the design (LCI, 2010a). Instead, the yellowcake slurry would be stored in holding tanks (inside the processing plant) or in transport tanks parked in a secure (fenced) area of the facility for ultimate shipment offsite, via authorized transport carried out in compliance with NRC and U.S. Department of Transportation regulations, to an NRC-licensed processing facility or a facility licensed by an agreement state.

The applicant has designed the processing facility capacity to process up to 909,000 kg (2 million lbs) per year of yellowcake slurry from the elution and precipitation circuits. The applicant expects to produce approximately 455,000 kg (1 million lbs) of yellowcake slurry (U_3O_8) per year for a period of at least eight years (LCI, 2010a). This annual production rate will be established by NRC license condition as the upper limit for the processing plant. A design where the applicant would apply for a license that includes a yellowcake dryer is addressed as Alternative 3 to the proposed action (see SEIS Section 2.1.3).

2.1.1.1.3.2 Management of Production Bleed and Other Liquid Effluents

As stated in GEIS Section 2.4.3, uranium mobilization would produce excess water that must be properly managed (NRC, 2009). The production wells at an ISR facility would extract slightly more water than is reinjected into the host aquifer, which creates a net inward flow of groundwater into the wellfield. This excess water, referred to as production bleed, would be controlled by withdrawing a small portion of the barren solution from the ion-exchange circuit. The applicant has proposed a production bleed ranging from about 0.5 to 1.5 percent (LCI, 2010a; 2008a,b) at the proposed Lost Creek ISR Project. As described previously, the production bleed would be considered byproduct material that must be properly managed. The applicant has received a permit from WDEQ (the agency EPA authorizes to implement the UIC program) for up to five Class I UIC deep injection wells for the purposes of disposing of the production bleed and other liquid wastes (WDEQ, 2010). These wells would be located throughout the site, evenly, as not to interfere with each other and would be similar in depth and design (WDEQ, 2010). In addition, two 49 × 79-m [160 × 260-ft] storage ponds would be

constructed in Blue Gulch, adjacent (to the east) of the processing plant for handling liquid effluent should it be necessary to shut down the Class I disposal wells (Figure 2-3). The ponds would be designed to handle the nominal facility effluent generation flow rate [227 (Lpm); 60 (gpm)]. The redundant design was proposed in case a leak is detected in one of the ponds. At maximum design-rated production of 22,700 Lpm [6,000 gpm], approximately 230 to 340 Lpm [60 to 90 gpm] would be diverted as production bleed. If the Class I deep disposal wells became inoperable or were shut down for maintenance, two 49 × 79-m [160 × 260-ft] storage ponds would be used to temporarily store the production bleed.

Other liquid effluents generated during the operation of the proposed Lost Creek ISR Project include storm water, 1,890 to 2,650 L/day [500 to 700 gal/day] of domestic wastewater (sewage), pumping test water, and about 49 L/min [13 gal/min] from the process circuit (elution circuit bleed, resin rinse, and washdown water containing waste petroleum products and chemicals) (LCI, 2008a, 2009b). The applicant states that the elution circuit bleed and any liquid byproduct material from any source could be sent to the deep wells for disposal as long as the quality and quantity limitations in the Class I UIC permit (WDEQ, 2010) are satisfied. Also, the applicant would be required by license condition to notify NRC and document unintentional releases of source or byproduct material and process chemicals. The applicant would be required by license condition to maintain documentation of spills of source or byproduct materials (including process solutions) and process chemicals, maintain procedures to evaluate spill consequences, and to implement reporting requirements.

2.1.1.1.3.3 Schedule

The applicant anticipates operating the proposed Lost Creek ISR Project for 8 years, based on the data collected in the six wellfields proposed. The wellfields, while individually operated, would overlap in time, as they come online sequentially (LCI, 2008b). However, two wellfields would not be in production at the same time. Each wellfield would be in production about 24-26 months. Production operations are anticipated to begin with Wellfield 1 during the first year following the start of development for the proposed Lost Creek ISR Project in 2011 and continue until Wellfield 6 ceases to be productive in about the eight year period following development (Figure 2-1).

2.1.1.1.4 Aquifer Restoration Activities

Aquifer restoration within the wellfield ensures that the water quality and groundwater use in surrounding aquifers would not be adversely affected by the uranium recovery operation, as discussed in GEIS Section 2.5 (NRC, 2009). After the uranium is recovered, the groundwater in the wellfield contains other constituents that the lixiviant mobilized. The process whereby groundwater constituents are selected for monitoring throughout the life of the project is described in SEIS Section 6.3.1.2. In compliance with 10 CFR Part 40, Appendix A, Criterion 5B(5), groundwater quality in the exempted ore-bearing aquifer is required to be restored to (i) Commission-approved baseline; (ii) maximum concentration levels (MCLs) of constituents listed in Table 5C, if the constituent is listed in Table 5C and if the baseline level of the constituent is below the value listed; or (iii) Alternate Concentration Limit (ACLs) the Commission established, if the baseline level of the constituents and the values listed in the Table 5C are not reasonably achievable. ACLs development is described in SEIS Appendix C. These standards are implemented during aquifer restoration to ensure public health and safety. The applicant is required to provide financial sureties to cover planned and delayed restoration costs in compliance with 10 CFR Part 40, Appendix A, Criterion 9. NRC reviews the financial sureties annually.

Under the Federal UIC program (40 CFR Part 145) the exempted production aquifer would no longer be protected under the SDWA as a USDW. In compliance with 40 CFR 146.4, the exempted aquifer does not currently serve as a source of drinking water and cannot now and would not in the future serve as a source of drinking water. Hence, groundwater in exempted aquifers cannot be considered as a source of drinking water after restoration.

The applicant needs to establish baseline water quality prior to the submission of a license application. The excursion parameters and UCLs are determined based on the baseline water quality sampled from monitoring wells placed in the ore-bearing, underlying, and overlying aquifers, when applicable. Therefore, the UCLs should be established prior to ISR operations. UCLs are used for control and management of excursions, if they occur, during ISR operations and restoration.

GEIS Section 2.5 describes a typical aquifer restoration process (NRC, 2009). Aquifer restoration in each wellfield would begin as the uranium recovery operations end. By doing this, the period of groundwater contamination within the exempted aquifer is shortened. The preextraction class of use would be determined by the baseline water quality sampling program that would be performed for each wellfield compared to the use categories defined by the WDEQ-Water Quality Division. Restoration would be demonstrated to meet the requirements of WDEQ and NRC. Consistent with current ISR restoration practices and NRC license conditions, an applicant will establish restoration criteria or restoration target values (RTVs) on a parameter-by-parameter basis for the primary goal of restoring all parameters to pre-ISR baseline conditions. Prior to operation, background (baseline) groundwater quality would be determined. Background water quality data would be collected from the monitoring wells before any ISR operations take place, as required by 10 CFR Part 40, Appendix A, Criterion 7.

There are three possible phases of aquifer restoration: groundwater transfer, groundwater sweep, and groundwater treatment. These three stages would be designed to optimize restoration equipment used in treating groundwater and to minimize the volume of groundwater consumed during the restoration stage. Depending on the progress of restoration, the applicant may not need all the stages to achieve the RTVs. NRC allows licensees the flexibility to select the restoration methods to be used for each wellfield (NRC, 2003a). The WDEQ UIC program reviews any aquifer restoration plans for compliance with the applicable terms and conditions of the UIC permit requirements. Stability monitoring would also be conducted as part of the restoration program. The aquifer restoration program for the proposed Lost Creek ISR Project would include two stages: restoration and stability monitoring. The following subsections describe the aquifer restoration program proposed for the Lost Creek ISR Project (LCI, 2008b).

2.1.1.1.4.1 Groundwater Sweep

During the groundwater sweep phase of the proposed Lost Creek ISR Project, groundwater from a wellfield undergoing aquifer restoration would be pumped via production wells to the processing plant ion-exchange circuit without reinjection. This pumping would draw native groundwater into the ore zone aquifer to flush constituents from the areas affected by the lixiviant injection during the operations phase. The groundwater removed from the aquifer during the sweep phase would contain constituents mobilized during uranium recovery and residual lixiviant. Following treatment in the ion-exchange circuit to recover any residual uranium, the groundwater pumped during the groundwater sweep phase would be disposed as byproduct material via Class I deep well injection in accordance with the limits in the UIC permit (WDEQ, 2010). The pumping rates used would depend on the ability of the wellfield to sustain the withdrawal rate and the limits established by the UIC Class I permit. The number of pore

volumes that would be treated during the groundwater sweep phase will depend on the capacity of the wastewater disposal system and the effectiveness of the sweep in lowering the amount of total dissolved solids (TDS). Pore volume is the term the ISR industry uses to define an indirect measurement of a unit volume of aquifer water ISR recovery affected. It represents the volume of water that fills the void space in a certain volume of rock or sediment. A detailed description of pore volume is presented in the GEIS (NRC, 2009). For example, for Wellfield 1, the applicant calculated a pore volume of 129 million L [34.2 million gal] (LCI, 2010a) using methods accepted during the NRC safety review. The applicant anticipates that one pore volume or less is recovered during the sweep before moving into the groundwater treatment phase, although they will adjust the pore volume estimate, if necessary, as they gain experience in restoring wellfields at the proposed Lost Creek ISR Project (LCI, 2010a).

2.1.1.1.4.2 Groundwater Treatment

Groundwater treatment would occur following groundwater sweep. During the groundwater treatment stage of the proposed Lost Creek ISR Project, groundwater would be pumped from the wellfield undergoing restoration to the process facility. At the process facility, ion-exchange and reverse osmosis treatment circuits would be used to treat the groundwater before it is reinjected into the affected aquifer. The ion-exchange columns would remove most of the soluble uranium and replace it with chloride or sulfate. This process is detailed in GEIS Section 2.5.3 (NRC, 2009).

Following treatment in the ion-exchange circuit, a portion of the restoration recovery water would be sent to the reverse osmosis unit for further treatment (LCI, 2008b). During the reverse osmosis process, the groundwater would be forced through semipermeable membranes to (i) reduce the TDS in groundwater being restored, (ii) reduce the quantity of water needed to be removed from the aquifer to achieve the RTVs, (iii) concentrate the dissolved contaminants in a smaller volume of brine to facilitate waste disposal, and (iv) enhance ion exchange. About 60 to 75 percent of water passes through the reverse osmosis membranes, leaving approximately 99 percent of the dissolved salts in the resulting brine water. The clean water or permeate would be reinjected into the wellfield, stored for use in the milling process, or sent to the deep disposal wells (LCI, 2008b). The permeate may also be decarbonated prior to reinjection into the wellfield. The brine water contains most of the dissolved salts and would be sent to the deep disposal wells.

After groundwater treatment, the applicant proposed that it might introduce a small amount of reductant (probably sodium sulfide) to remove oxygen from the groundwater and chemically reduce any other oxidized minerals to a less form that is less readily dissolved (LCI, 2008b). This addition would reduce those uranium minerals and other trace elements that were solubilized by oxidation. The applicant states that it would use a safety plan to ensure safe handling of the reductant (LCI, 2008b). As stated in the NRC safety evaluation of the proposed Lost Creek ISR Project, the applicant committed to (i) prepare a Comprehensive Safety Plan for use of chemical reductant, which will be implemented only after review by the NRC-approved Safety Evaluation Review Panel, and (ii), the applicant would be required by license condition to obtain NRC approval prior to use of biorestoration.

The applicant proposed that water coming from a number of sources may be added prior to reinjecting the permeate into the wellfield to control the amount of production bleed into the restoration area (LCI, 2008b). The sources of this ‘make-up’ water could include water from a wellfield in a more advanced state of restoration, water being exchanged with a new wellfield production area, water from a different aquifer, or the purge of an operating wellfield. The

number of pore volumes that would be treated and reinjected during the groundwater treatment phase would depend on the efficiency of the reverse osmosis circuit in removing TDS and the effectiveness of any reductant in lowering uranium and trace element concentrations (LCI, 2008b). The applicant proposed monitoring the quality of selected wells during this phase to determine the effectiveness of the groundwater treatment process (LCI, 2008b). The applicant stated that it anticipates, based on experience at other ISR facilities in Wyoming, five to seven pore volumes will be needed to restore a wellfield. As an example, the applicant calculated the pore volume for Wellfield 1 to be 129 million L [34.2 million g]. (LCI, 2008b)

2.1.1.1.4.3 Recirculation

Following the groundwater treatment phase, the applicant would pump from the wellfield and reinject the recovered solution into the wellfield to recirculate and homogenize groundwater conditions. When active restoration activities are complete, the applicant would collect groundwater samples to determine whether restoration requirements have been met. Documentation would include an evaluation of the water quality data and a description of the techniques used.

2.1.1.1.4.4 Monitoring and Stabilization

During aquifer restoration, lixiviant injection ceases and groundwater transfer, sweep, and treatment are used to attempt to restore the production aquifer groundwater quality to original background levels. During aquifer restoration, the applicant would sample the horizontal, overlying, and underlying aquifer monitoring wells for the excursion parameters of chloride, total alkalinity, and conductivity (LCI, 2008b). LCI would also measure static water levels prior to sampling for excursion parameters.

Restoration is complete when the applicant is able to demonstrate that the production aquifer groundwater meets the regulatory groundwater protection standards and is stable. NRC regulations require the groundwater quality be returned to the standards identified in 10 CFR Part 40, Appendix A, Criterion 5(B)(5). Those standards are either baseline, to the MCLs provided in the table in 10 CFR Part 40, Appendix A, Criterion 5C; or to an ACL NRC established in accordance with Criterion 5B(6). According to this criterion, the applicant may propose ACLs, subject to NRC approval, when background concentrations are not practically achievable at the site and when no substantial hazard to human health or the environment is present. The applicant would have to provide the basis for these ACLs, including consideration of practicable corrective actions, and must show that the ACLs are ALARA. The NRC process for reviewing and approving ACLs is described in SEIS Appendix C.

When the applicant reaches the groundwater protection standard, it must show that the constituent concentrations are stable for four consecutive quarters (no statistically increasing trends). To show stability, the production aquifer wells would be sampled on a quarter-year basis and analyzed for the following parameters:

- Bicarbonate
- Calcium
- Carbonate
- Chloride
- Conductivity
- Dissolved aluminum
- Dissolved arsenic
- Dissolved lead
- Dissolved manganese
- Dissolved mercury
- Dissolved molybdenum
- Dissolved nickel
- Dissolved selenium
- Dissolved uranium
- Nitrogen, Ammonia as N
- Nitrate + Nitrite as N
- pH
- Potassium
- Radium-226 (pCi/L)
- Radium-228 (pCi/L)
- Silica

- Dissolved barium
- Dissolved boron
- Dissolved cadmium
- Dissolved chromium
- Dissolved copper
- Dissolved iron
- Dissolved vanadium
- Dissolved zinc
- Fluoride
- Gross alpha (pCi/L)
- Gross beta (pCi/L)
- Magnesium
- Sodium
- Sulfate
- TDS
- Total iron
- Total manganese

The applicant proposed methods to identify and evaluate "hot spots" with elevated residual concentrations of a parameter after restoration at an isolated well or location. If a hot spot were to be identified, the applicant would use additional measures, such as additional water quality sampling, statistical trend analysis, or groundwater modeling, to evaluate potential impacts on the surrounding aquifers. If indicated, the applicant would implement corrective measures such as additional restoration or stabilization monitoring. (LCI, 2008b)

2.1.1.1.4.5 Schedule

The applicant anticipates the restoration of each wellfield to take approximately 30 months (from the beginning of the groundwater sweep through the regulatory approval stage) (LCI, 2008b). The applicant anticipates the aquifer restoration phase of Wellfield 1 would begin during the 3rd year after development begins for the proposed Lost Creek ISR Project and Wellfield 6 would be completed during the 10th year after development starts (see Figure 2-1).

2.1.1.1.5 Decontamination, Decommissioning, and Reclamation Activities

The decommissioning of an ISR facility would be based on an NRC-approved decommissioning plan. GEIS Section 2.6 describes the general process for decontamination, decommissioning, and reclamation of an ISR facility (NRC, 2009). By license condition, the applicant would submit a revised decommissioning, decontamination, and reclamation plan within 90 days of receipt of a license. Prior to the commencement of operations, the applicant would be required by NRC license condition to establish and maintain an NRC-approved financial surety arrangement adequate to cover the costs for a third party to complete the decommissioning and decontamination if necessary. For the purposes of complying with 40 CFR Part 40.42(d), the applicant would be required by license condition to submit a detailed decommissioning plan to NRC for review and approval at least 12 months before the planned commencement of final decommissioning. When approved, this plan would amend the license, initiate the decommissioning process, and provide NRC the detailed information to evaluate the applicant's implementation of the approved decommissioning plan. For lands administered by BLM or other surface management agencies, other reclamation standards would be applicable.

Prior to release of the property for unrestricted use, the applicant would conduct a comprehensive radiation survey to establish that any contamination is within the 10 CFR Part 40, Appendix A limits. The applicant would return all lands to their previous land use, unless both the state and landowner justified and approved an alternate land use. For example, a rancher could decide to retain access roads. The goal of decommissioning and reclamation would be to return disturbed lands to conditions of equal or better than what existed prior to uranium recovery. The following sections describe the proposed decommissioning and surface reclamation plans for the Lost Creek ISR Project. As part of this process, wells would be plugged and abandoned, disturbed lands would be reclaimed, contaminated equipment and materials would be removed, appropriate cleanup criteria for structures would be determined, items to be released for unrestricted use would be decontaminated to meet NRC requirements,

and surveys would be performed to determine whether there was residual contamination in soils and structures.

2.1.1.1.5.1 Radiological Surveys and Contamination Control

The applicant would conduct a preremediation radiological survey to identify areas on the proposed Lost Creek ISR Project site that need to be cleaned up to the applicable regulatory limits from the baseline radiological survey. The survey would include soils, structures, and equipment. These decommissioning surveys enable LCI to determine how to best handle or dispose of various soils, structures, and other materials as either process-contaminated or otherwise contaminated. The applicant has committed to using NRC guidelines for decontamination (LCI, 2010a; NRC, 2002). Detection limits for radiological survey equipment are established by license condition to be consistent with NRC guidance (NRC, 2002).

2.1.1.1.5.2 Wellfield Decommissioning

When NRC and WDEQ have reviewed and approved the applicant's assessment that the groundwater restoration is complete for a wellfield, all production, injection, and monitoring wells and drillholes would be plugged and abandoned in place according to BLM and State of Wyoming regulations to prevent adverse impacts to groundwater quality (LCI, 2008b). State of Wyoming rules and regulations that govern well plugging and abandonment include Wyoming Statute 35-11-404, WDEQ Rules and Regulations Chapters VIII and XI, and Wyoming State Engineers Office Rules and Regulations Part III, Chapter VI (LCI, 2010a). To comply with these requirements, the applicant has proposed a general process of well abandonment that includes plugging all wells with a grouting gel specifically designed for well abandonment or using a bentonite (clay) slurry (LCI, 2010a). The casing would be cut off and plugged with well-abandonment gel from total depth to within no less than 1 m [3 ft] of the collar. A plug, either cement or plastic, would be placed at the top of the well casing. Wellfield decommissioning would include the removal of wellfield piping, well heads, and associated equipment. If still usable, the wellfield piping, well heads, and associated equipment would be taken to a new production area. However, if no longer usable, the equipment would be gamma surveyed and placed in either a contaminated or noncontaminated temporary storage area located near the processing plant until disposal. If the final production area is being reclaimed, the contaminated piping, well heads, and associated equipment that are not salvageable would be taken to an NRC-approved disposal facility. When a well is fully abandoned, any disturbed area would be reclaimed and reseeded and a written report sent to the state engineer (LCI, 2010a).

2.1.1.1.5.3 Process Buildings and Equipment and Other Structures

Following completion of groundwater restoration in the final production area, the Lost Creek processing plant and associated structures would be decommissioned. Prior to dismantling any facilities, the applicant would review operational records for spills and conduct preliminary radiological surveys with criteria established by NRC license condition to determine levels of contamination and identify those structures or areas needing decontamination (LCI, 2010a). All process equipment associated with the processing plant would be dismantled and either sold to another NRC-licensed facility or decontaminated in accordance with NRC regulations and guidance documents. Materials unable to be decontaminated would be disposed of at one of the approved facilities mentioned previously. Materials able to be decontaminated would be reused, sold, or removed and disposed of offsite, which is dependent on the type of material, as further discussed in SEIS Section 2.1.1.1.6. When the buildings and concrete subfloors have

been removed, the former building sites would be recontoured to blend in with the surrounding terrain. Gamma surveys would be conducted to verify that radiation levels are within acceptable NRC limits. As described previously, the applicant would be required by license condition to provide a decontamination, decommissioning, and reclamation plan to NRC for review and approval within 12 months prior to commencing reclamation of a wellfield. Soils (topsoil and subsoil) would be replaced at sites where structures are removed, according to BLM's Plan of Operations regulations (43 CFR 3809, Part 400, et seq.). The decontamination, decommissioning, and reclamation plan would include a description of the areas to be reclaimed, a description of the planned reclamation activities, a description of methods to be used to protect workers and the environment against radiation hazards, a description of the planned final radiation survey, and a cost estimate. (LCI, 2010a)

With the exception of any facilities, access roads, or utility corridors required for future operation, the applicant proposed that all of the features associated with a header house would be removed when groundwater restoration in that header house and wellfield has been deemed complete. The header houses and pump stations would be moved to new locations in other areas of the permit area, or dismantled and disposed of in accordance with applicable regulations.

Any contaminated piping would be disposed of at an NRC-licensed facility, and noncontaminated piping would be removed for salvage or for disposal in accordance with applicable regulations. Topsoil along the pipeline route would be spread and the disturbed area reseeded with a seed mixture BLM and WDEQ prescribed.

Soils would be replaced where previously excavated, whenever possible. The topsoil would be stripped, handled, and stockpiled separately from subsoil, in accordance with WDEQ regulations. The replacement would be along the contour, where necessary, to prevent soil erosion. To avoid clods, soils would not be replaced when the ground is wet or frozen. The replaced topsoil would be disked to create an adequate seed bed.

2.1.1.1.5.4 Engineered Structures and Site Roads

Any site roads, as well as roads accessing the Lost Creek ISR site, would be removed and the surface recontoured, except those required for postoperational activities. Culverts, as well as road surface and roadbed materials, would be removed and the land surface reclaimed following BLM regulations and guidelines. Unless approval from NRC or WDEQ for leaving a specific road is obtained for post operational use, the applicant would reclaim all roads. Improved or constructed roads would be reclaimed by removal of culverts; removal of road surfacing materials; replacing stockpiled soils, recontouring; as necessary, preparation of the seed bed; and reseeding in accordance with the procedures outlined using a seed mix approved by BLM and WDEQ. (LCI, 2010a)

2.1.1.1.5.5 Final Contouring and Revegetation

Areas in which reclamation would be required within the permit area include the wellfields, in particular where the header houses and roads have been removed, and the processing plant area. Disturbed areas would be reclaimed to the BLM/WDEQ-approved postoperations land use by regrading the surface to the approximate preoperations contour, reestablishing drainages, replacing salvaged topsoil, and revegetating the areas. (LCI, 2010a)

2.1.1.1.5.6 Schedule

Decommissioning and reclamation are the final steps in the ISR process, and for each wellfield these would begin in approximately the sixth or seventh year after the start of wellfield development (Figure 2-1). When the aquifer has been restored to the standards established by NRC and WDEQ, the activities described in the previous five sections can begin. The applicant estimated the timeframe for decommissioning and land surface reclamation to be approximately 1 year per wellfield. Because it is necessary for the groundwater treatment phase of the groundwater restoration process, the Lost Creek process plant would continue to operate until after restoration is complete in the final wellfield. Decommissioning and land reclamation for the process plant is anticipated to begin about the ninth year of the proposed Lost Creek ISR project and extend over about 2 years (Figure 2-1).

2.1.1.1.6 Effluents and Waste Management

The operation of an ISR facility generates various types of effluents and waste. This section describes the types and volumes of effluents or wastes to be generated by operation of the proposed Lost Creek ISR Project. Also, the textbox that follows defines the different liquid and solid wastes that would be generated. The proposed disposal methods and locations for liquid and solid wastes are described in SEIS Section 3.13, and the impacts from generating and disposing of these wastes are described in SEIS Section 4.14. Baseline air quality and air emission impacts are discussed in Sections 3.7 and 4.7, respectively.

The following terms define the various types of solid and liquid wastes generated at the proposed Lost Creek ISR Project:

Liquid wastes

Liquid byproduct material (this term refers to all liquid wastes resulting from the proposed action except for sanitary wastewater and well development and testing wastewater)

Liquid hazardous waste (Resource Conservation and Recovery Act or state-defined hazardous waste that is non-byproduct material and includes universal hazardous wastes and used oil)

Sanitary wastewater [ordinary sanitary (septic system) wastewater; this wastewater is nonhazardous, nonbyproduct material wastewater]

Well development and testing wastewaters (wastewater generated during well development and pumping tests; this water is nonhazardous, nonbyproduct material wastewater and would not require treatment before disposal)

Solid wastes

Solid byproduct material (this term refers to all solid wastes resulting from the proposed action that exceed NRC limits in 10 CFR Part 20 for unrestricted release)

Nonhazardous solid waste [including domestic/municipal wastes (trash), construction/ demolition debris, septic solids, and material such as equipment and soils) that have been determined to meet NRC criteria in 10 CFR Part 20 for unrestricted release]

Hazardous waste (Resource Conservation and Recovery Act or state-defined hazardous waste that is nonbyproduct material and includes universal hazardous wastes)

2.1.1.1.6.1 Gaseous or Airborne Particulate Emissions

During the four stages of the proposed Lost Creek ISR Project (construction, operation, aquifer restoration, and decommissioning), airborne emissions from the ISR process would primarily consist of fugitive dusts {from 31 km [19 mi] of unpaved roads}; combustion engine exhausts (from vehicles and onsite equipment); and radon gas emissions during various stages of construction, well drilling, and processing. No significant airborne uranium particulate emissions would be expected from the proposed Lost Creek ISR Project because the proposed processing does not include drying the yellowcake slurry product.

Fugitive dust would be generated primarily during construction, transportation, and decommissioning activities by travel on unpaved

roads and from disturbed land associated with the construction of wellfields, roads, and auxiliary facilities. With the prevailing wind direction from the west and northwest during the day (LCI, 2010a), airborne emissions produced by the proposed Lost Creek Project would generally blow in the east and southeast directions. In addition, access roads would be maintained via motorized patrol and the applicant would minimize disturbance to natural vegetation when possible to minimize wind erosion. The applicant estimated the total dust from vehicular traffic on gravel roads during the operation phase at 154 t/yr [170 T/yr] based on proposed activities and emissions factors the EPA provided (EPA, 2006; LCI, 2008a; 2010a). Traffic-generating activities included in the calculations account for employees commuting, ion-exchange resin shipments, and delivery of supplies and materials. Combustion engine exhaust due to vehicular exhaust from workers commuting to the site; materials transport to the site; and diesel emissions from drill rigs, diesel-powered water trucks, and other equipment used during the construction phase would also contribute to gaseous particulate emissions. NRC staff calculated emissions from diesel combustion engines in drilling rigs and construction equipment used predominantly during the construction and decommissioning phases; these are detailed in SEIS Appendix D. These calculations evaluated emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), particulate matter (PM_{10}), formaldehyde, volatile organic compounds (VOC), and carbon dioxide (CO_2). Results show CO_2 and NO_x have the highest emissions of the pollutants evaluated. The calculated annual emissions for these pollutants during the construction phase bound emissions calculated for the decommissioning phase. Based on the applicant's proposed schedule for wellfield construction that includes overlapping wellfield construction, the emissions-generating activities were approximated by assuming one wellfield per year was constructed. The NRC staff also assumed the applicant would drill two deep disposal wells in the first year. The calculated annual emissions of CO_2 and NO_x for this construction scenario are 816 and 17.2 t/yr [900 and 19 T/yr]. The staff's emissions calculation results indicate the drilling of deep wells contributes a significant proportion to the total emissions during construction. Therefore, if the applicant chose to drill a wellfield and all five proposed deep wells in 1 year, these emissions would increase to 1,722 t/yr [1,900 T/yr] CO_2 and 35 t/yr [39 T/yr] NO_x. Approximations of the cumulative facility lifecycle emissions for CO_2 and NO_x from construction of all six proposed wellfields and five deep disposal wells and reclamation of these wellfields and all surface facilities are 6,165 t/yr [6,800 T/yr] and 154 t/yr [170 T/yr]. Results for all of the diesel engine emissions calculated are also provided in SEIS Appendix D. Mobile road (vehicle) combustion emissions were not calculated, because these engine emissions are controlled at the source by mandated emission controls and the magnitude of proposed road vehicle activity is small relative to existing road traffic (Section 4.3).

The primary radioactive airborne effluent at the proposed Lost Creek ISR Project would be Rn-222 gas. Rn-222 can be released in to the wellfield when the pregnant lixiviant is brought to the surface from the ore-zone aquifer. Radon-222 can be released during wellfield drilling, production, operation of the plant facilities, resin transfer operations, and aquifer restoration activities. The highest annual radon-222 releases would occur when multiple, concurrent release activities occur during a single year (as shown in Figure 2-1). The applicant calculated the potential radon-222 emissions from the proposed Lost Creek ISR Project (LCI, 2008b) using methods NRC documented in NUREG–1569 (NRC, 2003a). The highest annual radon-222 emissions from these results were 13.76 TBq/yr [372 Ci/yr] as the sum of concurrent radon releases from wellfield construction, wellfield production, ion-exchange purges, and wellfield restoration purges and venting (LCI, 2008b). Additional information on proposed radon-222 emissions and the evaluation of potential impacts are provided in Section 4.13.1.2.1.

In proposed facilities, the use of general area and local ventilation systems would aid in controlling the buildup of radon to limit worker exposures (LCI, 2008b). General area ventilation

involves forced air ventilation of work areas in process buildings using fans along exterior walls at the floor level. Local ventilation for process vessels where radon releases are more likely would involve hoods, ducting, or piping near the point of release and fans, where needed, to exhaust the radon emissions to the outside atmosphere through a stack.

Potential sources of radioactive particulate emissions at ISR facilities can include emissions from resuspension of dried storage pond sediments. Because the proposed action does not include yellowcake drying operations, potential radioactive particulate emissions from drying operations would not occur. The applicant also proposes to maintain sufficient liquid in ponds to avoid resuspension of pond sediments.

2.1.1.1.6.2 Liquid Wastes

The proposed Lost Creek ISR Project would generate liquid waste from production bleed, restoration, miscellaneous plant wastewater, and domestic liquid waste. These wastes are described as either liquid byproduct material or other liquid wastes.

Liquid byproduct materials would be generated during all phases of uranium recovery at the proposed Lost Creek ISR Project. Such effluents include well-development water, pumping test water, storm water runoff, waste petroleum products and chemicals, washdown water, and domestic (sanitary) wastewater. Liquid effluents generated during well development and pumping tests would have to at least satisfy WDEQ-water quality division (WQD) Class IV (groundwater cleanup) standards. Based on NRC (1999), liquid effluent wastes generated during or after the uranium-extraction phase of site operations and all evaporation pond sludge derived from such waste waters are classified as byproduct material. The applicant estimates that the liquid byproduct material volumes during operations would be about 230 to 340 L/min [60 to 90 gal/min], and the maximum liquid byproduct material produced during aquifer restoration would be about 492 L/min [130 gal/min]. The applicant has received a 10-year permit from WDEQ for up to five UIC Class I disposal wells for deep injection of the liquid byproduct material. The maximum permitted disposal capacity in these five wells would be 946 L/min [250 gal/min] (WDEQ, 2010).

Although not a liquid waste, storm water runoff would also need to be managed at the proposed Lost Creek ISR Project. Facility drainage would be designed to route storm water runoff away from or around the processing facilities, ancillary buildings, chemical storage buildings, and parking areas. Federal and State agencies regulate the discharge of both storm water runoff and the discharge of wastewater to surface waters through their permitting processes. The status of obtaining a storm water permit for the proposed Lost Creek Project, as required under the Clean Water Act and WDEQ regulations, is summarized in SEIS Table 1-2.

The water balance (water flow rates through the plant and the wastewater disposal systems) for wellfields in production and those in restoration at the proposed Lost Creek ISR Project is shown graphically in Figure 2-13.

The restoration water would be treated by reverse osmosis and then reinjected into the production area undergoing restoration. Restoration water bleed would be transferred to the deep disposal wells. Sanitary wastes would also be generated from restrooms and lunchrooms. Sanitary wastes would be disposed of in an onsite septic system. (LCI, 2008b)

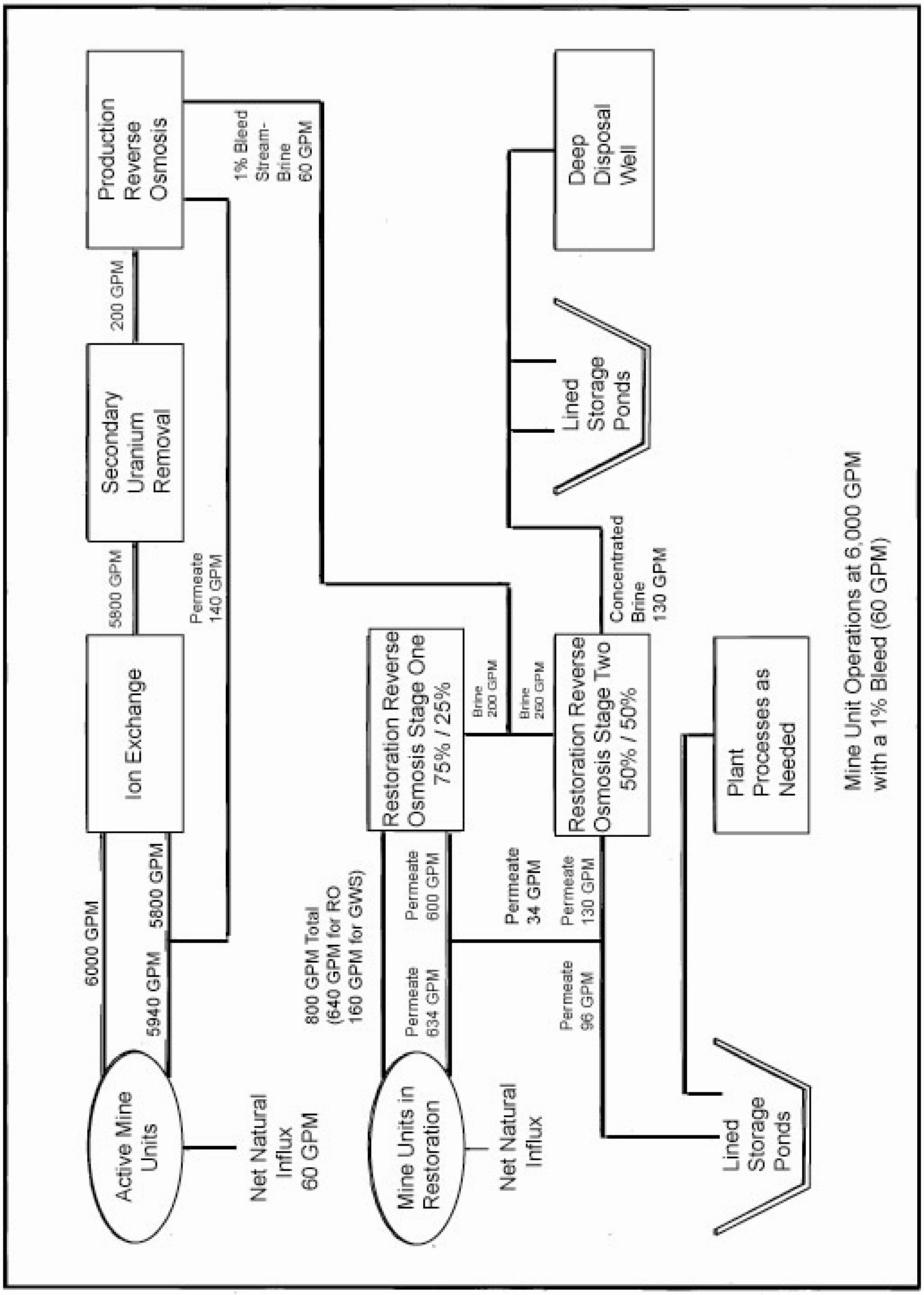

Figure 2-13. Project Water Balance
Source: Modified from LCI (2008b)

2.1.1.1.6.3 Solid Wastes

All phases of the operational lifecycle of the proposed Lost Creek ISR Project could generate solid byproduct material and nonhazardous solid waste. Solid byproduct material is material that does not meet the NRC criteria for unrestricted release (including any soils contaminated from the operations). This material would be disposed of at a licensed disposal site. Byproduct material could include spent resin, empty chemical containers and packaging, pipes and fittings, tank sediments, contaminated soils from leaks and spills, and contaminated construction and demolition debris. Nonhazardous solid wastes could include septic solid, municipal solid waste (general trash), and other solid wastes.

The storage, treatment, and eventual disposal of these wastes would differ according to their characteristics. These wastes are described as solid byproduct material, solid nonhazardous and nonradioactive waste, or solid hazardous waste.

Solid waste contaminated with radioactive material that cannot be decontaminated to meet NRC limits for unrestricted release (including any soils contaminated from the operations) would be disposed of as byproduct material at a licensed waste disposal site or mill tailings facility. These materials would include process wastes (spent ion-exchange resin, filter media, and tank sludge) and equipment (tanks, vessels, and piping) that become contaminated during the ISR process. To the extent practicable, these materials would be decontaminated for disposal or reuse. Equipment and materials that cannot be decontaminated would be properly packed, sealed, and labeled for disposal at a licensed facility. The applicant estimates that approximately 77 m^3 [100 yd^3] of solid byproduct material would be generated annually during facility operations. The applicant proposes to temporarily store this waste in clearly labeled, covered containers in posted restricted access areas. (LCI, 2010a)

The NRC staff calculated the amount of solid byproduct material that could be generated from decommissioning activities based on information provided in the applicant's surety estimate (LCI, 2010b) to be 3,032 m^3 [3,966 yd^3]. This estimate includes materials resulting from removal of plant facilities and equipment, wellfield equipment and piping from the six proposed wellfields, and removal of any contaminated soils that do not meet NRC limits for unrestricted release. As described earlier, the applicant does not presently have an agreement in place with a licensed site to accept its solid byproduct material for disposal. The applicant would be required to have a byproduct material disposal agreement in place prior to operations. The applicant has committed to obtaining the required disposal agreement prior to operations (LCI, 2010a), but as of this writing (March 2011), a specific agreement is not yet in place. Section 3.13 describes the options for disposal site locations, and Section 4.14 describes the impact of disposing of solid byproduct material.

Nonhazardous solid wastes are either (i) nonradioactive or (ii) comply with NRC unrestricted release limits and do not contain hazardous waste. This would include materials such as paper, wood, plastic, steel, biodegradables, and sewage sludge. Materials that can be decontaminated would fall in this category. Solid nonhazardous waste materials, with the exception of sewage sludge, would be recycled, where possible, or temporarily stored in bins prior to offsite disposal at a licensed solid waste facility. The applicant estimates that approximately 380 to 540 m^3 [500 to 700 yd^3] of nonradioactive solid waste plus 2.3 to 3.8 m^3 [3 to 5 yd^3] of sewage sludge, would be generated annually when the facility is operating (less than one truckload/year). The NRC staff calculated the amount of nonhazardous solid waste that could be generated from decommissioning activities based on information provided in the applicant's surety estimate (LCI, 2010b) as 1,251 m^3 [1,380 yd^3]. This estimate includes nonhazardous solid waste

materials resulting from removal of plant facilities and equipment and wellfield equipment from the six proposed wellfields. Assuming 15 m^3 [20 yd^3] per truck, this would result in a total of about 69 total shipments of nonhazardous solid waste (LCI, 2010b). Section 3.13 describes the expected disposal site location and capacity, and Section 4.14 describes the impact of disposing nonhazardous solid waste from the proposed Lost Creek ISR Project.

Hazardous wastes (such as waste petroleum products and batteries) would be stored in clearly labeled, sealed containers in a secure location and periodically collected by a commercial hauler for recycling or energy recovery or disposal at a licensed disposal facility. All hazardous waste materials would be handled and disposed of in compliance with all pertinent state and federal regulations. The applicant estimates 4.5 to 9.1 kg [10 to 20 lb] of batteries and other nonradioactive hazardous wastes would be generated annually.

The applicant did not provide a detailed list of hazardous wastes that would be generated by the proposed project. Based on the operations and waste types generated at similar ISR facilities, NRC anticipates that the proposed Lost Creek ISR Project facility would be classified as a conditionally exempt small quantity generator of hazardous waste (CESQG), under RCRA and Wyoming regulations. This classification does not require a permit or license from WDEQ. A CESQG (i) must determine whether its waste is hazardous; (ii) must not generate more than 100 kg [220 lb] per month of hazardous waste or, except with regard to spills, more than 1 kg [2.2 lb] of acutely hazardous waste; (iii) may not accumulate more than 1,000 kg [2,205 lb]of hazardous waste onsite at any time; and (iv) must treat or dispose of its hazardous waste in a treatment storage or disposal (TSD) facility that meets specific requirements of 40 CFR 261.5. If the facility fails to meet these four criteria, it would lose CESQG status and be fully regulated as either a small-quantity generator {more than 100 kg [220 lb] but less than 1,000 kg [2,205 lb] of nonacute hazardous waste per calendar month} or a large-quantity generator {at least 1,000 kg [2,205 lb] nonacute hazardous waste per calendar month}. Any hazardous waste, such as organic solvents, paints, waste oil and paint thinners, empty chemical containers, tank sediments/sludges, chemical waste, and spent batteries, would be stored in clearly marked containers and disposed of in accordance with a management program that the facility would develop to meet applicable local, State, and Federal regulatory requirements. (LCI, 2008a; 2010a)

2.1.1.1.7 Transportation

Primary transportation activities would involve truck shipping and worker commuting. A variety of truck shipments are planned to support proposed activities during all phases of the facility lifecycle. This shipping activity involves construction equipment and materials, operational processing supplies, ion-exchange resins, yellowcake product, and waste materials.

Transportation to, from, and within the boundaries of the proposed Lost Creek ISR Project would primarily encompass the use of both light-duty and heavy trucks. Light-duty trucks and automobiles would transport construction contractors and the operations workforce, as well as deliver smaller equipment and office supply products. The applicant's estimates of the workforce required for each phase are construction (94 workers), operations (89 workers) aquifer restoration (17 workers) and decommissioning (11 workers). During all phases of the project, heavy-duty trucks would transport construction equipment and materials, operational processing supplies, yellowcake slurries, and waste materials. Transportation to and from the proposed Lost Creek ISR Project area would include shipment of yellowcake slurry from the processing plant to an offsite dryer; delivery of construction-related materials, process chemicals, and maintenance equipment from suppliers; shipments of nonhazardous solid waste

to local landfills; transfer of byproduct material to a licensed facility for disposal; and the transport of employees to and from the proposed site. Potential transportation impacts are described in SEIS Section 4.3.

Within the proposed Lost Creek ISR Project area, there would be about 15 light trucks traveling to and from the wellfields for monitoring and maintenance and 10 drill rigs operating for well installation and ore delineation. These vehicles would reside onsite and not routinely leave unlike the commuting workforce, incoming shipments of supplies, or outgoing yellowcake slurry. The projected vehicle types and numbers are provided in Table 2-1. Considering the maximum annual production rate of yellowcake slurry at the proposed Lost Creek ISR Project of 453,600 kg [1 million lb] and an approximate capacity of 6,800 kg [15,000 lb] for each yellowcake slurry shipment) (LCI, 2008a), about 70 slurry shipments (one shipment every 5 days), would occur each year of operations. Assessment of potential transportation impacts of the proposed action is provided in SEIS Section 4.3.

A final destination for outgoing shipments of yellowcake slurry has not been determined at this time. Construction-related materials, process chemicals, and maintenance supplies would be delivered on varying schedules depending on production rate, usage, time of year, and other needs. Projections of solid waste generation are similarly dependent on production rate. The applicant estimates that initial vehicular traffic, including commuting employees, would consist of at 30 to 35 light trucks and 2 to 5 heavy trucks per day entering and leaving the site during the construction phase. During operation, light truck traffic would diminish slightly to about 20 light trucks, with heavy truck traffic remaining constant at 2 to 5 heavy trucks per day (this includes 1 to 2 trucks per week carrying yellowcake slurry offsite).

The traffic generated during the decommissioning phase, related to shipment of waste materials offsite, is expected to represent most of the truck traffic during that period. The NRC staff estimated the annual and average daily number of shipments that would be expected from the proposed decommissioning activities for the processing plant and six wellfields, based on the calculated amounts of decommissioning solid wastes described in SEIS Section 2.1.1.1.6.3 (3,032 m^3 [3,966 yd^3] of solid byproduct material and 1,251 m^3 [1,380 yd^3] of total nonhazardous solid waste) and the volume of material per shipment (15 m^3 [20 yd^3]). Because the applicant proposed a 12-month duration for the decommissioning of each wellfield (Figure 2-1), NRC staff conservatively estimated the annual decommissioning waste generated by assuming the applicant completes decommissioning and reclamation of a single wellfield, 3 deep disposal wells, and all the surface facilities in a single year. This resulted in approximately 175 shipments of waste material for 1 year. Based on the types and estimated volumes of waste generated, the staff estimated that approximately 40 percent of these shipments would go to a landfill and the remainder to a licensed byproduct facility. If the disposal facilities are assumed to accept shipments 5 days per week, and the shipments are assumed to occur throughout the year with each shipment resulting in 2 one-way truck trips, the annual average daily traffic contribution would be approximately 0.67 truck round trips per day and about 3.4 shipments per week or approximately 6 one-way trips per week. This level of trucking activity for decommissioning waste shipments is lower than the applicant's estimates for trucking during the other phases of the proposed facility lifecycle.

2.1.1.1.8 Financial Surety

As stated in GEIS Section 2.10, NRC regulations [10 CFR Part 40, Appendix A, Criterion (9)] require that applicants cover the costs to conduct decommissioning, reclamation of disturbed

Table 2-1. Projected Vehicle and Construction Equipment: Proposed Lost Creek ISR Project

Vehicle Type	Company Owned (Onsite Only)	Company Owned (On- and Offsite)	Contractor Owned (On- and Offsite)	Total
Pickup Truck (½, ¾, 1 ton)	24	3	10	37
Van	—	4	—	4
Tractor Trailer	—	1	—	1
All Wheel Drive Forklift	3	—	—	3
Hard Surface Forklift	2	—	—	2
Motor Grader	1	—	—	1
Backhoe	2	—	—	2
Geophysical Logging Truck	3	—	—	3
All Terrain Vehicle	1	—	—	1
Flat Bed Trailer	3	—	—	3
Reel Trailer	3	—	—	3
High-Density Polyethylene (HDPE) Fusion Cart	1	—	—	1
Generator	9	—	—	9
Water Truck	2	—	10	12
Mechanical Integrity Testing Truck	1	—	—	1
Cementers	6	—	—	6
Side Dump or End Dump Trailer	—	1	—	1
Truck-Mounted Drill Rig	—	—	10	10
Source: LCI (2008a,b)				

areas, waste disposal, dismantling, disposal of all facilities including buildings and wellfields, and groundwater restoration. The applicant would maintain financial surety arrangements to cover such costs for the proposed Lost Creek ISR Project. The initial surety estimate would be based on the first year of operation, which includes the construction of the Lost Creek processing plant. NRC and WDEQ-LQD would require, on a forward-looking basis, annual revisions to the financial surety to cover existing and planned operations and existing and planned construction. When NRC, WDEQ-LQD, and the applicant have agreed to the estimate, the applicant would submit a reclamation performance bond, irrevocable letter of credit, or other surety instrument to NRC and WDEQ-LQD. NRC reviews financial surety in detail as part of its review for the Safety Evaluation Report. For additional information on financial surety requirements, see 10 CFR Part 40, Appendix A and GEIS Section 2.10.

2.1.1.2 Alternative Wastewater Disposal Options

Liquid wastes would be generated during the operations and aquifer restoration phases of the lifecycle for the proposed Lost Creek ISR Project. These wastes are considered byproduct materials and must be managed and disposed of in compliance with applicable state and federal regulations, as established by license and permit. The applicant states the normal operational waste stream would be nonhazardous under the Resource Conservation and Recovery Act (RCRA). Predominantly, the liquid waste stream would consist of the following:

- Process bleed ranging from 1.5 percent of the total water extracted from the ore horizon

- Effluents from the processing plant such as process drains, elution circuit bleed, and washdown water

- Wellfield purge water

- Ion-exchange and reverse-osmosis reject brines produced during aquifer restoration

Of these, the process bleed would be the largest component during operations. Assuming a total plant throughput of 22,700 Lpm [6,000 gpm], a 1.0 to 1.5 percent process bleed would produce about 227 to 340 Lpm [60 to 90 gpm] of liquid waste. During the aquifer restoration phase of the facility, the majority of the liquid waste would comprise discharge from the groundwater sweep and reverse osmosis processes used to treat groundwater, with each process generating about 606 Lpm [160 gpm] for disposal. Because operations and groundwater restoration would overlap during the 8-year lifecycle of the proposed Lost Creek ISR Project, the applicant estimates the average wastewater for disposal would be about 659 Lpm [174 gpm]. (LCI, 2008a)

The applicant has proposed managing its liquid waste using deep well injection through UIC Class I wells. In May 2010, the applicant received a permit from WDEQ for up to five UIC Class I injection wells for deep disposal of liquid wastes into the Fort Union Formation at a depth of between about 1,125 and 2,286 m [6,139 and 9,590 ft] (WDEQ, 2010). WDEQ classified the groundwater in the Fort Union Formation as Class VI, [unusable or unsuitable for use (WDEQ, 2005)], and each well is permitted for a maximum injection rate of 189 Lpm [50 gpm], for a total maximum disposal capacity of 950 Lpm [250 gpm]. In addition, the applicant has proposed constructing two storage ponds, each with an area of 0.39 ha [0.96 ac]. By maintaining a freeboard of about 1.2 to 1.5 m [4 to 5 ft], the applicant states that the storage ponds could manage about 227 Lpm [60 gpm] of wastewater. Therefore, the 5 permitted UIC Class I injection wells and the proposed storage ponds could manage a maximum of about

1,173 Lpm [310 gpm] if both systems operated at maximum capacity, more than the anticipated wastewater rate of 659 Lpm [174 gpm] (LCI, 2008a). Even without taking into consideration the storage pond capacity, the total disposal capacity the WDEQ UIC permit defined {950 Lpm [250 gpm]} is greater than the anticipated wastewater rate. This option is discussed in Section 2.1.1.1.

Historically, ISR facilities have used several other methods to manage and dispose of liquid wastes. These include solar evaporation ponds, land application, and surface water discharge. The following sections consider these disposal options, as well as deep well injection through UIC Class V permitted wells (NRC, 2003a). The characteristics of each of these different wastewater disposal options are summarized in Table 2-2.

In addition to these methods, the applicant for the proposed Moore Ranch ISR Project in Campbell County, Wyoming, evaluated the potential costs and benefits associated with two other wastewater disposal options: (i) mechanical evaporation of liquid wastes using either gas or electric power and (ii) liquid waste volume reduction by chemical precipitation/reverse osmosis (Uranium One, 2009). Based on reasonable assumptions, the applicant for the proposed Moore Ranch ISR Project calculated that the amounts of energy associated with mechanical evaporation were more than a factor of 10 greater than the proposed action of deep well disposal via injection into UIC Class I wells. Similarly, the disposal of the brines produced by the chemical precipitation/reverse osmosis resulted in increased offsite shipments of byproduct material for disposal (43 additional truck shipments/week) with disposal costs increased by a factor of almost 70 (Uranium One 2009).

2.1.1.2.1 Evaporation Ponds

One commonly used method to dispose of liquid wastes is to pump the liquids to one or more ponds and allow for natural solar radiation to reduce the volume through evaporation. The waste streams are usually treated prior to being discharged into evaporation ponds, but radionuclides and other metals may still be present, which are concentrated as the liquids evaporate. The basic design criteria for an evaporation pond system are contained in 10 CFR Part 40, Appendix A. The location of the pond(s), design, and construction of the necessary clay or geotextile liner systems and embankments for the ponds, as well as pond inspection and maintenance, would be conducted in accordance with NRC regulations (NRC, 2003b, 2008b), and established by NRC license conditions, as necessary. The siting and design of any impoundments would also take into account applicable EPA requirements at 40 CFR Part 264 (NRC, 2008b). The Wyoming State Engineer's Office also has state permitting authority for new impoundments. An earlier study of potential locations for a tailings impoundment associated with a potential conventional uranium mill at the site of the proposed Lost Creek ISR facility identified nearby natural basins underlain by a mudstone (NRC, 1982). This low permeability layer would be a favorable condition to be considered in siting potential evaporation ponds for this waste disposal option. The effectiveness of this wastewater disposal option would depend on the evaporation rate compared to the rate at which liquid wastes are produced. The evaporation rate varies seasonally, depending on temperature and relative humidity; the rate tends to be highest during warm, dry conditions and is lower under cool, humid conditions. If the evaporation rate is low or the seasonal conditions favoring evaporation are short in duration, the operator could compensate to some extent by increasing the size, and therefore, the surface area, of the evaporation pond(s). Historically, the area of an individual evaporation pond at uranium ISR facilities has ranged from about 0.04 to 2.5 ha [0.1 to 6.2 ac] (NRC, 1997, 1998a,b; Cohen and Associates, 2008), although these are for facilities that use a combination of waste disposal methods.

Table 2-2. Comparison of Different Liquid Wastewater Disposal Options

	Class I Injection Well	Class V Injection Well	Evaporation Ponds	Land Application	Discharge to Surface Waters
Land S ze/ Footpr nt	0.1 ha [0.25 ac]	0.1 ha [0.25 ac] Potent a y add t ona and area requ red for rad um-sett ng bas ns 0.1 to 1.5 ha [0.25 to 4 ac] and purge reservo rs 4 ha [10 ac] or more.	Ind v dua Pond: 0.4 to 2.5 ha [1 to 6.25 ac], max 16.2 ha [40 ac]. Pond System: about 40 ha [100 ac].	40 ha [100 ac] Potent a y add t ona and area requ red for rad um-sett ng bas ns 0.1 to 1.6 ha [0.25 to 4 ac] and purge reservo rs 4 ha [10 ac] or more.	0.1 ha [0.25 ac], depend ng on outfa . Potent a y add t ona and area requ red for rad um-sett ng bas ns 0.1 to 1.6 ha [0.25 to 4 ac] and purge reservo rs 4 ha [10 ac] or more. Potent a y separate storage fac t es (mpoundments, tanks) to ma nta n separate waste streams.
Re evant Regu at ons and Perm ts	10 CFR Part 20, Subparts D, K UIC C ass I perm t (WDEQ)	10 CFR Part 20, Subparts D, K, Append x B UIC C ass V perm t (WDEQ) WYPDES perm t (WDEQ)	10 CFR Part 40, Append x A Wyom ng State Eng neer's Off ce Contract for byproduct mater a d sposa (ners, s udges). App cab e EPA re ease m ts	10 CFR Part 20, Subparts D, K, Append x B 10 CFR Part 40, Append x A, Cr ter on 6(6) Zero re ease WYPDES perm t (WDEQ) App cab e EPA re ease m ts	10 CFR Part 20, Subparts D, K, Append x B NESHAP perm t (40 CFR Part 61) Zero re ease WYPDES perm t (WDEQ) Zero re ease WYPDES perm t (40 CFR Part 440, Subpart C)
Construct on Requ rements	Land c ear ng and excavat on equ pment for pad, mud p ts. Dr ng r g	Land c ear ng and excavat on equ pment for pad, mud p ts, rad um-sett ng bas s, treatment fac t es. Dr ng r g	Land c ear ng and excavat on equ pment to prepare surface for pond(s). Construct on equ pment to construct pond ner(s).	Land c ear ng and excavat on equ pment for roads, rad um-sett ng bas ns, treatment fac t es.	Land c ear ng and excavat on equ pment for roads, rad um-sett ng bas ns, treatment fac t es.

Table 2-2. Comparison of Different Liquid Wastewater Disposal Options (continued)

	Class I Injection Well	Class V Injection Well	Evaporation Ponds	Land Application	Discharge to Surface Waters
Wastewater Storage Pr or to D sposa	App cant proposes two 0.39-ha [0.96-ac] storage ponds for surge capac ty.	Storage/surge tank(s) Rad um-sett ng bas ns, treatment fac ty f needed to reduce rad um and uran um, and other contam nant concentrat ons.	None	Storage/surge tanks(s) Rad um-sett ng bas ns, treatment fac ty f needed to reduce rad um and uran um, and other contam nant concentrat ons.	Yes. App cant may e ect to ma nta n separate “process” and “m ne” wastewater streams. Rad um-sett ng bas ns, treatment fac ty f needed to reduce rad um and uran um, and other contam nant concentrat ons.
Wastewater Treatment	No add t ona treatment, but may add ant fou ng agent to reduce sca ng n we .	Decontam nat on through on exchange reverse osmos s (RO). Add t ona treatment of nject on zone c ass of use/pr mary dr nk ng water, wh chever s more str ngent. May add ant fou ng agent to reduce sca ng n we .	Decontam nat on through IX/RO. No add t ona treatment.	Decontam nat on through IX/RO. Rad um-sett ng bas ns, treatment fac ty f needed to reduce rad um and uran um, and other contam nant concentrat ons.	Decontam nat on through IX/RO. Add t ona treatment c ass of use/pr mary dr nk ng water, wh chever s more str ngent.
Decomm ss on ng	P ug and abandon we n accordance w th WDEQ requ rements.	Rad um-sett ng bas n ners and s udges, treatment of bu d ng debr s to be d sposed as byproduct mater a , add t ona transportat on of wastes to censed d sposa fac ty. P ug and abandon we n accordance w th WDEQ requ rements.	Pond ners and s udges to be d sposed of as byproduct mater a , add t ona transportat on of wastes to censed d sposa fac ty.	Rad um-sett ng bas n ners and s udges, treatment of bu d ng debr s to be d sposed of as byproduct mater a , add t ona transportat on of wastes to censed d sposa fac ty. App cat on so s to be d sposed of as byproduct mater a f m ts exceeded. Add t ona transportat on of wastes to censed d sposa fac ty.	Rad um-sett ng bas n ners and s udges, treatment of bu d ng debr s to be d sposed of as byproduct mater a , add t ona transportat on of wastes to censed d sposa fac ty.

Table 2-2. Comparison of Different Liquid Wastewater Disposal Options (continued)

	Class I Injection Well	Class V Injection Well	Evaporation Ponds	Land Application	Discharge to Surface Waters
Env ronmenta Benef ts	Iso at on from access b e env ronment. Low exposure to nd v dua s at surface. Sma est footpr nt, no add t ona decomm ss on ng wastes. No added transportat on mpacts for wastes. No add t ona waste streams created. M n ma and temporary v sua mpacts from dr ng.	Wastewater treated to dr nk ng water standards.		Wastewater treatment to reduce uran um, rad um, and other const tuents. L m ted construct on needed for and app cat on area.	Wastewater treated to dr nk ng water standards.
C mate Inf uences	Deeper dr ng requ res onger r g t me, h gher d ese em ss ons (approx mate y 20 × typ ca product on we).	Deeper dr ng requ res onger r g t me, h gher d ese em ss ons (approx mate y 20 × typ ca product on we). Add t ona equ pment needed to construct wastewater storage and treatment fac t es.	Add t ona equ pment needed to construct evaporat on ponds.	Add t ona equ pment needed to construct wastewater storage and treatment fac t es.	Add t ona equ pment needed to construct wastewater storage and treatment fac t es.
Hea th & Safety Issues	Potent a p pe ne eaks.	Potent a eaks from wastewater storage and treatment fac t es. Add t ona waste vo ume dur ng decomm ss on ng.	Potent a eaks from evaporat on ponds. Add t ona waste vo ume dur ng decomm ss on ng.	Potent a eaks from wastewater storage and treatment fac t es. Add t ona waste vo ume dur ng decomm ss on ng.	Potent a eaks from wastewater storage and treatment fac t es. Add t ona waste vo ume dur ng decomm ss on ng.

The total footprint of the evaporation pond system for all liquid waste streams has been estimated as high as 40 ha [100 ac] (NRC, 1997). The applicant, however, has proposed only two storage ponds, each with a surface area of 0.39 ha [0.96 ac] to be used in conjunction with deep well disposal via a UIC Class I injection well (LCI, 2010a; 2008a,b).The estimated average annual evaporation rate from free water surfaces in the vicinity of the proposed Lost Creek ISR Project is about 109 cm/yr [43 in/yr] (Wyoming State Climate Office, 2004). Using this estimate, the minimum total pond area needed to handle the anticipated wastewater volumes {340 to 659 Lpm [90 to 174 gpm]} by evaporation alone would be about 16 to 32 ha [41 to 78 ac]. The proposed storage ponds would not be sufficient by themselves to handle the anticipated wastewater volumes; the applicant has specifically stated that these ponds are only to provide temporary surge capacity if the disposal wells need to be shut down and are not intended to be used as evaporation ponds for routine disposal of wastewater (LCI, 2010a; 2008a,b). Taking into account annual precipitation effectively reduces the evaporation rate, thus requiring the pond system to be about 25 percent larger. Also, additional storage areas would need to be built to facilitate wastewater transfer between ponds for maintenance or repair work. During the winter months in Wyoming where temperatures are below freezing, the ponds would be ice covered, reducing the evaporation effectively to zero. To maintain year-round liquid disposal capability at the proposed Lost Creek ISR Project facility, the applicant would be required to have either sufficient storage capacity or at least one other disposal option (e.g., deep well injection, land application) available.

To identify potential leaks from the evaporation pond system into the subsurface, an applicant would need to design, construct, and monitor a leak detection system and conduct routine inspections, typically on a daily, weekly, monthly, and quarterly basis, with special inspections as appropriate (NRC, 2008b). According to Regulatory Guide 3.11, an applicant's design should also incorporate freeboard (i.e., distance from the water level to top of the embankment) of about 1 to 2 m [3 to 6 ft], depending on the size of the individual pond, so precipitation or wind-driven waves would not result in an overtopping of the embankment (NRC, 2008b). The applicant has stated that it would install a leak detection system and maintain freeboard at 1.2 to 1.5 m [4 to 5 ft] in its storage ponds (LCI, 2008a). Additionally, an applicant would need to maintain sufficient reserve capacity in the storage pond system to allow the entire contents of one or more pond(s) to be transferred to other ponds in the event of a leak and subsequent corrective action and liner repair (NRC, 2009). An applicant would also implement measures such as perimeter fencing and netting to protect humans and wildlife. These measures would be established as conditions in an NRC license and enforced through the NRC inspection program. In addition, an applicant would be expected to operate, monitor, and maintain an evaporation pond disposal system to ensure compliance with all applicable federal and state regulations that govern potential airborne effluents.

Because pond(s) are open to the air, dust and dirt can be blown into the pond, and dissolved solids concentrations may increase through evaporation to the point where salts precipitate from the solution. The ponds may need periodic maintenance to clean and maintain good repair and to adjust the necessary freeboard. The accumulated salts and solids would be disposed as byproduct material at an NRC-licensed disposal facility. For example, the applicant for the proposed Moore Ranch ISR Project evaluated the potential waste volumes and costs/benefits associated with liquid waste disposal using evaporation ponds as compared to disposal via Class I deep well injection (Uranium One, 2009). For the assumed conditions at Moore Ranch, the applicant estimated that the volumes of solid byproduct material produced as solidified brine from an evaporation pond system would be about 76.5 m^3 [100 yd^3] every 3 to 4 days. This volume of solid byproduct material would result in about 10 truck shipments per week for offsite disposal at an NRC-licensed facility (Uranium One, 2009). Similarly, when the operations and

aquifer restoration phases end, the pond liners and any accumulated materials would be disposed as byproduct material. As an example of decommissioning waste volumes, the amount of byproduct material generated during decommissioning and reclamation of evaporation ponds at the Smith Ranch ISR facility in Converse County, Wyoming, was estimated in 2007 at 52 m^3 [68 yd^3] (NRC, 2009). The applicant for the proposed Lost Creek ISR Project estimates that decommissioning the two proposed storage ponds {0.78 ha [1.91 ac]} at the end of the project lifecycle would generate about 867 m^3 [1,134 yd^3] of solid byproduct material (sludges, liners, and leak detection system piping) for offsite waste disposal at an NRC-licensed facility (LCI, 2008a, 2010).

2.1.1.2.2 Land Application

Land application is a disposal technique that uses agricultural irrigation equipment to broadcast wastewater on a relatively large area of land for subsequent evaporation. Land application is authorized, but has not been implemented, at several ISR facilities (NRC, 1995; 1998b). Liquid effluent disposed of in this manner would require treatment to meet NRC release requirements in 10 CFR Part 20, Subparts D and K and Appendix B, and WDEQ requirements imposed by a zero-release Wyoming Pollution Discharge Elimination System (WYPDES) permit (NRC, 2003a). Water, soils, and vegetation would be monitored on a regular basis established by license condition to ensure soil loadings and vegetation concentrations remain within permit limits (NRC, 1995, 2003a).

Pretreatment of liquid wastes using ion-exchange columns, reverse osmosis, and precipitation of barium/radium sulfate is typically incorporated into this process to decrease uranium and radium levels. This pretreatment is necessary to meet regulatory release limits and minimize the potential buildup of radionuclides in surface soils and vegetation. Despite pretreatment, however, liquid waste disposal by land application typically requires large areas to remain below release requirements. For example, the Crow Butte facility near Crawford, Nebraska, has identified about 40 ha [100 ac] as available for land application, if needed (NRC, 1998b), and the Highland Uranium Project in Converse County, Wyoming, identified two land application sites, each about 22 ha [54 ac] (NRC, 1995). Depending on how an applicant would treat the wastewater prior to land application, this disposal option might have additional land requirements related to constructing radium-settling basins and storage reservoirs (NRC, 1995). These facilities would add to the required footprint for this disposal option. For example, radium settling basins are typically on the order of 0.1 to 1.6 ha [0.25 to 4 ac] (NRC, 1995, 1997, 1998a); purge reservoirs for temporary storage of treated wastewater can be much larger, with a surface area on the order of 4 ha [10 ac] or more, depending on the terms of the necessary permit (NRC, 1998a).

An additional NESHAP review by EPA may be required to demonstrate that radionuclides such as radon released to the air from this option meet the requirements of 40 CFR Part 61. NRC staff calculations for land application over an area of 42 ha [104 ac], assuming average wastewater concentrations of 37 Bq/m^3 [1 pCi/L] for radium and 1 mg/L [1 ppm] for uranium, resulted in potential doses below regulatory limits (NRC, 1997). Similarly, representative calculations for 7 years of land application to an area of 18.5 ha [46 ac] with an assumed wastewater application rate of 1,514 Lpm [400 gpm] estimated a radon flux of 1.3 pCi/m^2-sec, not much more than an assumed background of 1 pCi/m^2-sec (NRC, 2003a Appendix D).

Areas used for land application would need to be included in decommissioning surveys at the end of the operation and aquifer restoration phases to ensure soil concentration limits would not be exceeded, potentially adding to the total amount of material for disposal at a licensed facility

(NRC, 2003a). In addition, any pond liners and precipitated solids accumulated in a radium-settling basin system would need to be disposed of as byproduct material. For example, the annual amount of radium-bearing sludges generated in a 1.6-ha [4-ac] radium-settling basin was estimated to be about 22.4 m^3/yr [29.3 yd^3/yr] (Powertech, 2009).

2.1.1.2.3 Surface Water Discharge

Another disposal method historically used at uranium ISR facilities is treatment of waste and discharge at the surface. Similar to land application, the liquid effluent would need to be pretreated to meet NRC release requirements in 10 CFR Part 20, Subparts D and K and Appendix B; the provisions of 10 CFR Part 40, Appendix A that require conformance with EPA regulations in 40 CFR Part 440; and WDEQ requirements imposed by a zero-release WYPDES permit. The WYPDES permit would specify limits calculated to ensure the discharge does not cause a violation of water quality standards for waters of the state that include perennial and ephemeral streams, and wetlands (WDEQ, 2004). WDEQ would not issue the permit if the discharge would cause or contribute to the violation of water quality standards. Specific requirements for uranium ISR facilities are provided in EPA regulations at 40 CFR Part 440, Subpart C. Pretreatment of the liquid wastes using ion-exchange columns, reverse osmosis, and precipitation of barium/radium sulfate is typically incorporated into this process to decrease uranium and radium levels in the wastewater. As with the land application option, this treatment might require additional land for the construction of radium-settling basins and storage reservoirs (NRC, 1995, 2003a).

The regulatory framework for liquid effluent disposal by surface discharge is complicated and requires an applicant to make the distinction between “process wastewater” generated during uranium recovery operations and “wellfield wastewater” generated during aquifer restoration (NRC, 2003a). An applicant would need to develop storage capabilities, depending on whether it intended to maintain separate liquid effluent streams or commingle (mix) process and wellfield wastewater prior to treatment to 10 CFR Part 20 standards. In addition, an applicant would need to address any radioactivity at the discharge point or from storage facilities (tanks, impoundments), radium-settling basins, and related sludges as part of decommissioning the facility (NRC, 2003a). In addition, an applicant would not be allowed to discharge process liquid effluent to navigable waters of the United States in accordance with EPA regulations at 40 CFR 440.34 (NRC, 2003a). In a letter to the applicant dated August 10, 2010, the U.S. Army Corps of Engineers, the agency with jurisdiction over navigable waters of the United States, determined that the surface water within the proposed Lost Creek ISR Project permit area must occur within a closed hydrologic basin and “…have no surface connection to a traditional navigable water.” For this reason, the U.S. Army Corps of Engineers concluded that no surface water bodies within the proposed Lost Creek permit area meet the definition of waters of the United States (U.S. Army Corps of Engineers, 2010). Even though the U.S. Army Corps of Engineers states they have no jurisdiction over these waters, the ephemeral streams in the vicinity of the proposed Lost Creek ISR Project would still be considered “waters of the state”, and the applicant would need to obtain a WYPDES for surface discharges (WDEQ, 2004).

2.1.1.2.4 Class V Injection Well

At the well, the techniques employed in disposing of liquid wastes through a UIC Class V deep injection well would be similar to those for deep injection of liquid wastes in a UIC Class I disposal well, as described previously in SEIS Section 2.1.1.1. The main difference would be the nature of the permit (WDEQ, 2001). For disposal by a UIC Class V well, WDEQ regulations assume at least one USDW would underlie the potential injection zone. Also, the waste stream

to be injected could not be a hazardous waste. For this reason, an applicant would need to treat the wastewater to meet NRC release standards in 10 CFR Part 20, Subparts D and K and Appendix B to ensure that all toxic substances remain at concentrations less than the WDEQ class-of-use standards or any federal primary drinking water standards; whichever is more stringent (WDEQ, 2001). Similar to land application and surface discharge, the liquid waste would be pretreated using ion-exchange columns, reverse osmosis, and barium/radium sulfate, and potentially radium-settling basins to decrease the levels of uranium, radium, and other contaminants in the wastewater. As a result, an applicant would need to address storage facilities (tanks, impoundments) or radium-settling basins and sludges as part of decommissioning the facility (NRC, 2003a). In addition, a UIC Class V permit would require an applicant to implement a monitoring plan to ensure wastes would be confined to the authorized injection zone (WDEQ, 2008).

2.1.2 No-Action (Alternative 2)

Under the No-Action alternative, NRC would not approve the license application for the proposed Lost Creek ISR Project. The No-Action alternative would result in the applicant not constructing, operating, restoring the aquifer of, or decommissioning the proposed Lost Creek ISR Project. No facilities, roads, or wellfields would be built, and no pipeline would be laid, as described in SEIS Section 2.1.1.1.2. No uranium would be recovered from the subsurface ore body; therefore, no injection, production, and monitoring wells would be installed to operate the facility. No lixiviant would be introduced in the subsurface, and no buildings would be constructed to process extracted uranium or store chemicals. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impacts of the other alternatives, including the proposed action.

2.1.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, NRC would issue the applicant a license for the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Lost Creek ISR Project site for uranium recovery and the production of dry yellowcake as the final product. By doing so, the project would differ from the proposed action only in that additional equipment for the production of dry yellowcake would be needed. The additional dryer equipment would be installed in the proposed Lost Creek processing plant. The dry yellowcake would then be packaged and transported from the proposed Lost Creek processing plant directly to Metropolis, Illinois for the next step in the production of fuel for commercial nuclear reactors. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility before being shipped to Illinois.

As with the proposed action, yellowcake slurry (30 to 50 percent solids) would be produced. However, under this alternative, the slurry would be filter-pressed to remove additional water, dried, and packaged onsite. This would be accomplished, in part, by drying the slurry in a yellowcake dryer. Historically, two kinds of yellowcake dryers have been used multihearth dryers and vacuum dryers.

Older uranium ISR facilities used gas-fired multihearth dryers, which use high temperatures that burn all organic contaminants. A scrubber is used to remove uranium particulates before they are released to the atmosphere.

Newer ISR facilities usually use vacuum yellowcake dryers. In a vacuum dryer, the heating system is isolated from the yellowcake so that no radioactive materials are entrained in the heating system or its exhaust. The drying chamber that contains the yellowcake slurry is under vacuum, so that any potential leak would cause air to flow back into the chamber. Drying takes place at relatively low temperatures.

Emissions from the drying chamber are normally treated through a bag filter to remove yellowcake particulates, and any water vapor exiting the drying chamber is cooled and condensed. The dried product (yellowcake) is removed from the bottom of the dryer and packaged in drums for eventual shipping offsite to Metropolis, Illinois. The packaging area also has a bag filter dust collection system to protect personnel and to minimize yellowcake release. Air from the bag filter dust collection system is typically routed to the dryer offgas line and scrubber. During drum loading, the drum is also kept under negative pressure via a drum hood with a suction line. Parameters important to the effective operation of the dryer are monitored, per NRC regulations at 10 CFR Part 40, Appendix A, Criterion (8). The final, dried product is cooled, packaged, and shipped in 208-L [55-gal] drums. In a letter to NRC (LCI, 2010c), the applicant stated that they planned to submit an amendment request to install a rotary vacuum dryer in the future. In an April 2011 letter to NRC (LCI, 2011), the applicant indicated that the amendment request would be submitted to NRC in June 2011.

2.2 Alternatives Eliminated from Detailed Analysis

As NRC regulations require, the NRC staff considered other alternatives to the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek ISR Project. The range of alternatives was determined by considering the purpose and need for the proposed action and the applicant's objectives to extract uranium from a particular ore body. Reasonable alternatives considered in a site-specific environmental review depend on the proposed action and site conditions. This section describes alternatives to the proposed action that were considered but not carried forward for detailed analysis for reasons described in the following sections. SEIS Sections 2.2.1 and 2.2.2 describe different mining and associated milling alternatives for the proposed project site. SEIS Section 2.2.3 discusses the use of different lixiviant chemistry.

2.2.1 Conventional Mining and Milling at the Lost Creek Project

Uranium ore deposits at depth may be accessed either by open pit (surface) mining or by underground mining techniques. Open pit mining is used to exploit shallow ore deposits, generally deposits less than 170 m [550 ft] below ground surface (EPA, 2008a). To gain access to the deposit, the topsoil is first removed and may be stockpiled for later site reclamation, while the remainder of the material overlying the deposit (i.e., the overburden) can be removed via mechanical shovels and scrapers, trucks or loaders, or by blasting (EPA, 1995, 2008a). The depth to which an ore body is surface mined depends on the ore grade, the nature of the overburden, and the ratio of the amount of overburden to be removed per extracted ore unit (EPA, 1995).

Underground mining techniques vary depending on size, depth, orientation, grade of the ore body, stability of the subsurface strata, and economic factors (EPA, 1995, 2008a). In general, underground mining involves sinking a shaft near the ore body and then extending levels from the main shaft at different depths to access the ore. Ore and waste rock would need to be removed through shafts by elevators or by using trucks to carry these materials up inclines to the surface (EPA, 2008a).

In addition, when the open pit or underground workings are established, the mine may need to be dewatered to allow the extraction of the uranium ore. Dewatering can be accomplished either by pumping directly from the open pit or through pumping of interceptor wells to lower the water table (EPA, 1995). The mine water likely would require treatment prior to discharge, due to contamination from radioactive constituents, metals, and suspended and dissolved solids. Discharge of these mine waters may have subsequent impacts to surface water drainages and sediments, as well as to near-surface sources of groundwater (EPA, 1995).

Following the completion of mining, either by open pit or underground techniques, reclamation of the mine is needed. Stockpiled overburden can be reintroduced into the mine, either during extraction operations or following any topsoil reapplied in an attempt to reestablish topography consistent with the surroundings. With the end of dewatering, the water table may rebound and fill portions of the open pit and underground workings. Historically, uranium mines have impacted local groundwater supplies and the waste materials from the mines have contaminated lands surrounding the mines (EPA, 2008b).

Ore extracted from the open pit or underground mine would be processed in a conventional mill. As described in GEIS Appendix C (NRC, 2009), ore processing at a conventional mill involves a series of steps (handling and preparation, concentration, and product recovery). While the conventional milling technique recovers approximately 90 percent of the uranium content of the feed ore (NRC, 2009), the process generates substantial wastes (known as tailings) because roughly 95 percent of the ore rock is disposed of as waste (NRC, 2009). This process also can consume large amounts of water {e.g., approximately 534 Lpm [141 gpm]} for the proposed Pinon Ridge mill in Colorado (EFRC, 2009).

Tailings are disposed of in areally extensive lined impoundments; NRC reviews the design and construction of these to ensure safe disposal of the tailings (NRC, 2009). Reclamation of the tailings pile generally involves evaporation of liquids in the tailings, settlement of the tailings over time, and covering the pile with a thick radon barrier and earthen material or rocks for erosion control. An area surrounding the reclaimed tailings piles would be fenced off in perpetuity, and the site transferred to either a State or Federal agency for long-term care (EIA, 1995). The costs associated with final mill decommissioning and tailings reclamation can run into the tens of millions of dollars (EIA, 1995).

As discussed previously, the average ore grade of the uranium deposit at the proposed Lost Creek ISR Project is above 0.1 percent, while the depth to the deposit is approximately 91 to 213 m [300 to 700 ft] below ground surface. While the ore grade and depth to ore are consistent with deposits mined either by open pit or underground workings, the environmental impacts from mining and conventional milling are more substantial than impacts from the ISR process at this site (see Chapter 4).

NRC evaluated the potential environmental impacts of conventional uranium milling operations in a programmatic context, including the management of mill tailings in the final SEIS on uranium milling (NRC, 1980). This SEIS evaluated the nature and extent of conventional uranium milling to inform the regulatory requirements for management and disposal of mill tailing and for mill decommissioning. The impacts from operating a conventional mill are significantly greater than for operating an ISR facility. For example, at the proposed Lost Creek ISR Project, approximately 115 ha [285 ac] would be used for uranium extraction operations (e.g., six wellfields, the processing plant, pipeline infrastructure). However, for a conventional mill, more than twice that amount of land would be devoted to milling and allied activities during operations, and during mill construction a total of 300 ha [741 ac] could be impacted

(NRC, 1980). Furthermore, the deposition of windblown tailings could further restrict the use of the land near the tailings. Levels of contamination would extend several hundred meters [yards] beyond the model site boundary, as evaluated in the GEIS for conventional milling. Therefore, conventional milling was eliminated from detailed analysis in the Lost Creek SEIS.

Heap leaching is described in GEIS Appendix C (NRC, 2009). For low-grade ores, heap leaching is a viable alternative. Low-grade ore removed from open pit or underground mining operations undergoes further processing to remove and concentrate the uranium. Heap leaching is typically used when the ore body is small and situated far from the milling site. The low-grade ore is crushed to approximately 2.6 cm [1 in] in size and mounded above grade on a prepared pad. A sprinkler or drip system positioned over the top continually distributes leach solution over the mound. Depending on the lime content, an acid or alkaline solution can be used. The leach solution trickles through the ore and mobilizes the uranium, as well as other metals, into the solution. The solution is collected at the base of the mound by a manifold and directed to be processed to extract the uranium. The uranium recovery from heap leaching is expected to range from 50 to 80 percent, resulting in a final tailings material of around 0.01 percent U_3O_8 content. When heap leaching is complete, the depleted materials are considered byproduct material that must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for disposal in place. While the impacts from heap leaching may be less than those from conventional milling, the impacts from the associated open pit or underground mining would still be substantial. For these reasons, similar to those listed in SEIS Section 2.2.1, this alternative is not carried forward for detailed analysis.

2.2.2 Alternate Lixiviants

Alternate lixiviant chemistry was also considered for the operations phase of the proposed action, including acid leach solutions and ammonia-based lixiviants. Acid-based lixiviants (such as sulfuric acid), dissolved heavy metals, other solids associated with uranium in the host rock, and other chemical constituents require additional remediation and have greater environmental impacts. At a small-scale research facility in Wyoming, test patterns were developed using acid-based lixiviants. During operations, two significant problems developed: (i) the mineral gypsum precipitated on the well screens and in the aquifer, which plugged the wells and reduced the efficiency of wellfield restoration. (ii) aquifer restoration had limited success because of the gradual dissolution of the precipitated gypsum, which resulted in increased salinity and sulfate levels in the affected groundwater. Because it is technically more difficult to restore acid mine sites, the use of an acid-based lixiviant was eliminated from detailed analysis in the Lost Creek SEIS.

Ammonia-based lixiviants have also been used at ISR operations in Wyoming. However, operational experience has shown that ammonia tends to adsorb onto clay minerals in the subsurface and then slowly desorb from the clay during restoration, therefore requiring a much larger volume of groundwater to be removed and processed during aquifer restoration (Mudd, 2001). Because of the greater consumptive use of groundwater to meet groundwater restoration requirements, the use of an ammonia-based lixiviant was eliminated from detailed analysis.

2.3 Comparison of the Predicted Environmental Impacts

NUREG–1748 (NRC, 2003b) categorizes the significance of potential environmental impacts as follows:

SMALL: 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: The environmental effects are sufficient to alter noticeably but not destabilize important attributes of the resource considered.

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

In this section, for each of the three alternatives, the potential environmental impacts to each resource area are summarized for all four of the ISR phases: construction, operation, aquifer restoration, and decommissioning. The significance levels (SMALL, MODERATE, and LARGE) are specific to each resource and are defined in Chapter 4.

The environmental resources found in the proposed project area are described in Chapter 3. Based on the description of the ISR process and the historical information on ISR facilities in Chapter 2 and in the GEIS, the potential environmental impacts are described and analyzed in Chapter 4. These impacts are listed in Table 2-3. For resource areas where two significance levels are shown (e.g., MODERATE/SMALL), the first level indicates the potential impact without mitigation and the second level indicates the estimated impact considering mitigation.

2.4 Final Recommendation

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.91(d), sets forth its NEPA recommendation regarding the proposed action. Unless safety issues mandate otherwise, the NRC staff recommendation to the Commission related to the environmental aspects of the proposed action is that a source material license for the proposed action be issued as requested. This recommendation is based upon (i) the license application, including the ER the applicant submitted and applicant supplemental letters and responses to NRC staff requests for additional information; (ii) consultation with Federal, State, Tribal, and local agencies; (iii) NRC staff independent review; (iv) NRC staff consideration of comments received on the draft SEIS; and (v) the assessments summarized in this SEIS.

Table 2-3. Summary of Impacts for the Proposed Lost Creek ISR Project

Section 4.2–Land Use Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.2.1.1	NONE 4.2.2	SMALL 4.2.3
Operation	SMALL 4.2.1.2	NONE 4.2.2	SMALL 4.2.3
Aquifer Restoration	SMALL 4.2.1.3	NONE 4.2.2	SMALL 4.2.3
Decommissioning	SMALL 4.2.1.4	NONE 4.2.2	SMALL 4.2.3
Section 4.3–Transportation Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.3.1.1	NONE 4.3.2.1	SMALL 4.3.3.1
Operation	SMALL 4.3.1.2	NONE 4.3.2.2	SMALL 4.3.3.2
Aquifer Restoration	SMALL 4.3.1.3	NONE 4.3.2.3	SMALL 4.3.3.3
Decommissioning	SMALL 4.3.1.4	NONE 4.3.2.4	SMALL 4.3.3.4
Section 4.4–Geology and Soils Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.4.1.1	NONE 4.4.2	SMALL 4.4.3
Operation	SMALL 4.4.1.2	NONE 4.4.2	SMALL 4.4.3
Aquifer Restoration	SMALL 4.4.1.3	NONE 4.4.2	SMALL 4.4.3
Decommissioning	SMALL 4.4.1.4	NONE 4.4.2	SMALL 4.4.3
Section 4.5–Water Resources Impacts (Surface Water and Wetlands)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.5.1.1.1	NONE 4.5.1.2	SMALL 4.5.1.3
Operation	SMALL 4.5.1.1.2	NONE 4.5.1.2	SMALL 4.5.1.3
Aquifer Restoration	NONE 4.5.1.1.3	NONE 4.5.1.2	NONE 4.5.1.3
Decommissioning	SMALL 4.5.1.1.4	NONE 4.5.1.2	SMALL 4.5.1.3

Table 2-3. Summary of Impacts for the Proposed Lost Creek ISR Project (continued)

Section 4.5–Water Resources Impacts (Groundwater)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.5.2.1.1	NONE 4.5.2.2	SMALL 4.5.2.3
Operation	MODERATE/SMALL 4.5.2.1.2	NONE 4.5.2.2	MODERATE/SMALL 4.5.2.3
Aquifer Restoration	MODERATE/SMALL 4.5.2.1.3	NONE 4.5.2.2	MODERATE/SMALL 4.5.2.3
Decommissioning	SMALL 4.5.2.1.4	NONE 4.5.2.2	SMALL 4.5.2.3
Section 4.6–Ecological Resources Impacts (Vegetation)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE 4.6.1.1.1.1	NONE 4.6.2	MODERATE 4.6.3
Operation	SMALL 4.6.1.2.1	NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration	SMALL 4.6.1.3	NONE 4.6.2	SMALL 4.6.3
Decommissioning	MODERATE 4.6.1.4	NONE 4.6.2	MODERATE 4.6.3
Section 4.6–Ecological Resources Impacts (Wildlife)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL 4.6.1.1.1.2	NONE 4.6.2	MODERATE/SMALL 4.6.3
Operation	SMALL 4.6.1.2.2	NONE 4.6.2	SMALL 4.6.3
Aquifer Restoration	SMALL 4.6.1.1.3	NONE 4.6.2	SMALL 4.6.3
Decommissioning	MODERATE*/SMALL 4.6.1.1.4	NONE 4.6.2	MODERATE 4.6.3
Section 4.7–Air Quality Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL† 4.7.1.1	NONE 4.7.2	MODERATE/SMALL† 4.7.3.1
Operation	MODERATE/SMALL† 4.7.1.2	NONE 4.7.2	MODERATE/SMALL† 4.7.3.2
Aquifer Restoration	MODERATE/SMALL† 4.7.1.3	NONE 4.7.2	MODERATE/SMALL† 4.7.3.3
Decommissioning	MODERATE/SMALL† 4.7.1.4	NONE 4.7.2	MODERATE/SMALL† 4.7.3.4

Table 2-3. Summary of Impacts for the Proposed Lost Creek ISR Project (continued)

Section 4.8–Noise Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL‡ 4.8.1.1	NONE 4.8.2	SMALL 4.8.3
Operation	MODERATE/SMALL‡ 4.8.1.2	NONE 4.8.2	SMALL 4.8.3
Aquifer Restoration	SMALL 4.8.1.3	NONE 4.8.2	SMALL 4.8.3
Decommissioning	SMALL 4.8.1.4	NONE 4.8.2	SMALL 4.8.3
Section 4.9–Historical and Cultural Resources Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL 4.9.1.1	SMALL 4.9.2	MODERATE/SMALL 4.9.3
Operation	SMALL 4.9.1.2	SMALL 4.9.2	SMALL 4.9.3
Aquifer Restoration	SMALL 4.9.1.3	SMALL 4.9.2	SMALL 4.9.3
Decommissioning	SMALL 4.9.1.4	SMALL 4.9.2	SMALL 4.9.3
Section 4.10–Visual and Scenic Resources Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	MODERATE/SMALL§ 4.10.1.1	NONE 4.10.2	SMALL 4.10.3
Operation	SMALL 4.10.1.2	NONE 4.10.2	SMALL 4.10.3
Aquifer Restoration	SMALL 4.10.1.3	NONE 4.10.2	SMALL 4.10.3
Decommissioning	MODERATE/SMALL§ 4.10.1.4	NONE 4.10.2	SMALL 4.10.3
Section 4.11–Socioeconomics (Demographics)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.1	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.1	NONE 4.11.2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3

Table 2-3. Summary of Impacts for the Proposed Lost Creek ISR Project (continued)

Section 4.11–Socioeconomics (Income)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.2	NONE 4.11. 2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.2	NONE 4.11. 2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11–Socioeconomics (Housing)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.3	NONE 4.11.2	SMALL 4.11.3
Operation	MODERATE/SMALL 4.11.1.2.3	NONE 4.11.2	SMALL 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11–Socioeconomics (Employment Rate)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.4	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.4	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11–Socioeconomics (Local Finance)			
	Alternative1—Proposed Action	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.5	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.5	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3

Table 2-3. Summary of Impacts for the Proposed Lost Creek ISR Project (continued)

Section 4.11–Socioeconomics (Education)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	NONE 4.11.1.1.6	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.6	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.11–Socioeconomics (Health and Social Services)			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.11.1.1.7	NONE 4.11.2	SMALL 4.11.3
Operation	SMALL 4.11.1.2.7	NONE 4.11.2	MODERATE 4.11.3
Aquifer Restoration	SMALL 4.11.1.3	NONE 4.11.2	SMALL 4.11.3
Decommissioning	SMALL 4.11.1.4	NONE 4.11.2	SMALL 4.11.3
Section 4.12–Environmental Justice			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	NONE 4.12.2	NONE 4.12.3	NONE 4.12.4
Operation	NONE 4.12.2	NONE 4.12.3	NONE 4.12.4
Aquifer Restoration	NONE 4.12.2	NONE 4.12.3	NONE 4.12.4
Decommissioning	NONE 4.12.2	NONE 4.12.3	NONE 4.12.4
Section 4.13–Public and Occupational Health and Safety Impacts			
	Proposed Action (Alternative 1)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.13.1.1	NONE 4.13.2	SMALL 4.12.3.1
Operation	MODERATE/SMALL¶ 4.13.1.2	NONE 4.13.2	MODERATE/SMALL¶ 4.13.3.2
Aquifer Restoration	SMALL 4.13.1.3	NONE 4.13.2	SMALL 4.13.3.3
Decommissioning	SMALL 4.13.1.4	NONE 4.13.2	SMALL 4.13.3.4

Table 2-3. Summary of Impacts for the Proposed Lost Creek ISR Project (continued)

Section 4.14–Waste Management Impacts			
	Proposed Action (Alternative 1-Disposal Via Class I Injection Well Only)	No-Action (Alternative 2)	Dry Yellowcake (Alternative 3)
Construction	SMALL 4.14.1.1	NONE 4.14.2	SMALL 4.14.3
Operation	SMALL 4.14.1.2	NONE 4.14.2	SMALL 4.14.3
Aquifer Restoration	SMALL 4.14.1.3	NONE 4.14.2	SMALL 4.14.3
Decommissioning	SMALL 4.14.1.4	NONE 4.14.2	SMALL 4.14.3

* The impact on the Greater Sage Grouse would be MODERATE. The impact on other protected species would be SMALL.

† An intermittent, MODERATE impact from fugitive road dust emissions generated by travel on unpaved roads through the Town of Bairoil.

‡ An intermittent, MODERATE noise impact from transportation through smaller rural communities such as Bairoil and Jeffrey City.

§ A short-term, MODERATE impact on the visual setting from fugitive road emissions.

‖ A MODERATE impact on housing availability in smaller communities; however, a SMALL impact regionally

¶ A MODERATE occupational (worker) impact; a SMALL impact on public health and safety.

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3 DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 Introduction

The Lost Creek *In-Situ* Uranium Recovery (ISR) Project is located in the Great Divide Basin, in a rural northeast area of Sweetwater County, Wyoming. The proposed project is about 113 km [70 mi] southeast of the city of Lander and approximately 61 km [38 mi] northwest of the city of Rawlins (see Figure 1-1). The proposed project area encompasses approximately 1,722 ha [4,254 ac] of land. An estimated 115 ha [285 ac] of land surface would be directly disturbed by ISR construction and operations. (LCI, 2008a)

This chapter describes the existing site conditions of the proposed Lost Creek ISR Project. For the purposes of this Supplemental Environmental Impact Statement (SEIS), the area considered in the analysis is the 1,722-ha [4,254 ac] proposed project area and the immediate environs. The resource areas described in this section include land use, transportation, geology and soils, water resources, ecology, noise, air quality, historical and cultural resources, visual and scenic resources, socioeconomics, public and occupational health, and waste management. The description of the affected environment is based upon information provided in the applicant's environmental report (LCI, 2008a) and supplemented by additional information identified by NRC and the public. The information in this chapter forms the basis for assessing the potential impacts (see Chapter 4) of the proposed action and each alternative (Chapter 2).

3.2 Land Use

The proposed Lost Creek ISR Project is located in the Great Divide Basin in the southeast quadrant of the Wyoming West Uranium Milling Region (NRC, 2009a) in the northeastern section of Sweetwater County, Wyoming (Figure 3-1), and encompasses approximately 1,722 ha [4,254 ac] of land. The proposed project area is located approximately 24 km [15 mi] southwest of the town of Bairoil, 61 km [38 mi] northwest of Rawlins, 113 km [70 mi] southwest of the city of Lander, and 144 km [90 mi] southwest of Casper. With the discovery of uranium deposits four decades ago, subsequent exploratory drilling and studies have occurred throughout the proposed project area (LCI, 2008b). The current surface ownership of the proposed Lost Creek ISR project is comprised of public lands. Approximately 85 percent is owned by the U.S. Government and administered by the U.S. Bureau of Land Management (BLM) Rawlins and Lander Field Offices, with the remaining 15 percent owned and administered by the State of Wyoming (LCI, 2008a). The subsurface minerals are owned by the U.S. government and the State of Wyoming. Figure 2-2 illustrates how the federal and state land ownership is divided within the proposed project area. (LCI, 2008a)

There are no state maintained roads, farms or residences within the proposed project area. The primary land use within the study area is for cattle grazing. There is no crop production within two miles of the proposed project site. Other land uses within the surrounding region include grazing, industry, wildlife habitat, hunting, recreation, off-road vehicle use, oil and gas extraction, gas and carbon dioxide pipelines, and transmission lines. The closest residence is approximately 24 km [15 mi] from the proposed site. (LCI, 2008a)

The regional landscape consists of rolling plains, rock outcrops, ridges, bluffs, and some isolated mountainous areas. The primary vegetation is sagebrush and rabbit brush. There are no perennial streams—only ephemeral drainages that carry surface water runoff from significant weather events such as spring snow melt and intense rainstorms. (LCI, 2008a)

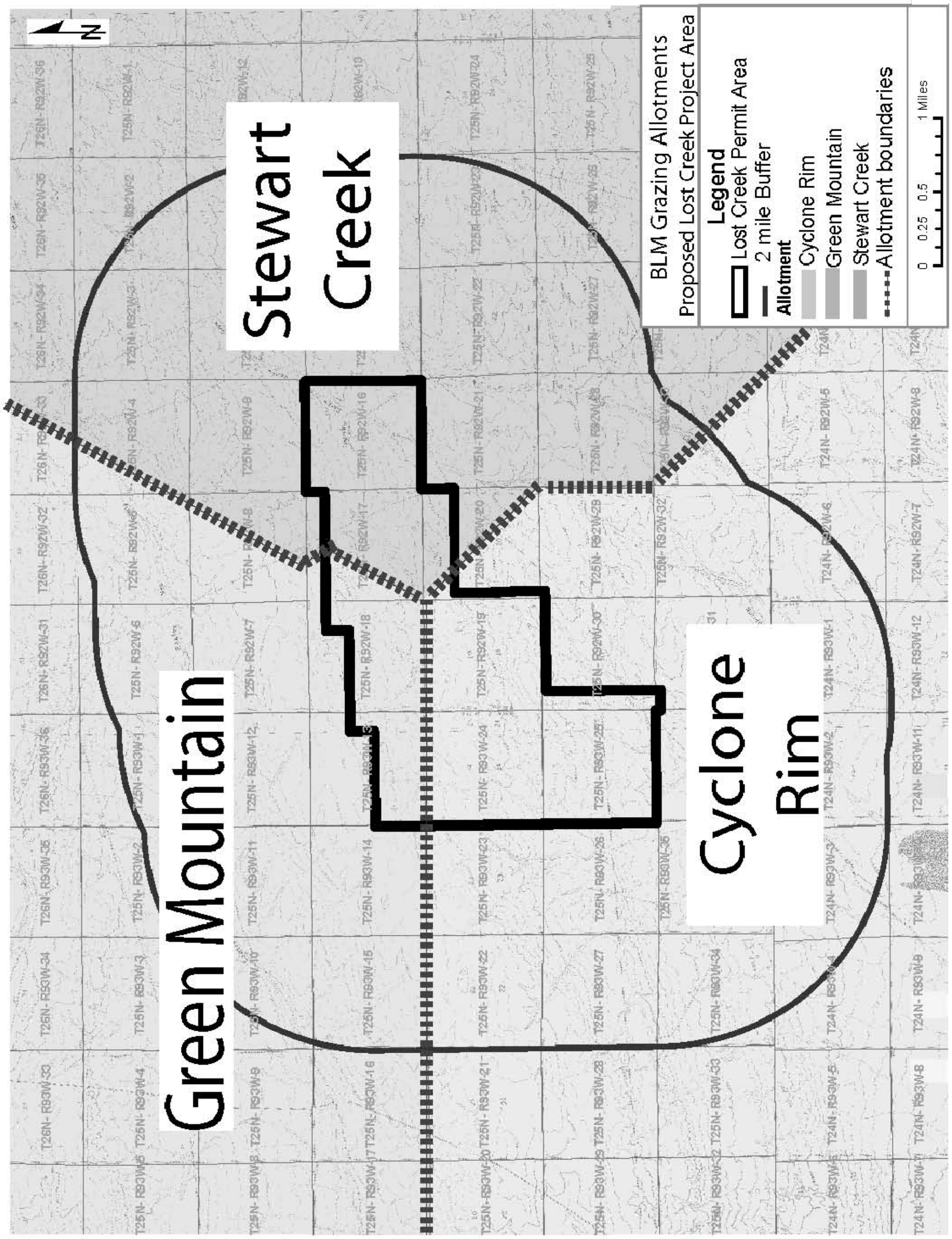

Figure 3-1. BLM Grazing Allotments
Source: Modified from LCI (2008a)

3.2.1 Rangeland

The BLM administers public land ranching in accordance with the *Taylor Grazing Act of 1934*. The terms and conditions for grazing on BLM-managed lands are set forth in the permits and leases issued by the Bureau to public land ranchers. The BLM's overall management objective is to ensure the long-term health and productivity of these lands and to create multiple environmental benefits that result from healthy watersheds. (BLM, 2010a)

Three BLM grazing allotments—Stewart Creek, Green Mountain, and Cyclone Rim—encompass the entire proposed project area. The Cyclone Rim allotment occupies the largest land area within the proposed project area at approximately 1,000 ha [2,500 ac]. The Stewart Creek and Green Mountain allotments occupy the remaining approximately 680 ha [1,700 ac] of land within the project area. All three BLM grazing allotments continue outside the proposed project area and the study area to occupy a large portion of northeastern Sweetwater County (Figure 3-1). The grazing allotments are mostly used by cattle, with a small number of horses and sheep. (LCI, 2008b)

The productivity of the grazing lands is measured by animal unit months (AUMs). An AUM is defined as the amount of forage to sustain one mature cow or the equivalent, based on an average daily forage consumption of 11.7 kg [26 lb] of dry matter per day. The total AUMs for the study area are 3,662. These grazing allotments are used for rangeland capable of supporting approximately 305 head of cattle with year-round grazing sustenance (LCI, 2008b). Large expanses of open land used historically for grazing provide a valuable cultural resource in terms of views and agricultural activity, as well as an economic source of income for ranchers and the State of Wyoming (NRC, 2009a).

The BLM also protects, manages, and controls wild horses and burros under the authority of the Wild Free-Roaming Horses and Burros Act of 1971 to ensure that healthy herds thrive on healthy rangelands. The BLM maintains and manages wild horses in herd management areas (HMAs). The BLM establishes an appropriate management level (AML) for each HMA. An AML is the population objective for the HMA that will ensure a thriving ecological balance among all the users and resources of the HMA. (BLM, 2010b; BLM, 2011a)

Two wild horse HMAs, the Stewart Creek HMA and the Lost Creek HMA, overlap the proposed project area. These two HMAs cover the same area as the BLM grazing allotments: the Lost Creek HMA coincides with the Cyclone Rim Allotment, and the Stewart Creek HMA coincides with the Stewart Creek allotment. (BLM, 2005)

3.2.2 Hunting and Recreation

Recreational activities that occur within 32 km [20 mi] of the proposed project area include fishing, hiking, camping, and wildlife viewing. WGFD hunting areas include land within and surrounding the proposed project area. Antelope, deer, elk, and mountain lion are the predominant types of game that are hunted within the region (LCI, 2008a). The number of licensed hunters and the wildlife taken from the area are summarized in Table 3-1.

Table 3-1. Hunting Statistics for Hunt Areas That Include the Project Area

Game	Hunter Days	Active Licenses	Total Harvest	Hunter Success (Percent)	Outfitters	Hunting Area
Antelope	683	233	229	98.30	19	Chain Lakes
Deer	544	126	12	9.50	7	Chain Lakes
Elk	496	82	42	51.20	3	Shamrock Hills
Mountain Lion	NA	NA	1	NA	5	Red Desert
Source: WGFD (2007) NA= No Data						

There are several fishing businesses that operate within 24 km [15 mi] of the proposed project area. The closest known fishing areas to the proposed project area are Lost Creek and Lost Creek Butte Lake, which are located approximately 16 km [10 mi] from the proposed project area. There are also designated camping sites in the Green Mountains located 13 km [8 mi] north of the proposed project area. (WGFD, 2005a)

Approximately 48.3 km [30 mi] northwest of Rawlins and 12.9 km [8 mi] south of the Lost Creek site is the Chain Lakes Wildlife Habitat Management Area, a land area Wyoming designated as “Unique and Irreplaceable or Rare and Uncommon” (WSGS, 2010). Located in the Red Desert (in the Great Divide Basin), this 254-km^2 [98-m^2] area provides winter habitat for antelope, as well as protects their migration routes between summer and winter ranges. In addition to pronghorn antelope, feral (wild) horses, rabbits, and sage-grouse are the principal wildlife, as sagebrush grassland communities dominate the area.

3.2.3 Minerals and Energy

While the lands encompassing the proposed Lost Creek ISR project area are occupied by the Stewart Creek, Green Mountain, and Cyclone Rim BLM grazing allotments, portions of these public lands are also used for natural resource extraction, which is classified as a subcategory use of pasturelands and rangelands (BLM, 2008). The mining industry accounts for approximately 20 percent of all economic activity conducted in Sweetwater County. The principal natural resources in the vicinity of the proposed project area are leasable energy minerals, such as oil, gas, coal, and trona, and locatable minerals like uranium, clay, and zeolite (Sweetwater County Conservation District, 2005).

Oil and natural gas resources in the region surrounding the proposed Lost Creek ISR project area are described in the Resource Management Plan prepared by the BLM Rawlins Field Office. The majority of the existing oil and gas production is located in the western portion of the Rawlins Resource Management Plan Planning Area which includes Sweetwater County. This production includes two oil fields (Lost Soldier and Standard Draw), and three gas fields (Standard Draw, Wild Rose, and Wamsutter). The closest of these fields is about 27 km [16 mi] south-southwest of the proposed Lost Creek ISR Project. Historic oil production in the Rawlins Resource Management Plan Planning Area prior to 1990 was about 8 million barrels per year, but has decreased steadily since about 1990. About half of the recent production has been

from the Lost Soldier–Wertz Fields near Bairoil where oil recovery operations via carbon dioxide (CO_2) injection are in the final stages. In contrast, gas production in the Rawlins Resource Management Plan Planning Area has increased steadily since about 1978 and in 2001 represented about 11 percent of the total gas production for Wyoming. (BLM, 2008)

Similar to the rest of Wyoming, there has been increased exploration for CBM in the coal fields to the southeast and east of the proposed Lost Creek ISR Project. As of January 2002, however, the total amount of produced gas was about 5.1 million m^3 [179 million ft^3]. The closest coal field is about 35 km [21 mi] southeast of the Lost Creek site, but the most active CBM exploration is occurring 66 km [40 mi] south-southeast of the proposed project area. Of areas identified as having high oil, gas, and CBM potential, the closest is about 54 km [32 mi] southeast of the Lost Creek site. There has also been some oil and gas exploration within the Hanna coal field about 85 km [51 mi] to the east, but as of 2007, there had been no economically viable fields discovered (BLM, 2008; 2007a). SEIS Section 5.1.1.3 considers the cumulative impact from coal mining in the region.

As of October 2003, BLM reported that the Rawlins Resource Management Plan Planning Area contained almost 2,700 wells, with the majority drilled to depths of 2,450 to 3,650 m [8,000 to 12,000 ft], considerably deeper than the 91- to 213-m [300- to 700-ft] ore zone targeted by the proposed Lost Creek ISR Project. The most heavily drilled areas are about 25 km [15 mi] or farther to the south-southwest. (BLM, 2008)

Six coal fields are located within the Rawlins Resource Management Plan Planning Area. As described previously, the closest, North Indian Springs field, is located about 56 km [35 mi] southeast of the proposed Lost Creek ISR Project. Two surface coal mining operations in the Great Divide Basin are located southwest of the proposed project area: Bridger Coal {about 88 km [55 mi] to the southwest} and Black Butte Coal {about 97 km [60 mi] to the southwest} (NRC, 2009a). Production for the two mines in 2008 was approximately 5.2 mil t [5.7 mil T] for Bridger Coal and 3.6 mil t [3.9 mil T] for Black Butte. The most significant historical coal production has been from the Hanna Field that is located about 85 km [51 mi] east of the Lost Creek site. Coal production from the Hanna Field began to decrease gradually, and by 2004 all active coal production had ended and only reclamation was ongoing. (BLM, 2008)

There are deposits of locatable minerals such as titaniferous magnetite, gold, copper, and diamonds in the Rawlins Resource Management Plan Planning Area, although there has been very limited historical production of these resources (BLM, 2008). The locatable mineral that has been produced commercially is uranium, with 5 conventional and two ISR uranium milling facilities located within 80 km [50 mi] of the proposed Lost Creek ISR Project. The closest facility to the proposed project area is the conventional Sweetwater Mill operated by Kennecott Energy, which is a licensed conventional uranium mill located approximately 8 km [5 mi] south-southwest of the proposed project area. (NRC, 2009a)

3.3 Transportation

The Lost Creek ISR Project lies in the north-central portion of the sparsely populated Great Divide Basin in the southern portion of the Wyoming West Uranium Milling Region. Interstate 80 (I-80) traverses the southern portion of the basin from east to west. The main north–south artery is U.S. 287, which traverses the eastern portion of the Great Divide Basin between Rawlins and Muddy Gap. The only other transportation routes in the basin are State Route (SR) 73 (Bairoil Road); the County Routes of Carbon, Sweetwater, and Fremont Counties; and

BLM roads (Figures 2-3 and 3-2). Both County and BLM roads are maintained gravel surfaces. (LCI, 2008a)

Transportation to the proposed project area would be predominantly from I-80 at Wamsutter, Wyoming, north on Wamsutter–Crooks Gap Road to the proposed primary access road (Lost Creek Road) entering the proposed project area from the west (Figure 3-2). Alternate site access would be via I-80 at Rawlins, Wyoming, north for about 24 km [15 mi] on U.S. 287, west approximately 40 km [25 mi] on Mineral Exploration Road (CR 63) then 9.6 km [6.0 mi] north on Sooner Road to the proposed access road entering the project area from the east. Each of these roads is paved, with the exception of Sooner Road. The distance from the location of the proposed plant facility to the nearest public road is 7.6 km [4.7 mi] west to Wamsutter–Crooks Gap Road and 7.2 km [4.5 mi] east to Sooner Road, and 31 km [19 mi] northeast to Bairoil. Bairoil has a population of approximately 100 and is the location of the nearest airstrip, Town offices (including a police station), and school. (LCI, 2008a)

The applicant plans to upgrade two roads to access the proposed project area. These plans include connecting the primary access road to the Crooks Gap–Wamsutter Road to the west, and the secondary access road to Sooner (BLM #3215) Road to the east. The applicant proposes to use the western access road for large, heavy-duty trucks carrying materials and supplies, while they expect the majority of the workers (in light-duty trucks) would gain access to the site from the east (Section 2.1.1.1.7). These roads would be upgraded to BLM standards, as they involve BLM-administered land {minimum 6.1 m [20-ft] travelway, 2 percent crown, maximum. 10 percent grade}. Other improvements would include: (i) 15.2 cm [6-in] compacted road base; (ii) ditch slopes 3:1 or greater; (iii) BLM-approved cattle guards; and (iv) culverts, posts, and signage. (LCI, 2009a)

Access to the proposed project area, as previously described, can be accomplished from several directions: (i) from Casper {169 km [105 mi]} via WY 220, US 287, WY 73, CR 22, and BLM #3215; (ii) from Rawlins 80.5 km [50 miles] via US 287, CR 63, and BLM #3215; (iii) from Wamsutter 64.4 km [40 mi] via Wamsutter–Crooks Gap Road (CR 23); and (iv) from Jeffrey City 48.3 km [30 mi] via CR 23. Traffic data (reported as annual average daily traffic counts) for local and regional roads is provided in Section 3.2.2 of the GEIS (NRC, 2009a) and in Table 3.2-1 of LCI's Environmental Report (ER) (LCI, 2008a). Traffic on WY 73 in the vicinity of the proposed Lost Creek ISR Project in 2006 was 30 trucks per day and 230 for all vehicles (NRC, 2009a). The applicant provided the same all-vehicle count for this road in 2007 (LCI, 2008a). For US 287, the daily traffic count for vehicles varied based on the location of the segment where the count was taken. In 2006, 690 trucks and 2,400 total vehicles per day were reported for the northbound segment from Lamont to Muddy Gap (NRC, 2009a). On US 287 at Jeffery City, these counts reduced to 140 trucks and 890 vehicles per day. Driving north toward Casper from the proposed project site follows WY 220. The 2006 traffic count for WY 220 northbound at Muddy Gap was 140 trucks and 910 total vehicles (NRC, 2009a). Daily traffic on I-80 was reported as 12,430 to 13,840 vehicles per day (LCI, 2008a). No traffic count data are available for the local unpaved roads in the vicinity of the proposed project site including Bairoil Road, Wamsutter–Crooks Gap Road, Mineral Exploration Road, and Sooner Road (LCI, 2008a).

Crash data analysis on the regional roads was also conducted for the applicant's environmental report. Data on truck crashes and truck volumes between 2002 and 2006 was used to calculate crash rates. For all of the study area roadways, the truck crash rates were negligible. In fact, on SR 73, no truck crashes occurred during the study period. (LCI, 2008a)

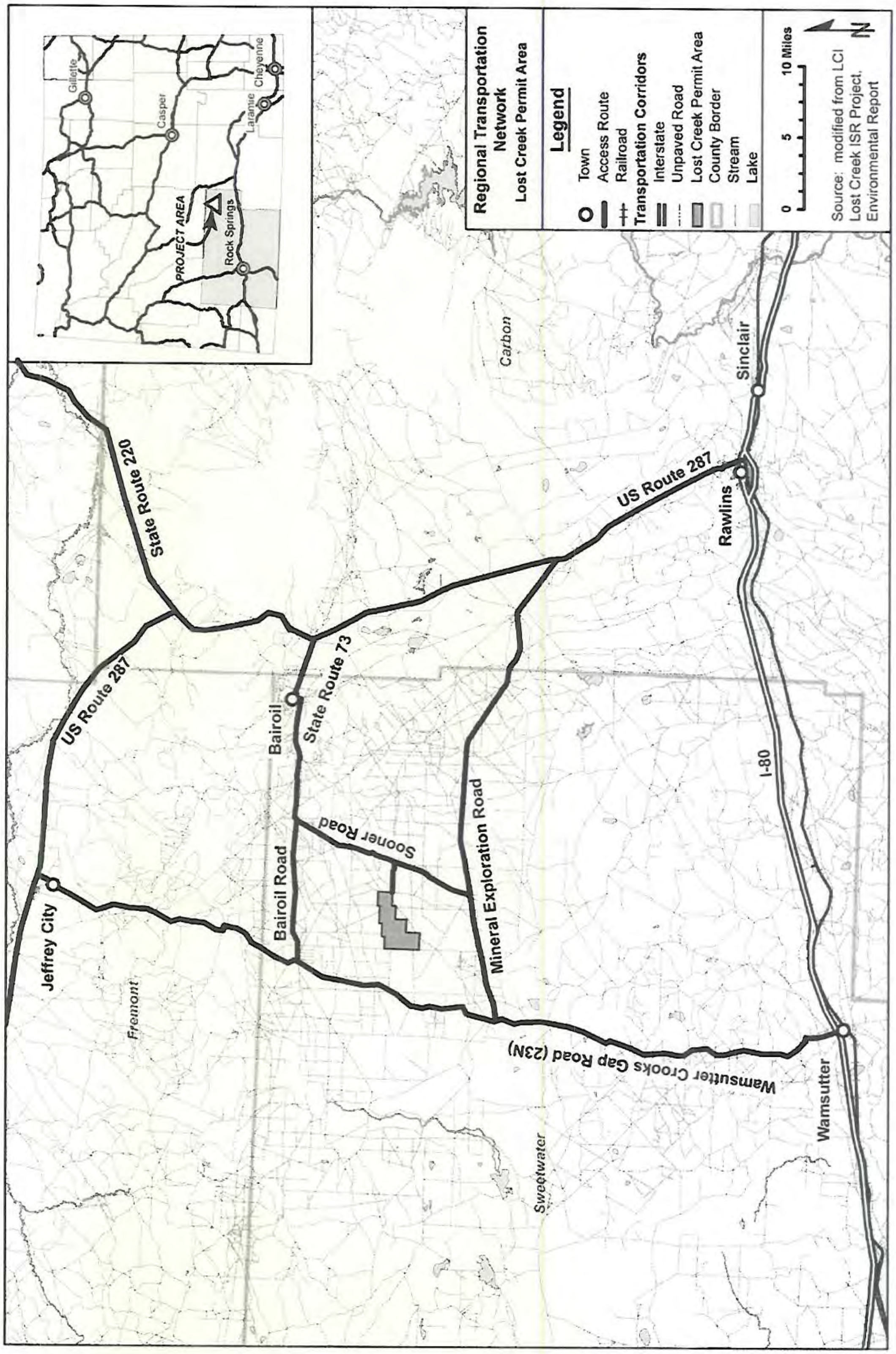

Figure 3-2. Regional Road Network
Source: Modified From LCI (2008a)

Onsite, approximately 15 light-duty trucks would travel among mine units for monitoring and maintenance, while about 10 drill rigs would be operating at any given time installing wells and delineating the ore body. These vehicles would use existing and new two-track roads. Onsite roads are shown in Figure 3-3. (LCI, 2008a)

3.4 Geology and Soils

GEIS Section 3.2 described the regional geology and soils in the Wyoming West Uranium Milling Region (NRC, 2009a) in which the proposed Lost Creek ISR Project would be located. The GEIS described two major uranium districts in the Wyoming West Uranium Milling Region: the Crooks Gap area of the Great Divide Basin and the Gas Hills area of the Wind River Basin. The proposed Lost Creek facility is located in the south-central portion of the Crooks Gap area of the Great Divide Basin. Section 3.4.1 summarizes the regional geology and describes the site-specific geology, and Section 3.4.2 describes the soils at the proposed Lost Creek site. Staff reviewed the information in the license application as well as other information (e.g., geologic cross-sections, financial surety calculations, the WDEQ UIC permit application) including the GEIS and finds the descriptions consistent with the published data.

3.4.1 Geology

The Crooks Gap Uranium District is located in the Great Divide Basin, an oval-shaped structural depression encompassing some 9,064 km^2 [3,500 mi^2] in south-central Wyoming. The proposed project area is located near the north-central part of the basin, which is bounded on the north by the Green and Granite Mountains, on the east by the Rawlins Uplift, on the south by the Wamsutter Arch, and on the west by the Rock Springs Uplift. As described in the GEIS, the dominant source of sediment in the Great Divide Basin is Precambrian (greater than 540-million-year-old) granitic rock of the Sweetwater Arch. Uplift of the Sweetwater Arch began to affect sedimentation in the adjacent Great Divide Basin in Late Cretaceous time (65 to 99 million years ago). Rapidly subsiding portions of the basin received thick clastic wedges of predominantly arkosic sediments, and the more slowly subsiding portions of the basin received a greater portion of paludal (marsh) and lacustrine (lake) sediments. Sediment transported southward into the Great Divide Basin was deposited as an apron of alluvial fans. One such alluvial fan is centered near the Crooks Gap Uranium District. (NRC, 2009a)

A schematic geologic cross section across the proposed project area is shown in Figure 3-4, depicting the entire sequence of stratigraphic units underlying the proposed project area. The uppermost stratigraphic unit is the Battle Spring Formation, with the exception of thin, scattered Quaternary (as old as 2.6 million years) sedimentary deposits (not shown in Figure 3-4) that are present within surface drainages in the proposed project area. The Battle Spring Formation, which is the host rock for the major sandstone-type uranium deposits in the Great Divide Basin, outcrops (surfaces) throughout the proposed project area. The Battle Spring and Wasatch Formations were deposited at equivalent times in the Great Divide Basin, and they interfinger with one another across the basin. However, in the proposed project area, the Battle Spring Formation overlies the lower sections of the Wasatch Formation. The applicant estimated that the combined thickness of the Battle Spring and Wasatch Formations in the proposed project area is about 1,890 m [6,200 ft]. Another major sedimentary unit, the Fort Union Formation, unconformably underlies the Battle Spring and Wasatch Formations and is approximately 1,417 m [4,650 ft] thick in the project area. (LCI, 2008b)

The Battle Spring Formation consists of thick beds of very fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and siltstones deposited as part of a

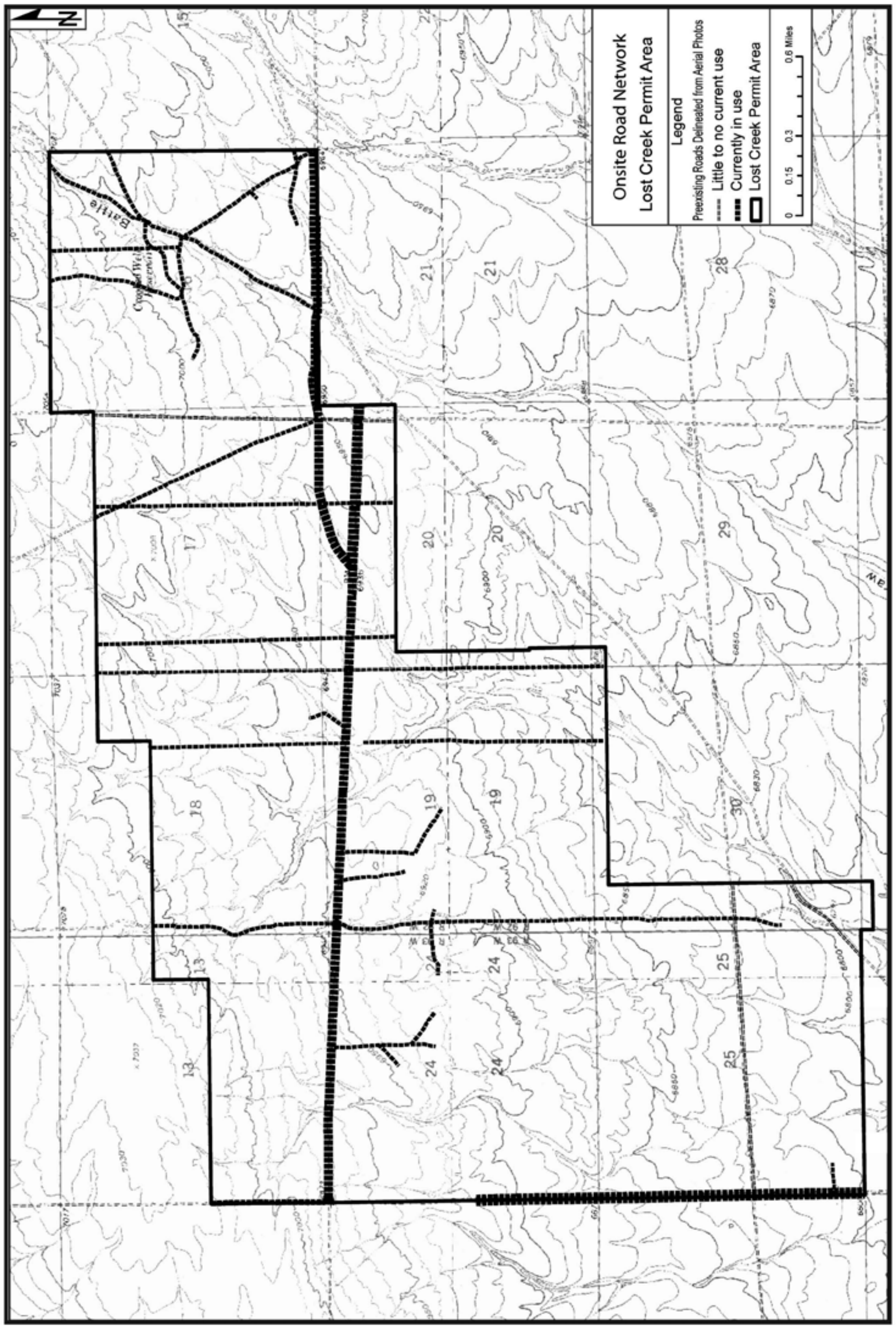

Figure 3-3. On-Site Roads
Source: Modified from LCI (2008a)

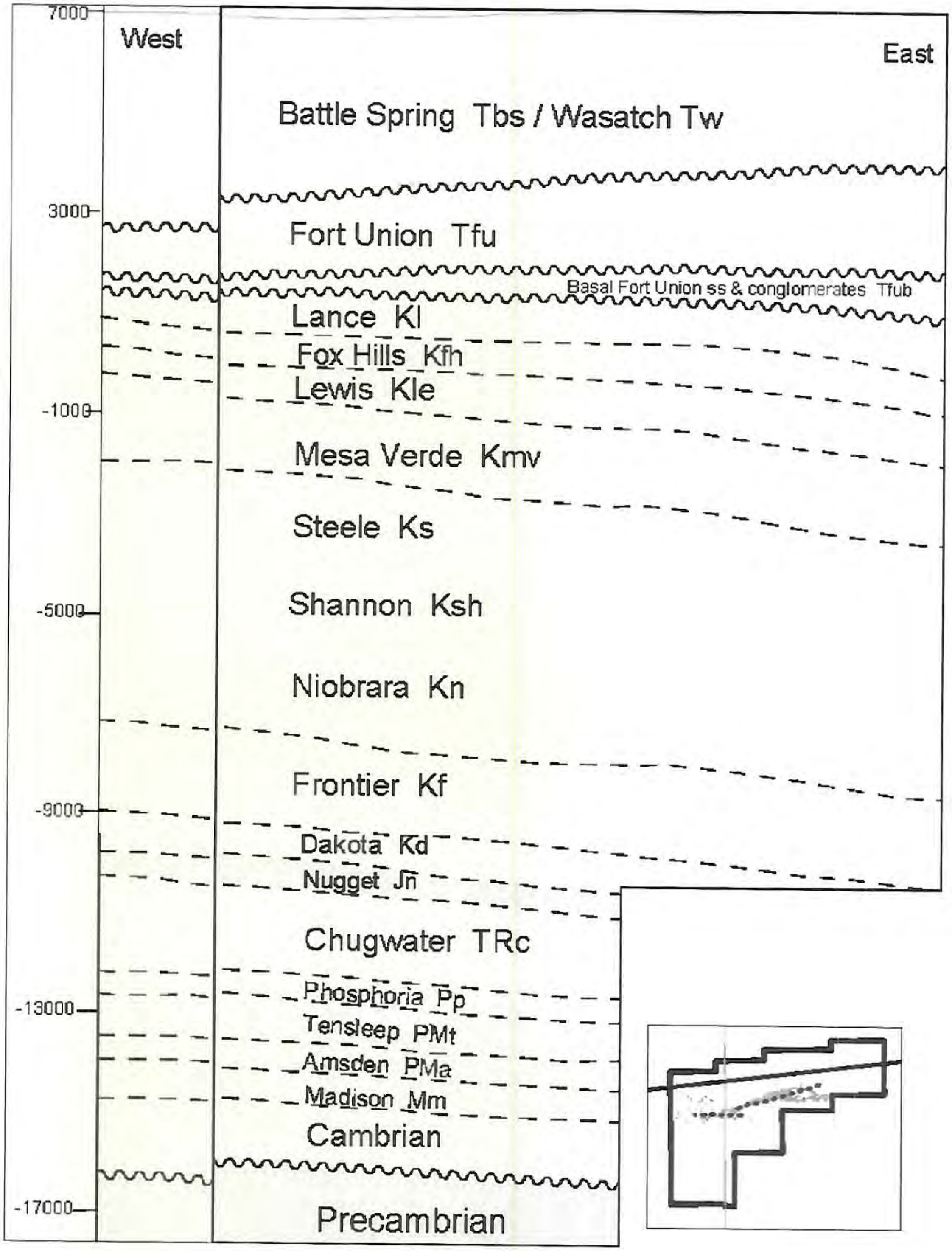

Figure 3-4. Project Geologic Cross Section
Source: Modified from LCI (2008b)

major alluvial system. Conglomerate beds locally occur. The upper portion of the Battle Spring Formation is host to the uranium mineralization in the proposed project area. The uranium mineralization is associated with finer-grained sandstones and siltstones, which may contain minor organic matter. (LCI, 2008a, Section 3.4.2.3)

The age of uranium mineralization in the Battle Spring Formation is estimated to be between 35 and 26 million years old. Regionally, uranium mineralization generally occurs either as tabular deposits or as C-shaped roll-front deposits. The mineralization is thought to have developed from oxygen-rich groundwater, carrying dissolved uranium that migrated downdip through porous sandstone layers in the basin and encountered pyrite and carbonaceous material. Reaction with these solids caused the water to lose its oxidizing potential and precipitate the uranium from solution. In addition, localized thinning of sandstones and reductions in grain size may have contributed to precipitation of uranium by slowing the advance of the uranium-bearing solutions. (LCI, 2008a, Section 3.4.2.3)

The applicant stated that known uranium mineralized zones are found at depths ranging from near surface down to 350 m [1,150 ft] below ground surface (bgs) in the proposed project area. Deeper mineralization may also exist. The main mineralization horizons trend in an east-northeast direction for at least a distance of 4.8 km [3 mi] and are up to 610 m [2,000 ft] wide. The thickness of individual mineralized beds at the proposed project area ranges from 5 to 8.5 m [16 to 28 ft] and averages about 5 m [16 ft]. The mineralization grade ranges from 0.03 percent to more than 0.20 percent equivalent uranium oxide (U_3O_8). Four main mineralized horizons, at depths ranging from 106 to 182 m [350 to 600 ft] bgs, have been identified. In the proposed project area, the applicant divided the top 213 m [700 ft] of the Battle Spring Formation into at least 5 horizons marked from top to bottom as BC, DE, FG, HJ, and KM. These horizons are sandstone layers separated from one another by various thicknesses of shale, mudstone, and siltstone. The sandstones also contain some internal, discontinuous shale, mudstone, and/or siltstone lenses. The two sandstone horizons with the most mineralization, the HJ and the KM, have been subdivided into upper, middle, and lower units (UHJ Sand, MHJ Sand, and LHJ Sand; and UKM Sand, MKM Sand, and LKM Sand). The richest mineralized zone occurs in the MHJ Horizon (MHJ Sand). It is about 9 m [30 ft] thick, occurs 122 to 137 m [400 to 450 ft] bgs, and is estimated to contain more than 50 percent of the uranium under the proposed project area. (LCI, 2008a)

The applicant has obtained a UIC permit for five disposal wells to be completed in the Fort Union Formation as shown on Figures 3-4 and 3-5. The estimated depth to the top of the Fort Union Formation in the fiver permitted disposal wells ranges from 1,872 – 2,038 m [6,139 to 6,685 ft] bgs (Petrotek Engineering Corporation, 2009), which is approximately 1,765–1,855 m [5,789–6,085 ft] deeper than the uranium recovery production zones. The gross injection interval thickness was estimated by the applicant as 591 m [1,940 ft] and the net sand thickness was estimated as 190 m [625 ft] based on the applicant's analysis of geophysical well logs. The lithology of the Fort Union Formation was described as being interbedded sandstones, siltstones, shales, and coals deposited in a fluvial (river) environment (Petrotek Engineering Corporation, 2009).

Geologic cross sections through the mineralized zones in the proposed project area are presented in Plates 3.4-1a, b, c, d, and e of the applicant's ER (LCI, 2008a). The primary uranium production zone is identified as the HJ horizon, although the KM horizon may also be considered for milling. The HJ horizon is overlain and underlain by extensive confining units. The upper confining unit is the Lost Creek Shale, which separates the HJ horizon from the FG

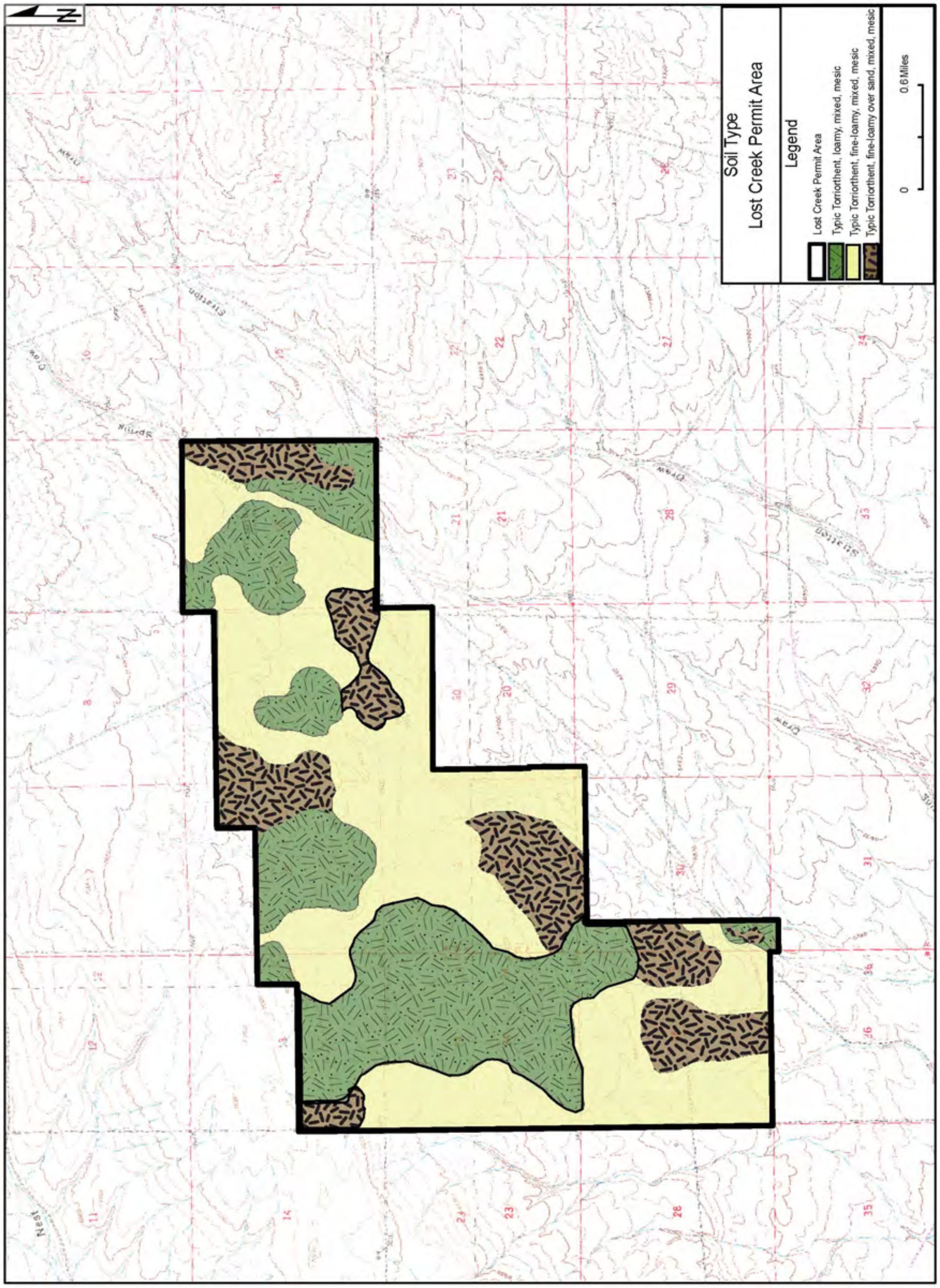

Figure 3-5. Project Soils Map
Source: Modified From LCI (2008a)

sand and ranges in thickness from 1.5 to 14 m [5 to 45 ft]. The lower confining unit for the HJ horizon is the Sage Brush Shale, which separates the HJ horizon from the KM sand and ranges in thickness from 3 to 23 m [10 to 75 ft]. Thickness (isopach) maps of these confining units are presented in Plates 3.4-2a and 3.4-2c of the applicant's ER (LCI, 2008a) and show the variability in thickness of the Lost Creek Shale and the Sage Brush Shale across the proposed project area. The FG and KM sands also are composed of multiple sand units separated by discontinuous shales, mudstones, or siltstones, comparable to the HJ horizon, and the applicant has similarly divided the FG and KM sands into upper, middle, and lower subunits (UFG, MFG, LFG, UKM, MKM, and LKM) (LCI, 2008b).

Thickness (isopach) maps of the HJ horizon and UKM sand are presented in Plates 3.4-2b and 3.4-2d of the ER (LCI, 2008a). The top of the HJ horizon ranges from approximately 116 to 153 m [340 to 450 ft] bgs. The HJ horizon is 37 to 44.3 m [110 to 130 ft] thick, averaging about 41 m [120 ft]. The HJ horizon thins to the south of the Lost Creek Fault (the fault), which is described next. A thicker section of the HJ horizon trends parallel to the fault. Most of the uranium mineralization is concentrated in the middle part of the HJ horizon and occurs as both roll-front and tabular deposits. The total thickness of the overlying FG horizon is approximately 30 m [100 ft]. The top of the FG horizon occurs at depths approximately 61 to 76 m [200 to 250 ft] bgs on the north side of the fault and 91 to 107 m [300 to 350 ft] bgs on the south side of the fault within the proposed project area. Directly underlying the Sage Brush Shale, the UKM sand is typically 9 to 18 m [30 to 60 ft] thick but can be more than 23 m [75 ft] thick. The top of the UKM sand is between 137 and 183 m [450 and 600 ft] bgs within the proposed project area (LCI, 2008b).

Conforming to the regional structural geology, the Battle Spring Formation dips gently to the northwest at an angle of 3 degrees from horizontal in the proposed project area (LCI, 2008a, Plate 3.4-1a). The most conspicuous local structural feature is a set of en echelon, subparallel normal fault segments that extend in a generally northeast-trending direction across most of the proposed project area. This set of fault segments is referred to as the Lost Creek Fault. Vertical displacement on the fault varies by segment, ranging from an offset of about 24 m [80 ft] in the eastern third of the proposed project area to about 13.7 m [45 ft] of offset in the western third, with little or no displacement along the fault in the central portion of the proposed project area. The mineralized sandstones and alternating confining layers in the proposed extraction zones are displaced by the faulting. The applicant plans to conduct ISR operations from strata located on both sides of the Lost Creek Fault (LCI, 2008b).

In terms of regional seismic hazard, the proposed project area is located in south-central Wyoming, which historically has had a low to moderate level of earthquake activity compared to the rest of the state (LCI, 2008a, Section 3.4.1). On the U.S. Geological Survey 500-year probabilistic seismic hazard map of Wyoming (Case, et al., 2002), the estimated peak horizontal acceleration in the proposed project area corresponds to a relatively low intensity of approximately 6.5 percent of gravitational acceleration (g). Such a value corresponds to a 10 percent chance during the next 50 years, and a 100 percent chance during the next 500 years, that an earthquake in the project area would have sufficient ground-shaking intensity to result in minor damage, at most, to a dwelling (e.g., cracked plaster and broken dishes) (LCI, 2008b).

There are two active fault systems in the region: the Chicken Springs and the South Granite Mountain fault systems. The Chicken Springs system, a series of east-west trending fault segments, is located about 10 km [6 mi] east of the proposed project area. The Wyoming State Geological Survey has estimated that the most recent activity on the Chicken Springs fault

system occurred within the Holocene (i.e., within the past 12,000 years) (LCI, 2008a, Section 3.4.3.3). The applicant cited reconnaissance-level investigations that estimated the Chicken Springs fault system could generate a magnitude 6.5 earthquake, which could result in moderate damage in Bairoil (the community nearest the Lost Creek ISR Project), located about 11.3 km [7 mi] northeast of the fault system (LCI, 2008a, Section 3.4.3.3). In the past 100 years, 5 nondamaging earthquakes have been recorded in the vicinity of Bairoil, none of which have exceeded magnitude 4.0 (Case, et al., 2002).

The South Granite Mountain fault system, which consists of several northwest-southeast trending normal and thrust faults, is farther from the proposed project area than the Chicken Springs fault system. It is located about 16 km [10 mi] north of Bairoil and is about 22.5 km [14 mi] northeast of the proposed project area (LCI, 2008a, Figure 3.4-5). The South Granite Mountain fault system is estimated to be capable of generating a magnitude 6.75 earthquake, which could result in moderate damage to buildings in Bairoil (Case, et al., 2002).

3.4.2 Soils

The applicant conducted a soil survey in the proposed project area and determined that soils within the proposed project area are typical of the semiarid areas of the western United States (LCI, 2008b, Section 2.6.4). Most of the soil has developed from the sedimentary bedrock underlying the proposed project area. The precipitation of the region is not enough to leach the majority of calcium and divalent cations from the soil profile, thus the soil pH tends to be slightly alkaline and the amount of vegetation is limited. Therefore, the soils tend to have low organic matter. (LCI, 2008b, Section 2.6.4.3)

The vertical relief on the proposed project area is approximately 80 m [260 ft]. Because of the limited relief and uniform surficial geology, only three soil types are exposed within the proposed project area (Figure 3-5). All three soil types are classified as *Typic Torriorthent* (LCI, 2008b, Section 2.6.4.3), which are shallow, easily erodible soils that develop in arid climates. Such soils typically support only sparse shrubs or grasses. The uniformity in vegetation across the proposed project area indicates that the three soil units are roughly equally productive and that plant growth is limited by precipitation and not by soil fertility. (LCI, 2008b)

The three soil type units are very similar in color, depth of horizons, and geomorphic surface. They differ primarily by soil texture. About 34 percent {581 ha [1,435 ac]} of the soils in the proposed project area are loamy, mixed mesic (i.e., moderate moisture content) soils, brown to yellowish-brown, that are typically 13 to 38 cm [5 to 15 in] thick. They are associated with a brown to pale brown sandy loam subsoil that extends to depths greater than 76 cm [30 in] in the subsurface. These loamy, mixed mesic soils generally are present on the lower foot-slopes, where slopes are less than 10 percent. The geomorphic surface ranges from bare, loamy soil to pebbles and gravel-sized particles. The dominant vegetation associated with this soil type is low-growing sagebrush with intermittent patches of grasses. (LCI, 2008b)

About 46 percent {786 ha [1,941 ac]} of the soils in the proposed project area are fine-loamy, mixed mesic soils. This soil type is abundant in the down slope areas of the region, where slopes are very gradual. The upper profile contains a dark, grayish-brown silt loam that is about 23 cm [9 in] thick. The subsoil is dark yellowish-brown to light yellowish-brown and extends to a depth of at least 68 cm [27 in]. The geomorphic surface consists of bare, fine sandy loam. The dominant vegetation associated with this soil type in the area is sagebrush, with scattered grasses and cacti. (LCI, 2008b)

Twenty percent {342 ha [844 ac]} of the proposed project area soils are fine loamy over sandy, mixed mesic soils in which the surface layer consists of a brown loam that is 10 to 38 cm [4 to 15 in] thick. The subsoil is a brown to a light yellowish-brown sandy loam that extends to a depth greater than 51 cm [20 in]. The geomorphic surface is bare, loamy soil with approximately 25 percent gravel. The dominant vegetation associated with this soil type is low-growth sagebrush and scattered grasses (LCI, 2008b). There is no prime farmland within the proposed project area (USDA, 2000).

Wind erosion is a concern at the proposed Lost Creek ISR project. A majority of the soils in the proposed project area contain a significant percentage of silt, which is directly related to dust emissions from unpaved roads. In Section 4.3 of the ER, the applicant stated that wind erosion would be controlled by removing vegetation only when necessary, and would utilize techniques such as surfacing roads with gravel, limiting traffic speeds, watering unpaved roads, spreading soil binding agents, and timely reclamation. (LCI, 2008a)

Water erosion is not an issue at the proposed project site due to very low surface slopes, limited amount of precipitation and the lack of perennial and intermittent streams. Removal of vegetation for any activity could expose soils to increased erosion. Excavation activities could break down soil aggregates, thus increasing runoff and gully formation. As stated in Section 4.3 of the applicant's ER, soil loss would be reduced by timely reclamation, installing drainage controls, and reseeding and installing water bars across reclaimed areas. (LCI, 2008a)

3.4.3 Artificial Penetrations

Artificial penetrations are manmade holes in the ground, in this context drillholes (i.e., boreholes or wells). The proposed project area contains drillholes from previous activities that occurred at the site as well as from the applicant's exploration activities.

Drillholes occur throughout the proposed project area. The applicant reported information on nearby historic drillholes in the license application (LCI, 2008b, Attachment 2.6-2, Tables 2.2-2, 2.2-3, 2.2-4, and 2.6-4). The applicant listed 809 historic drillholes completed within 3.2 km [2 mi] of the proposed project area, of which 220 had been drilled since 2000. Table 2.2-2 listed 306 ground water use permits within 3.2 km [2 mi] of the proposed project area and the identified groundwater uses consisted of livestock water supply, industrial (including dewatering), monitoring and miscellaneous uses (LCI, 2008b). Table 2.2-4 listed 15 potentially active and three abandoned/cancelled domestic and stock wells located within 8 km [5 mi] of the proposed project area that had been applied for by either BLM or Kennecott Uranium Company. Based on the applicant's mapping of drillhole locations (LCI, 2008b, Attachment 2.6-2 Plates A26-2a through A26-2c), the abandoned drillholes are generally on 200-foot centers resulting in approximately 40 abandoned drillholes within each of the proposed wellfields. No other subsurface mineral exploration or production within the proposed ore production zone was reported by the applicant (LCI, 2008b). The nearest oil and production is a gas field located approximately 16 km [10 mi] southwest of the proposed project area.

Although the applicant has attempted to locate abandoned drillholes and to properly plug undocumented wells, the NRC safety review determined that the information provided was unacceptable to conclude that the abandoned drillholes have been properly plugged. Therefore, NRC would require by license condition that the applicant attempt to locate and abandon historic drillholes within the perimeter well ring of each wellfield prior to the injection of lixiviant into a wellfield production unit such that the drillhole would not provide a conduit for the migration of production fluids.

3.5 Water Resources

3.5.1 Surface Waters and Wetlands

The GEIS (NRC, 2009a) cites the quality of the water bodies within the Wyoming West Uranium Milling Region as ranging between Class 2AB (drinking water) and Class 4C (unsuitable for aquatic life) in reference to the Wyoming Department of Environmental Quality (WDEQ) classification system. The only channel within the proposed Lost Creek ISR Project area WDEQ specifically classified is Battle Spring Draw. LCI reported the classification as Class 3B, but a review by staff concludes that the Battle Spring Draw has a water quality classification of 4C (WDEQ, 2004). Lacking a Use Attainability Analysis or other credible data, the unnamed channels, tributaries, and ponds are protected as Class 3 waters by default. Class 3 are waters, other than those designated as Class 1, that are intermittent, ephemeral, or isolated waters and because of natural habitat conditions, do not support nor have the potential to support fish populations or spawning, or certain perennial waters that lack the natural water quality to support fish (WDEQ, 2004).

Use designations for Class 3 streams include other (non-fish) aquatic life, recreation, wildlife, agriculture, industry and scenic value. Use designations for Class 4 streams are those for the Class 3 streams except for other aquatic life (WDEQ, 2004).

3.5.1.1 Drainage Basins

The proposed Lost Creek ISR Project area consists of 1,722 ha [4,254 ac] lying within the upper drainage area of the Great Divide Basin (see Figure 3-6). The Great Divide Basin is a closed basin where surface waters drain to the basin center to feed seasonal playa lakes. Three sub-watersheds occur on the proposed project site (see Figure 3-7). Battle Spring Draw comprises 239 ha [591 ac] in the far eastern end of the property, an unnamed tributary drains 802 ha [1,983] ac in the center of the site, and another unnamed tributary drains 666 ha [1,646 ac] in the western end of the property (LCI, 2008b). Each of these sub-watersheds conveys surface water toward the south to the Battle Spring Flat, located approximately 14.5 km [9 mi] beyond the proposed project boundary. In most instances, surface water flow infiltrates the soil before reaching Battle Spring Flat. Any runoff that reaches Battle Spring Flat is eventually lost to soil infiltration and evaporation (LCI, 2008a; Clarey, et al., 2010).

NRC staff reviewed the information provided by the applicant. The basins as described by the applicant are consistent with published topographic mapping. The description of the flows is consistent with published data (NRC, 1978; Clarey, et al., 2010).

3.5.1.2 Surface Water Features

GEIS Section 3.2.6.1 (NRC, 2009a) provides general climate and precipitation information relative to the proposed Lost Creek ISR Project area. This information is helpful in understanding the formation of stream channels and episodic nature surface water flow within the proposed project area. In general, the arid conditions limit the formation of year-round surface water and wetland features. Surface waters, particularly in the upper headwaters of the basin, are seasonal, associated with spring time snow melt and runoff from periods of intense rainfall. Otherwise, precipitation is sparse and is normally absorbed into the soil.

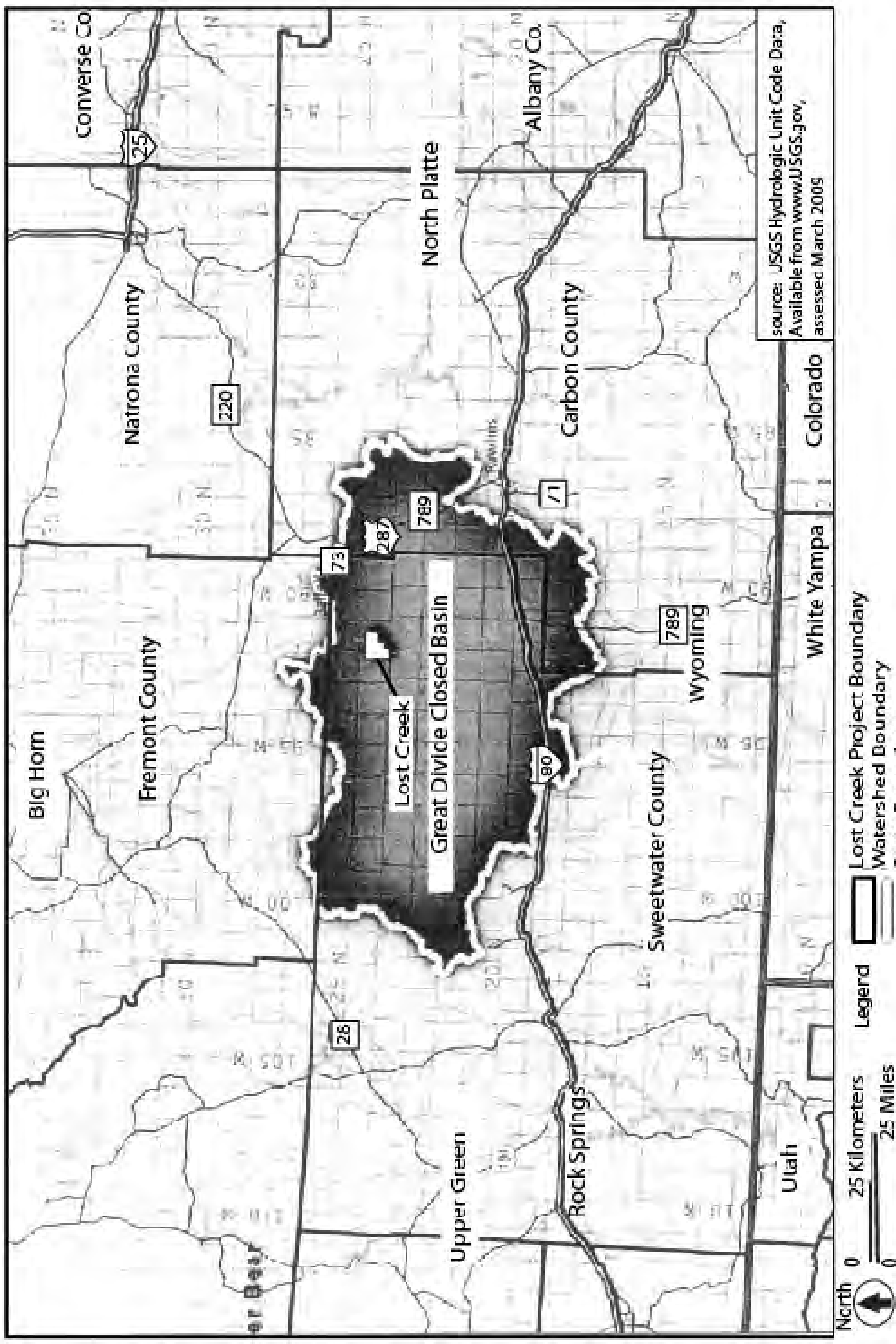

Figure 3-6. Regional Drainage Map
Source: Modified from LCI (2008a)

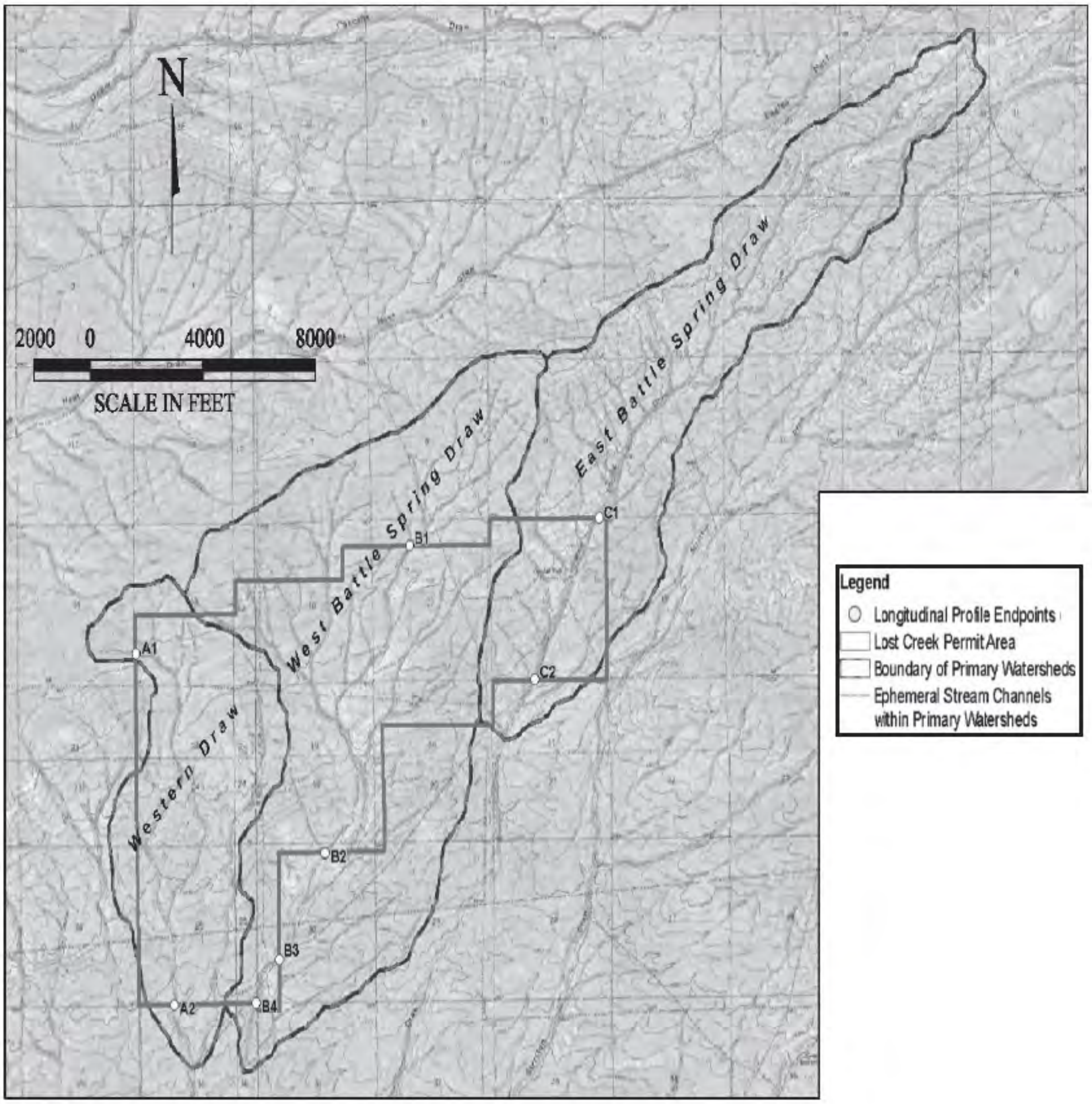

Figure 3-7. Area Watershed Map
Source: Modified from LCI (2008b)

The proposed Lost Creek ISR Project area contains numerous ephemeral channels and washes. These ephemeral channels only flow in response to heavy snow melt and large intense rainfall events. The only named channel is Battle Spring Draw, located on the eastern side of the property. No perennial or intermittent streams exist within the proposed project area. Channels are typically incised approximately 0.9 to 1.8 m [3 to 6 ft] bgs and possess trapezoidal cross sections and steep side slopes. The channels offer limited habitat for aquatic life; rather, the principal function of the surface water features is simply conveyance of surface runoff and groundwater recharge (LCI, 2008a). This information is consistent with published data for the basin (Clarey, et al., 2010).

A review of the National Wetlands Inventory (NWI) Database performed during the applicant baseline wetland surveys showed that the potential existed for two wetlands within the boundary of the proposed project (LCI, 2009b; FWS, 2011). The applicant characterized these locations in the field as described in SEIS Section 3.5.1.5 (LCI, 2009b). The applicant survey results demonstrate that neither potential wetland contains standing water long enough to support aquatic plants or animals (LCI, 2009b). One seasonal pond, the Crooked Well Reservoir, occurs within the proposed project area (LCI, 2008b). This 0.1-ha [0.25-ac] pond is an isolated depression located in the northeastern section of the property. Water from snow melt accumulates in the depression, but during the summer and fall seasons, the pond is dry. The principal functional value of this pond is drinking water for livestock (LCI, 2010, Section 2.7.1.1). The other potential wetland is an isolated 728-m^2 [0.18-ac] area located in the northwestern section of the proposed approximately 0.3 km [0.2 mi] north of Wellfield 5 (FWS, 2011).

3.5.1.3 Surface Water Flow

No stream flow gauging stations exist for streams within the proposed Lost Creek ISR Project area. The peak flows at various recurring intervals were estimated for the downstream points on the three flow regimes within the project area (i.e., West Battle Spring Draw, East Battle Spring Draw and the Western Draw) based on a model developed by Miller (2003). This model utilizes basin characteristics and correlates the calculated results with known flow measurements from data for hundreds of gauged watersheds in Wyoming. The model equation can be used to determine flows in ungaged watersheds. The model predicted flows at the downgradient points on the watershed in the proposed license area are listed on Table 3-2. The calculated peak flow ranges between 0.5 cms [16.9 cfs] for the 2-year storm event to as high as 9.7 cms [342.6 cfs] for the 100-year storm event (LCI, 2008b). In general, the moderate stream channel gradients, rolling terrain, and steeply incised channels result in the containment and retention of peak surface flows within existing streambanks (LCI, 2008b).

3.5.1.4 Surface Water Quality

In its license application, LCI provided historic water quality data from samples taken in 1974 and 1975 (LCI, 2008a). For the most part, the water quality from this period was good, although surface water sampling of Battle Spring Draw revealed high alkalinity (pH 9.5) and uranium concentrations {0.95 mg/l [1.16×10^{-4} oz/gal]}. In 2006 and 2007, 12 storm water samplers were installed at various locations upstream and downstream from the proposed project area (LCI, 2008a, Figure 3.5-4). These storm samplers were comprised of 1-L [0.26-gal] containers positioned in a manner that allowed the flow of surface water runoff to enter each container for unmanned collection. Samples were collected by the samplers in March and April of 2007 for which seven (7) of the 12 samplers were successful in collecting a full liter [0.26 gal] of water

Table 3-2. Calculated Peak Flows for the Three Watersheds Within the Project Area*

Watershed	Area (km^2/mi^2)	2-year (cms/cfs)	5-year (cms/cfs)	10-year (cms/cfs)	25-year (cms/cfs)	50-year (cms/cfs)	100-year (cms/cfs)
West Battle Spring Draw (at Point B4)	18.1/7.0	0.8/28.7	2/73.7	3.3/118.6	5.47/193.2	7.4/262.3	9.7/343.6
East Battle Spring Draw (at Point C2)	13.2/5.1	0.7/23.6	1.7/61.3	2.9/99.5	4.6163.3	6.2/222.8	8.3/293.3
West Draw (at Point A2)	7.51/2.9	0.5/16.9	1.3/45.0	2.1/73.9	3.4/123.0	4.7/169.3	6.3/224.9
* Source: LCI (2008b)							

(LCI, 2008a). The analytical results from the samples are provided in LCI (2008a: Table 3.5-3). Most of the parameters measured were found to be below detectable limits, and the pH ranged from slightly acidic to neutral (6.39 to 7.12).

Wide variations in certain parameters were observed when the data collected in 1974 and 1975 were compared with those from 2007. One explanation may be that the 1974–75 data were collected 11 km [7 mi] downstream where groundwater discharge to surface water may have had a significant influence. Additionally, there may have been a difference in flow volumes during the various sampling events (LCI, 2008a).

Surface water quality during 1974 and 1975 met the criteria for a Class 4C stream. The surface water quality during 2007 met the quality for a Class 3 stream. (WDEQ, 2004)

3.5.1.5 Wetlands

The federal definition of wetlands include "those areas inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted to life in saturated soil conditions" (33 CFR 328.3). Wetlands are important resources that provide habitat for aquatic fauna and flora, filter sediments and toxicants, and provide floodwater attenuation.

As part of the Lost Creek application, the applicant reviewed the NWI database to determine whether potential wetlands are present on the proposed site and found two potential wetlands described in SEIS Section 5.3.1.2 (USACE, 2010; FWS, 2011). The findings were confirmed in the field by qualified personnel in April 2006 and April 2009 using the 1987 Army Corps of Engineers Wetlands Delineation Manual (LCI, 2009b Attachment D11) to determine whether any USACE jurisdictional wetlands exist within the proposed project site, and none were found.

USACE regulates all "waters of the United States," the definition of which was recently influenced by the U.S. Supreme Court Decision *Rapanos v. United States* (No. 04-1034, 376 F. 3rd 629, June 19, 2006). Jurisdiction continues to be exerted for all traditional navigable waters, nonnavigable tributaries of traditional navigable waters with relatively permanent flow, and wetlands directly abutting these systems. For systems that are isolated or tributaries that are

not relatively permanent, USACE requires a significant nexus determination to determine whether a particular water body is jurisdictional. A significant nexus determination is needed to evaluate whether the impact of a particular water body would result in more than a speculative or insubstantial effect on the chemical, physical, and biological integrity of "traditional" navigable water.

In May 2010, LCI submitted a letter to the USACE requesting a jurisdictional determination by USACE of the surface waters in the project area. The USACE issued a response to the applicant request for jurisdiction determination on August 18, 2010 (USACE, 2010). The letter stated that the two potential wetlands identified in NWI database and the ephemeral channels in the area of the proposed Lost Creek ISR site are not considered "Waters of the U.S." Therefore, those surface waters are not jurisdictional, and USACE does not require the applicant to obtain authorization prior to modification of those surface water features (USACE, 2010). However, all surface waters, including perennial streams, are considered waters of the state and must meet state's water quality standards (BLM, 2011b).

3.5.2 Groundwater

3.5.2.1 Regional Groundwater Resources

As reported in GEIS Section 3.2.4. 3, the Crooks Gap Uranium District, where the Lost Creek site is located, is part of the Wyoming West Milling Region (NRC, 2009a). The Crooks Gap District lies within the Great Divide Basin, an internally closed drainage basin that contains uranium-bearing aquifers and encompasses 9,064 km^2 [3,500 mi^2]. The license area is located in the north-central portion of the Great Divide Basin, which is an internal drainage basin. The applicant presented a description of the regional hydrogeology in Section 2.7.2.1 of its application based on published data. The application described the hydrologic recharge areas as predominately along the topographically elevated margins of the basin, hence surface and groundwater flow is toward the center of the basin. The application identified the proposed Lost Creek ISR Project area is northeast of the basin center, groundwater flow at the site is toward the southwest. Regionally, the Great Divide Basin is part of the regional Upper Colorado River Basin aquifer system, a 51,800-km^2 [20,000-mi^2] system that also includes the Green River and Washakie structural basins of southwestern Wyoming (NRC, 2009a).

Whitehead (1996) subdivided the Colorado River Basin aquifer system was subdivided by into five principal aquifers: the Laney aquifer (Tertiary), the Wasatch/Battle Spring-Fort Union aquifer (Lower Tertiary), the Mesa Verde Aquifer (Cretaceous-Mesozoic), and the Upper and Lower Paleozoic aquifers. In the proposed project area, the stratigraphic units that host the Laney aquifer and the Green River Formation are not present. As such, at the Lost Creek site, the shallowest Lower Tertiary aquifers consist of sandstone units within the Wasatch/Battle Spring and Fort Union Formations. These formations are up to 3,350 m [11,000 ft] thick in Sweetwater County; about 2,135 m [7,000 ft] thick near the center of the basin in south-central Wyoming; and more than 1,890 m [6,200 ft] thick in the proposed project area. These uppermost aquifers serve as regional water supplies for drinking water and livestock and also host a series of uranium-rich sedimentary units. While Collentine, et al., (1981) identified these aquifers are identified as the most important and most extensively distributed and accessible groundwater sources in the study area, the waters typically contain high levels of radionuclides [greater than U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCLs)] within the basin and locally contain saline water where they are deeply buried. Below these Tertiary units is the Upper Cretaceous Lance/Fox Hills Formation that consists of very fine-grained sandstone, siltstone, and coal beds, which are not considered to be important

aquifer units in the proposed project area. Beneath this hydrologic system is a regionally continuous aquitard, the Upper Cretaceous Lewis Shale, which is between about 191 and 381 m [625 and 1,250 ft] thick in the proposed project area. Due to its low permeability and significant thickness, the Lewis Shale is considered the base of the hydrogeologic sequence of interest within the Great Divide Basin.

Below the Lewis Shale is the Mesa Verde aquifer system, the top of which is 4,267 m [14,000 ft] bgs in the proposed project area it consists of interbedded sandstones and shales underlain by Permo-Triassic confining units approximately 5,486 m [18,000 ft] bgs. The Mesa Verde aquifer is generally too deep to be economically developed for water supply or has an elevated TDS concentration that renders its water unsuitable for human consumption. Below the Permo-Triassic confining units, the principal aquifers in Paleozoic rocks are the Tensleep Sandstone of Pennsylvanian and Permian age and the Madison Limestone of Devonian and Mississippian age. Sandstone, limestone, and dolomite beds of Pennsylvanian to Cambrian age also are water bearing. Because they are the most deeply buried and contain saline water almost everywhere, the Paleozoic aquifers are rarely used for water supply in southwestern Wyoming. Locally, however, where aquifer units crop out near structural highs along the basin margin (e.g., the Rawlins Uplift and Rock Springs Uplift), the water is less saline and contains lower concentrations of radionuclides due to its proximity to the recharge areas and shorter residence time in the formations.

3.5.2.2 Local Groundwater Resources

The Lost Creek Site is directly underlain by the Battle Spring Formation, the upper part of the shallow Lower Tertiary aquifer system that extends from the ground surface to a depth of more than 1,890 m [6,200 ft]. The formation is interpreted to represent a major alluvial system, consisting of thick beds of very fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and siltstones and finer grained beds, with conglomerate beds locally present. The multiple sandstone layers serve as the main water-bearing units and are typically under confined conditions between the finer grained units, but locally unconfined conditions exist. Regionally, the potentiometric surface within shallow aquifer units is usually within less than 61 m [200 ft] of the ground surface. Most wells drilled for livestock water supply in this unit are less than 305 m [1,000 ft] deep and draw water from the higher permeability sandstone units. Uranium mineralization in the Battle Spring Formation is associated with finer grained sandstones and siltstones, which may contain minor organic matter in a few areas. This mineralization predominates in several horizons in the upper portion {top 213 m [700 ft]} of the Battle Spring Formation in the proposed project area, and its distribution is described in more detail in Section 3.1.2.3.

The site-specific information noted above summarizes the applicant’s conceptual model for the local groundwater resource as described in the license application. The applicant’s conceptual model is based on numerous, closely space (e.g., 200-foot centers) exploratory drillholes. NRC staff is required to review the applicant’s concept model to ensure its consistency with the data provided by the applicant as well as verify consistency of data with other sources. The review included examination of plan and cross-section mapping, borehole logs, tables of hydrogeologic data included water level and quality measurements, and a review of published data from the US Geological Survey, Wyoming State Geologic Survey and Wyoming State Engineer’s Office.

3.5.2.3 Uranium-Bearing Aquifers

As described in Section 3.4.1, LCI divided the top 213 m [700 ft] of the Battle Spring Formation into at least 5 horizons denoted from top to bottom as BC, DE, FG, HJ, and KM (see Figure 3-8). The primary uranium production zone for the proposed Lost Creek ISR Project area is identified as the HJ horizon. The HJ Horizon is subdivided into the Upper (UHJ), Middle (MHJ), and Lower (LHJ) sands, which are separated by thin non-contiguous shales. Based on results of pumping tests, the sands within the HJ horizon exhibit a degree of hydraulic communication. As such, LCI considers the combined HJ Sands as a single aquifer and has designated these sands as the production zone aquifer. The HJ sand units are bounded by laterally contiguous confining units identified by the applicant as the Lost Creek Shale and the Sage Brush Shale, which overlie and underlie the proposed production zone, respectively. The FG Horizon overlies the Lost Creek Shale, and the KM occurs beneath the Sage Brush Shale. LCI designated the Lower FG (LFG) sand as the aquifer overlying the production zone, and the Upper KM (UKM) sand has been designated as the aquifer underlying the production zone. The UKM, however, is also identified as a potential future production zone. The shallowest occurrence of groundwater within the proposed project area is within the DE Horizon, with the depth-to-water table varying from approximately 43 to 61 m [160 to 200 ft] bgs. The DE Horizon is separated from the FG Horizon below by an unnamed shale layer approximately 0–15 m [0–50 ft] thick.

Within the HJ Horizon, the applicant reported that the bulk of the uranium mineralization is present in the MHJ Sand. The total thickness of the HJ Horizon ranges from 30 to 49 m [100 to 160 ft], averaging approximately 36.5 m [120 ft]. The top of the HJ Horizon ranges from approximately 91 to 137 m [300 to 450 ft] bgs within the proposed project area. The upper, middle, and lower sand units are generally separated by discontinuous, thin, clayey units that do not act as confining units to prevent groundwater movement vertically between the HJ Sands horizons (LCI, 2008a). Monitoring wells have been completed in the HJ Horizon, the overlying aquifers (DE and LFG), and the underlying aquifer (UKM). Water levels have been measured in these wells to assess the potentiometric surface, groundwater flow direction, and hydraulic gradient of these units. Water level data are available from 2006 and 2007 monitoring events, as well as from historical data taken in 1982.

NRC staff performed a detailed review of the water level data and finds that the applicants conceptual model is consistent with the data presented. The staff verified that the potentiometric surface elevations and gradients are consistent with published regional data for the Battle Spring Formation. The 1982 water levels are similar to those observed during 2007 indicating that the data are representative of long-term characteristics. The applicant provide mapping at suitable scale and legible cross-sections for staff to adequately evaluate the site-specific hydrostratigraphy. The reported differences in potentiometric head for the various horizons are consistent with the applicant’s proposed conceptual model that the horizon are confined/semi-confined aquifers separated by confining units throughout the license area though the confining unit between the DE and FG horizons may not be as effective in inhibiting flow as confining units between the other horizons. The vertical hydraulic gradient between horizons indicates the potential for downward flow.

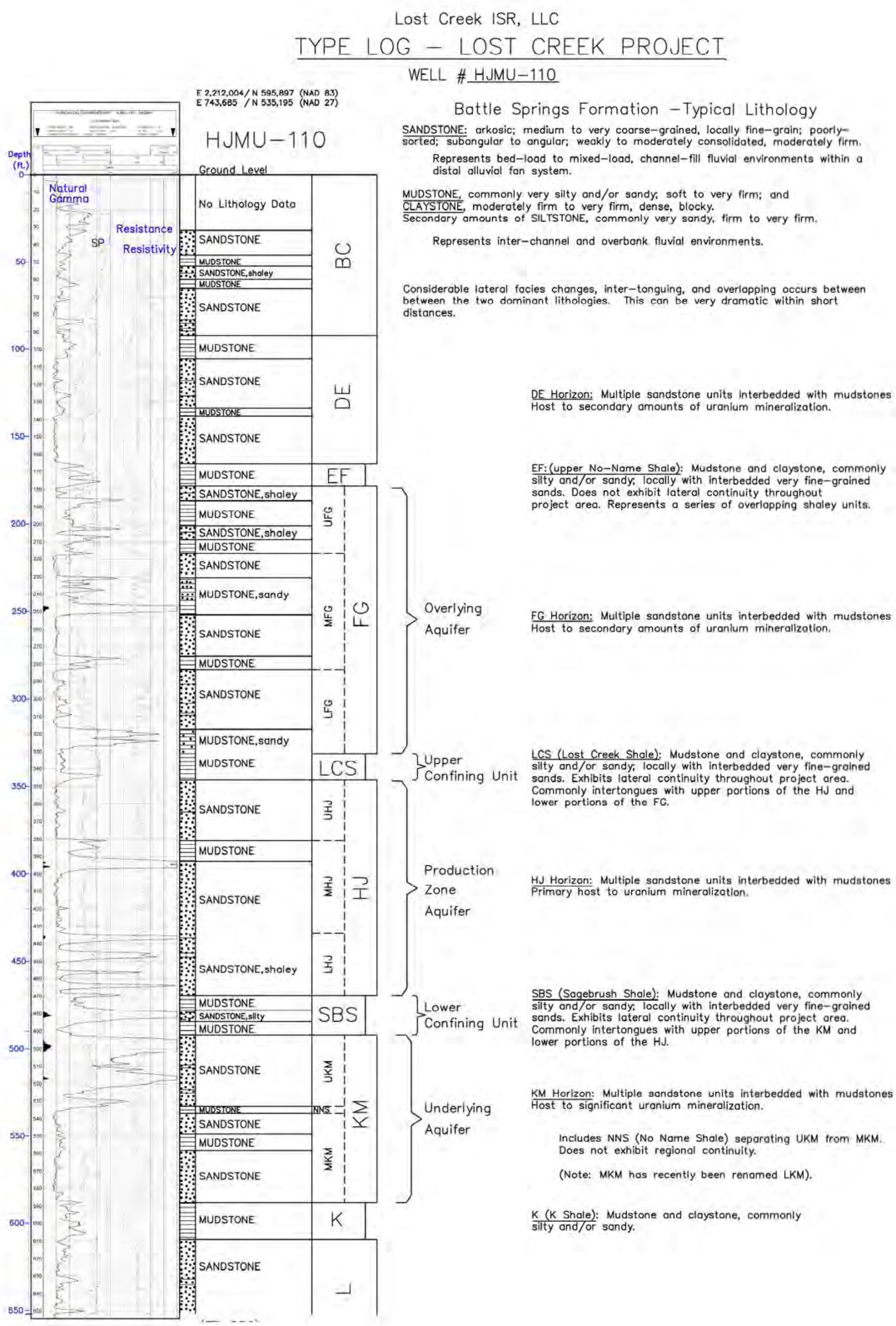

Figure 3-8. Hydrostratigraphic Units
Source: Modified from LCI (2008b)

Based on staff's review, the potentiometric surface in the DE Horizon indicates that it is the uppermost aquifer and largely under unconfined conditions. In several areas, the saturated thickness of the DE horizon is minimal (to a point to preclude the collection of a groundwater sample).

The applicant reported and staff verified that the horizon hydraulic gradient for the HJ Sand, determined from water level data from 1982, 2006, and 2007, ranged from 0.0034 to 0.0056 m/m [0.11 to 0.13 ft/ft] {3.4 to 5.6 m/km [18.0 to 29.6 ft/mi]}. The potentiometric surfaces developed from water level data for the LFG Sand are similar to those developed for the HJ Horizon. However, the data for the UKM Sand indicates that the difference in hydraulic heads across the fault is not as pronounced for the UKM sand as it is for the other shallow sands. This observation may be influenced by the limited number of monitoring wells in the UKM Sand. Horizontal hydraulic gradients calculated for the UKM Sand from available water level data ranged from 0.0053 to 0.0063 m [28.8 to 33.3 ft] {5.3 to 6.3 m/km [28 to 33.3 ft/mi]}. The available water level data were also used to evaluate vertical gradients. The data indicate that vertical gradients range from 0.05 to 0.34 between the LFG, HJ, and UKM aquifers and consistently indicate decreasing hydraulic head with depth. (LCI, 2008b)

The applicant suggested and staff agrees that the difference between water levels for the HJ Horizon on either side of the fault suggests that the fault is a barrier to groundwater flow. Based on 2007 data taken from wells screened in the HJ Horizon approximately 30.5 m [100 ft] apart on each side of the fault, the potentiometric surface on the north side of the fault was found to be 4.6 m [15 ft] higher than on the south side of the fault. Pumping tests conducted onsite support this view that the fault impedes groundwater flow. However, some hydraulic influence was noted across the fault during these on-site pumping tests, indicating that while the fault acts as a barrier to flow, it is not impervious to groundwater flow. Based on the potentiometric maps, groundwater is inferred to flow to the west-southwest, generally consistent with the regional flow system. The fault may direct groundwater in a more westward direction than would be the case if the fault were not present.

3.5.2.3.1 Hydrogeologic Characteristics

The applicant reports aquifer properties for the various horizons within the Battle Spring Formation within the proposed project area from historic and recent pumping tests. Hydro-Search, Inc., (1982) performed a hydrologic evaluation in 1982 to determine the feasibility of *in-situ* production of the Conoco uranium ore body at Lost Creek. More recently, in October 2006, Lost Creek ISR, LLC performed several short-term, single-well pumping tests and three longer term multiwell pumping tests (Hydro Engineering, Inc., 2007). The range of transmissivity values for the HJ aquifer calculated from the data collected during the 2006 tests was from 4.1 to 37.2 m^2/day [44 to 400 ft^2/day]. The range of transmissivity values for the LFG aquifer calculated from the data collected during the 2006 tests was from 0.4 to 3.7 m^2/day [4.4 to 40 ft^2/day]. The range of transmissivity values for the UKM aquifer calculated from the data collected during the 2006 tests was from 2.4 to 10.6 m^2/day [26 to 114 ft^2/day]. Although the 2006 testing was limited, the applicant reported none of the 2006 pumping tests of the HJ horizon indicate significant communication with the overlying or underlying aquifers and there was also no indication of hydraulic communication across the fault in any of the 2006 pumping tests. Staff notes that the testing was limited in extent (i.e., a single well, and thus communication between aquifers may not have been because of the limited data).

In June and July 2007, the applicant conducted another long-term pumping test in the HJ aquifer at Well LC19M (Petrotek Engineering Corporation, 2009). While Well LC19M had

previously been tested during the 2006 pumping tests, the objectives of this test were to further develop aquifer characteristics of the HJ Horizon, to evaluate the hydraulic impacts of the fault, and to demonstrate confinement of the production zone (HJ Horizon) aquifer. While Well LC19M is located on the north side of the fault, HJ monitoring wells were included on both sides of the fault, within distances likely to be impacted by the test, as observation wells. The transmissivity calculated from 5 wells completed in the HJ aquifer on the north side of the fault were similar, ranging from 2.8 to 7.0 m^2/day [30.0 to 75.5 ft^2/day] and averaging 6.3 m^2/day [68.3 ft^2/day]. Storativity calculated from those wells ranged from 6.6×10^{-5} to 1.5×10^{-4} and averaged 1.1×10^{-4}.

In October 2007, the applicant conducted an additional long-term pumping test in the HJ aquifer on the south side of the fault in Well LC16M (LCI, 2008b). During the test, water levels were measured in monitoring wells in the HJ aquifer on both sides of the fault, as well as in the overlying and underlying aquifer on the south side of the fault. The transmissivity calculated from five wells completed in the HJ aquifer on the south side of the fault were similar, ranging from 5.6 to 9.3 m^2/day [57 to 110 ft^2/day] and averaging 7.1 m^2/day [76.2 ft^2/day]. Storativity calculated from those wells ranged from 3.5×10^{-5} to 9.1×10^{-4}.

The transmissivity values calculated from the two 2007 long-term pumping tests did not consider the effect of the fault, which limits groundwater flowing from the south in the first test and from the north in the second test, resulting in bias in the estimate of transmissivity. As a result, LCI considered these transmissivities effective rather than actual transmissivities. Actual transmissivities are likely to be larger than those calculated from the 2007 test data.

The applicant noted that minor responses to pumping were also observed across the fault during both pumping tests. These responses suggest that the fault, while not entirely sealing, significantly impedes groundwater flow, even under considerable hydraulic stress. Small responses in water levels in the overlying and underlying aquifers were also observed during both the 2007 long-term pumping tests. While their cause is not clear, these responses suggest some hydraulic communication between the proposed HJ production zone and the overlying FG and underlying UKM aquifers. NRC staff also notes the responses in the overlying aquifer and fault as discussed below.

3.5.2.3.2 Level of Confinement

As described in Section 3.4.1, the HJ horizon is bounded above and below by areally extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale. While these shales are extensive, large sections of the Sage Brush Shale are less than 2.0 m [6.6 ft] thick, ranging from 1.5–23 m [5.0–75 ft] in the proposed project area. Several areas of the Lost Creek Shale are also less than 2.0 m [6.6 ft] thick in the proposed project area. Areas of thinning in the overlying and underlying confining layers suggest that there may be some hydraulic connection between the production aquifer and the overlying and underlying aquifers. These concerns are supported by the results of the 2007 pumping tests. Minor responses in the overlying and underlying aquifer were observed during these tests. A number of potential causes for these responses have been suggested in addition to leakage across the confining layers, including potential impacts from offsite pumping, leakage through abandoned boreholes, or communication across the fault. However, the cause of these responses observed in the overlying and underlying aquifers during the 2007 pumping test have not been clearly identified. Thus, there remain some concerns regarding the degree of confinement of the HJ production aquifer. LCI states that each wellfield unit would be subject to further extensive testing during the wellfield test required before initiating solution extraction in each wellfield unit. This

additional testing would employ a greater density of monitoring wells within the production zone aquifer and overlying aquifer on both sides of the fault.

NRC staff performed an independent calculation as part of its safety evaluation of the confinement and determined that under expected normal operating conditions, the fault and overlying and underlying confining units will provide sufficient containment of production fluids. However, should an imbalance condition arise, fluids may migrate through the fault and/or overlying and underlying confining units. Although the likelihood of this migration is low, NRC would require by license condition that enhanced monitoring be performed and that the applicant submit wellfield packages for NRC staff review and approval prior to a wellfield being placed in operation.

3.5.2.3.3 Groundwater Quality

In Wyoming, the quality of groundwater is measured against either EPA Drinking Water Standards (40 CFR Parts 142 and 143), which establish MCLs for specific chemical constituents or Wyoming Groundwater Quality standards. The Wyoming standards are based on ambient water quality and are divided into five Classes: Class I is defined as suitable for domestic use, Class II is defined as suitable for agriculture, Class III is defined as suitable for livestock, Class IV is defined as suitable for industrial use, and Class Special (A) is defined as suitable for fish and aquatic life (WDEQ, 2005).

LCI established the site preoperational groundwater quality in the proposed Lost Creek ISR Project area from well data collected by recent sampling in 2006 and 2007 and historical sampling Conoco performed in the late 1970s and early 1980s. The recent data included four quarters of water sampling in fall and winter 2006, spring and summer 2007, and fall 2009. The groundwater quality was measured in four wells in the DE uppermost aquifer, seven wells in the LFG overlying aquifer, nine wells in the HJ ore-zone aquifer, and five wells in the UKM underlying aquifer. The location of the wells is shown in Figure 3-9. The applicant presented the groundwater quality data for all four quarters for all wells in Table 2.7-13 of the technical report (TR). The groundwater quality parameters measured included all suggested analyses in NUREG–1569 (NRC, 2003, Table 2.7.3-1), except silver.

NRC staff determined the average groundwater quality in the proposed Lost Creek license area from wells in the uppermost DE aquifer, the overlying LFG aquifer, the HJ ore-zone aquifer, and the underlying UKM aquifer from the data. The results are shown in Table 3-3. The table shows that the average water quality in the uppermost DE aquifer exceeded the WDEQ Classes I, II, and III and EPA primary drinking water standards for gross alpha, uranium, and combined Ra 226 and 228. These standards were exceeded in all wells for all quarters. One well, LC31M, located in the far southwest corner of the proposed project area, exceeded the WDEQ Class I and EPA primary drinking water standards for sulfate and selenium for all four quarters.

This well also had the highest values of uranium {1.4 to 2.1 mg/l [1.7×10^{-4} to 2.5×10^{-4}oz/gal]} and gross alpha {35,779 to 52,910 Bq/m^3 [967 to 1,430 pCi/L]} of all wells at the site. The average water quality in the LFG overlying aquifer also exceeded the WDEQ Classes I, II, and III and EPA primary drinking water standards for gross alpha, uranium, and combined Ra-226 and 228 in all of the wells over all four quarters.

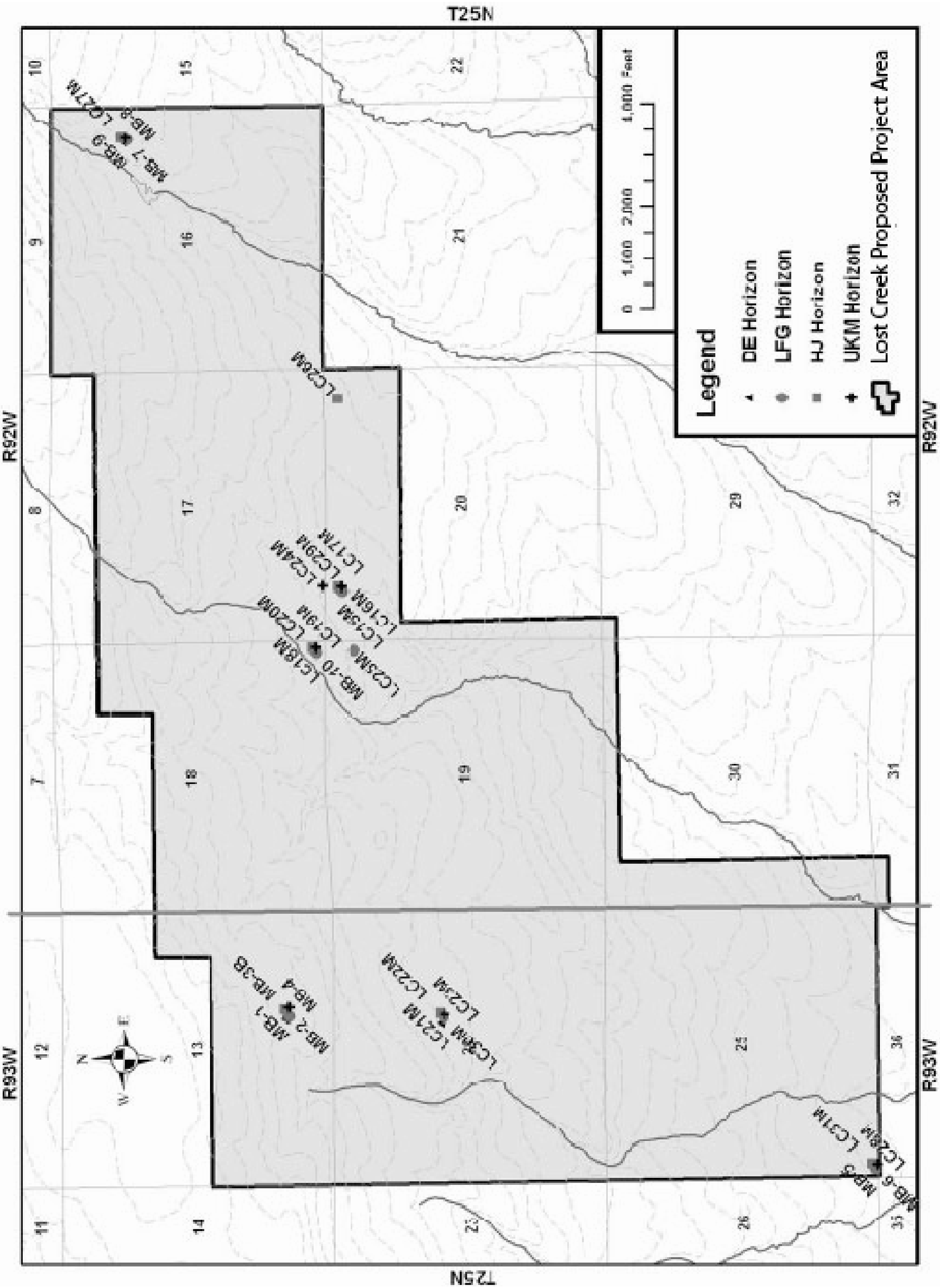

Figure 3-9. Monitoring Wells
Source: Modified from LCI (2008a)

Table 3-3. Average Preoperational Baseline Groundwater Quality for the Lost Creek Project Area Aquifers

Water Quality Parameter	Lost Creek License Area				
	Water Quality Standards*	DE Surficial Aquifer	LFG Overlying Aquifer	HJ Ore-zone Aquifer	UKM Underlying Aquifer
Bicarbonates as HCO_3 (mg/l)†		150	114	111	82
Carbonates as CO_3 (mg/l)		ND	2.5	3.5	27.8
Alkalinity (mg/l)		104.5	102.2	105.5	84.5
Chloride (mg/l)	250	6.3	5.3	5.5	5.5
Conductivity (umhos/cm)		566.8	463	485.9	558
Fluoride (mg/l)	2.0–4.0	0.3	0.21	0.21	0.20
pH (s.u.)	6.5–8.5	7.68–8.07	**7.32–8.57‡**	**7.85–9.51**	**7.66–11.6**
Total Dissolved Solids (mg/l)	500	347	296	311	297
Sulfate (mg/l)	250	135.7	121.5	131.9	117.6
Ra-226 (pCi/l)§	*5*	**2.8**	**26.6**	**143.3**	**9.1**
Ra-228 (pCi/l)	*5*	**2.4**	**3.8**	**6.6**	**3.49**
Uranium (mg/l)	0.03	**0.74**	**0.41**	**0.17**	**0.031**
Gross Alpha (pCi/l)	0.01	**495.9**	**356**	**395.4**	**41.3**
Gross Beta (pCi/l)	2.0	157.7	107.9	117.5	23.1
Nitrogen, Ammonia as N (mg/l)	0.5	0.027	0.08	0.015	0.39
Nitrogen, Nitrate+Nitrite as N (mg/l)	10	0.7	0.6	ND	ND
Aluminum (mg/l)	0.05–0.2	ND	ND	ND	ND
Arsenic (mg/l)	0.1	0.003	0.003	0.006	0.006
Barium (mg/l)	2.0	ND	ND	ND	ND
Boron (mg/l)		ND	ND	ND	ND
Cadmium (mg/l)	0.005	ND	ND	ND	ND
Calcium (mg/l)		68.1	58.8	67.7	51.5
Chromium (mg/l)	0.1	ND	ND	ND	ND
Copper (mg/l)	1.0	ND	ND	ND	ND
Iron (mg/l)	0.3	0.21	**0.37**	0.09	0.12
Lead (mg/l)	0.015	ND	ND	ND	ND
Magnesium (mg/l)		4.3	3.31	3.65	2.45
Manganese (mg/l)	0.05	ND	ND	ND	ND
Mercury (mg/l)	0.002	ND	ND	ND	ND
Molybdenum (mg/l)		ND	ND	ND	ND
Nickel (mg/l)	0.1	ND	ND	ND	ND

Table 3-3. Average Preoperational Baseline Groundwater Quality for the Lost Creek License Area Aquifers (continued)

Potassium (mg/l)		2.3	3.1	4.4	10.9
Selenium (mg/l)	0.05	**0.079**	0.024	0.002	0.002
Silica (mg/l)		15.6	14.1	14.9	14.4
Sodium (mg/l)		40.3	32.3	31.5	36.2
Vanadium (mg/l)		ND	ND	ND	ND
Zinc (mg/l)	5.0	ND	ND	ND	ND

*EPA Drinking Water Standards–40 CFR Part 142 and 40 CFR Part 143, *Wyoming Water Quality, Rules and Regulations, Chapter 8, Class I, Domestic Ground Water*
†To convert mg/l to oz/gal, multiply by 1.34×10^{4}
‡Bolded values exceed either EPA or Wyoming Class I Groundwater Standards
§To convert pCi/L to Bq/m^3, multiply by 37

The average water quality in the HJ ore-zone aquifer also exceeded the WDEQ Classes I, II, and III and EPA primary drinking water standards for gross alpha and combined Ra-226 and 228 in all but two of the wells over all four quarters. The exceptions were wells LC27M and LC28M, whose uranium concentrations were below the MCL of 0.03 mg/l [3.65×10^{-6} oz/gal], averaging 0.002 and 0.008 mg/l [2.43×10^{-7} and 9.74×10^{-7} oz/gal], respectively. Nonetheless, their gross alpha and combined Ra-226 and 228 values exceeded the aforementioned standards, which is consistent with the present uranium ore bodies in the aquifer unit. Uranium concentrations in the waters from the other HJ sands monitoring wells had an average range of 0.065 to 0.552 mg/l [7.91×10^{-6} to 6.72×10^{-5} oz/gal], which is between 2 and 18 times the MCL for uranium. One well, LC 26M, in the eastern part of the license area, exceeded the WDEQ Class I and EPA secondary drinking water standards for sulfate and total dissolved solids (TDS).

The average water quality in the UKM underlying ore-zone aquifer also exceeded the WDEQ Classes I, II, and III and EPA primary drinking water standards for gross alpha and combined Ra-226 and 228 in all the wells over all four quarters. Two of the wells, LC20M and LC24M, located in the ore-zone area, also exceeded these standards for uranium.

The water quality data demonstrate that none of the aquifers tested near and within the ore zone in the Lost Creek license area meet WDEQ Classes I, II, or III EPA primary drinking water standards for radionuclides Because none of the aquifers tested meet the WDEQ I, II, or III standards, the water cannot be used for domestic use, agricultural use, or for livestock. Nonetheless, for ISR operations to be conducted in an aquifer, EPA must declare it as an exempt aquifer. An exempt aquifer is one that is not now nor will ever be used for drinking water given its water quality.

3.5.2.3.4 Current Groundwater Uses

The applicant has identified the groundwater users (14 stock wells and 1 domestic well) within 3.2 and 8-km [2 and 5-mi] radii of the proposed project area using the Wyoming State Engineer's Office (WSEO) Water Rights Database (WSEO, 2006) and correspondence with BLM (Figure 3-10). The applicant noted that many other wells or ground water uses exist within the 8-km radius; however, the majority of the groundwater use permitted in the vicinity of the

proposed project area is for monitoring or miscellaneous mining-related purposes and does not represent consumptive use of groundwater. Many (i.e., hundreds) of these permits are associated with the Kennecott Sweetwater Mine, which is a convention uranium recovery mill with an NRC license but has not operated since 1983. Within a 3.2-km [2-mi] radius of the proposed project area, all water use permits are issued by BLM. Each of these permits is associated with a well that supplies a stock pond (or tank).

In summary, LCI has identified 15 active domestic or stock wells within an 8-km [5-mi] radius of the propose license area including four stock wells within a 3.2-km [2-mi] radius. Of these 15 wells, BLM has 10 active or potentially active wells (and 4 associated stock ponds), located outside the proposed project area, but within an 8-km [5-mi] radius of impact around the proposed project area boundary (LCI, 2008b). All of these BLM wells are used for livestock watering. There are four additional non-BLM stock wells and one domestic water supply well at Kennecott Uranium within the 8-km [5-mi] radius of the proposed project area.

NRC staff reviewed the WSEO water rights database that was associated with Clarey et al. (2010). In 2010, the SEO database had 265 groundwater rights listed within 8 km [5 mi] of the proposed project area. Of the 265 rights, the status of 125 rights was unadjudicated with 123 uses for monitoring wells, dewatering wells, miscellaneous and industrial associated with the uranium recovery properties (primarily Kennecott) and 2 uses for livestock watering, both of which were listed in LCI's table. Of the 140 wells with a good standing status, 117 uses were for monitoring wells at the uranium recover properties, 10 uses were for miscellaneous, reservoir, dewatering and/or industrial primarily at the Kennecott facility, one (1) use was for domestic supplies and 12 uses were for livestock watering. The latter 13 uses (domestic and live stock) are included in LCI's summary table. NRC independent review verified LCIs summary of the live stock water and domestic water supply wells within the 8 km [5 mi] radius of the proposed facility.

NRC staff also notes that one additional well was noted within the 8 km [5 mi] radius of the project area which was not a stock or domestic water supply use. That well was listed as Eagle Water Well #1 belonging to Southwestern Energy located in Section 31, Township 26N, Range 91W (Permit Number P165566W). The well use was listed as miscellaneous, and on the forms listed as q water supply for oil and gas water well. Based on documents in the WSEO file, the permit for this well may have expired in 2007.

To evaluate the impact at the wells, NRC staff estimated the relative depths of the wells with respect to production aquifer (HJ Horizon) and estimated the completion zone for each based on projecting the HJ Horizon to the location of each well (Table 3-4). Eight BLM wells are at or shallower than the proposed HJ Horizon production zone {~113–152 m [370–500 ft]}; however, because the Battle Spring Formation is said to dip 3 degrees to the west (LCI, 2008b, Section 2.6.1.2), the HJ Horizon is expected to be progressively shallower to the east and deeper to the west of the site. A projection of the HJ Horizon at the 3 degree dip would place the well-completion-zone for three of the shallower wells to east and northeast of the proposed project area (wells 2, 5, and 10 on Table 3.3) within the production horizon. After identifying the wells affected by the production zone, LCI predicted potential drawdowns in the production zone aquifer of 54 m [177 ft] at 3.2 km [2 mi] and 45 m [148 ft] at 8 km [5 mi] (LCI, 2008c). Consequently, the available water column for wells 2, 5, and 10 could be affected by the

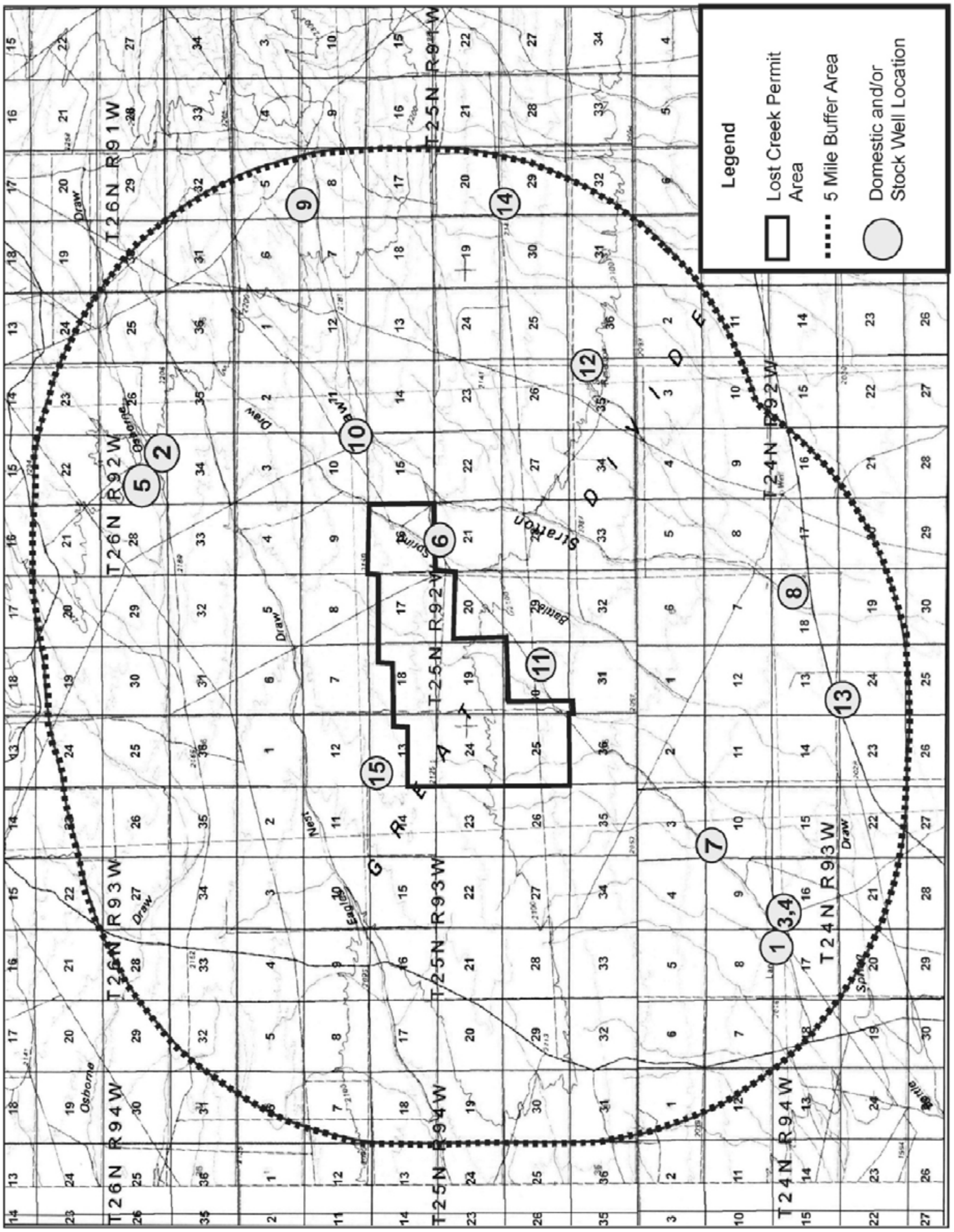

Figure 3-10. Domestic and Stock Wells Within 5 Miles of the Proposed Lost Creek ISR Project Area.
Source: :Modified from LCI (2008a).

Table. 3-4. Existing Wells Within 5 Miles of the Proposed Lost Creek ISR Project Area

Well No. (Map)	Well Permit Number/Name	Well Depth (ft.)	Depth (ft.) to Static Water	Projected Aquifer Horizons	Projected Drawdown
1	P6572W	216	60	DE, FG	15 ft
2	P8444P	280	250	FG, HJ	160 ft
3	P8461P	600	−1	DE, FG	16 ft
4	P8462P	600	60	DE, FG	16 ft
5	P10696P	237	−1	DE, FG, HJ	160 ft
6	P13834P/4451	900	104	DE, FG, HJ, KM	40 ft
7	P47137W	unknown	unknown	unknown	unknown
8	P55108W	220	138	DE, FG	15 ft
9	P5111W	300	199	KM	15 ft
10	P5112W/4775	280	155	HJ, KM	199 ft
11	P55113W/4777	220	109	DE, FG	22 ft
12	P55114W	320	237	KM	15 ft
13	P63765W	380	140	DE, FG	15 ft
14	P183470W	unknown	unknown	unknown	unknown
15	Eagle Nest Draw	370	269	DE, FG	15 ft
Source: LCI, 2008a					

predicted drawdown. LCI has committed to monitoring water levels at the four BLM livestock water wells located closest to the project area (within 1 mile) and quality at the nearby supply wells to ensure each well is not impacted by the proposed operations.

3.5.2.4 Surrounding Aquifers

As described previously, the Wasatch/Battle Spring Formation and the Fort Union Formation are of Tertiary Age, while the Lance Formation is of Upper Cretaceous age. They are considered part of the Tertiary aquifer system, which has been identified as the most important source of groundwater in the study area. Although some stock wells are known to be present in the Lance Formation along the formation’s outcrop areas along the border of the Great Divide Basin, the groundwater in the Lance Formation is largely undeveloped. Similarly, the Fort Union aquifer is largely undeveloped and unknown as a source of groundwater supply except in areas where it occurs at shallow depth along the margins of the basin. These surrounding aquifers

are hydrologically upgradient of the proposed production zone at Lost Creek and are separated stratigraphically as well (Clarey, et al., 2010).

The most important aquifers within the Great Divide Basin are in the Wasatch and Battle Spring Formations. Most wells drilled for water supply in the Battle Spring Formation are less than 305 m [1,000 ft] bgs. Collentine, et al. (1981) report that wells completed in the Battle Spring aquifers typically yield 114 to 152 Lpm [30 to 40 gpm], but yields as high as 568 Lpm [150 gpm] are possible. Water quality within the Battle Spring aquifer is generally good in the northeast portion of the basin with TDS levels usually less than 1,000 mg/L [0.122 oz/gal] and frequently less than 200 mg/L [0.0243 oz/gal]. Sulfate levels are also generally low in the shallow aquifers of the Battle Spring aquifer. Notable exceptions to the relatively good water quality include waters with elevated radionuclides. The presence of high levels of uranium in Tertiary sediments and groundwater of the Great Divide Basin has been well documented.

The applicant has proposed deep well disposal into the Fort Union Formation via Class I injection wells of liquid effluent as described in Section 3.4. The Fort Union Formation is 1,765–1,855 m [5,789 to 6,085 ft] deeper than and hydraulically isolated from the proposed production zones. The applicant determined that the proposed injection zone had a total dissolved solids concentration in excess of 10,000 mg/L, that the native groundwater quality in the proposed injection zone exceeded WDEQ groundwater quality standards for organic constituents, inorganic constituents, and for radionuclides {gross alpha and combined radium [226 + 228]} (Petrotek Engineering Corporation, 2009) reflecting the natural occurrence of both hydrocarbons and uranium in the subsurface. The WDEQ's issuance of Permit Number 09-586 (WDEQ, 2010a) to the applicant for five Class I disposal wells for injection of byproduct material into the Fort Union Formation demonstrates the WDEQ's agreement with the applicant that the Fort Union Formation can be classified as Class VI groundwater under Chapter VIII of the WDEQ Water Quality Rules and Regulations and that the WDEQ has made a determination that the liquid effluent can be isolated in the subsurface. Furthermore, no groundwater monitoring program associated with the deep disposal wells is required by WDEQ because of the reduction in the risk of pollution due to both the depth and confinement of the injection zones (WDEQ, 2010a). However, the UIC permit does require operational monitoring (e.g., injection pressure and injection rate and volume) and that the applicant retain records of monitoring information for three years following closure of the facility (WDEQ, 2010a).

3.6 Ecology

As described in the GEIS (NRC, 2009a), the Wyoming West Milling Region primarily consists of the Wyoming Basin and Middle Rockies ecoregions. The proposed Lost Creek ISR Project is located within the Rolling Sagebrush Steppe of the Wyoming Basin ecoregion. GEIS Section 3.2.5.1 provides the following description of this region:

> The Wyoming Basin ecoregion is a broad, arid intermontane basin interrupted by hills and low mountains and dominated by grasslands and shrublands. Nearly surrounded by forest-covered mountains, the region is drier than the Northwestern Great Plains to the northeast and does not have the extensive cover of pinyon-juniper woodland found in the Colorado Plateaus to the south. Much of the region is used for livestock grazing, although many areas lack sufficient forage to support this activity.

Overall, this region is less hilly than the Foothill Shrublands and Low Mountains ecoregion. Average annual precipitation ranges from 15 to 41 cm [6 to 16 in] and varies with elevation and

proximity to mountains. The region has a continental climate with cold winters and mild summers. Natural vegetation is mostly sagebrush steppe, with the eastern edge of the region having more mixed-grass prairie. Wyoming big sagebrush is the most common shrub with silver and black sagebrush occurring in the lowlands and mountain big sagebrush in the higher elevations. Frequent fires have affected the sagebrush steppe and, in some places, European annual grasses have replaced it. Most of the land is rangeland, cattle and sheep ranches, or wildlife habitat (Chapman, et al., 2004).

GEIS Section 3.2.5.1 explains that several subecoregions are located within the Wyoming Basin and provides the following description for the Rolling Sagebrush Steppe area where the proposed Lost Creek ISR Project is located:

> The Rolling Sagebrush Steppe area of the Wyoming Basin is composed of rolling plains with hills, mesas, and terraces. Areas near the mountains may contain footslopes, ridges, alluvial fans, and outwash fans (Chapman, et al., 2004). The most abundant shrub vegetation in the region is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), with silver sagebrush (*Artemisia cana*) and black sagebrush (*Artemisia nova*) occurring in the lowlands and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) in the higher elevations. Grass species include western wheatgrass (*Pascopyrum smithii*), needle-and-thread grass (*Stipa comata*), blue grama (*Bouteloua gracilis*), Sandberg bluegrass (*Poa secunda*), prairie junegrass (*Koeleria macrantha*), rabbitbrush (*Chrysothamnus nauseosus*), and fringed sage (*Artemisia frigida*).

The average elevation of the proposed Lost Creek ISR Project area is approximately 2,100 m [7,000 ft] above mean sea level (AMSL), with approximately 80 m [262 ft] of relief. Subzero winter temperatures and less than 25 cm [10 in] of annual precipitation result in limited vegetation development, and species diversity are limited. The applicant conducted a number of ecological studies at the proposed Lost Creek ISR Project to accomplish the objectives specified in NUREG–1569 (NRC, 2003) and to meet the applicable State of Wyoming requirements. These studies include vegetation and wildlife surveys, which are detailed in the following sections.

3.6.1 Terrestrial Ecology

The proposed Lost Creek ISR project area is located in the Wyoming Basin ecoregion at an elevation of approximately 2,134 m [7,000 ft] amsl. With approximately 79 m [260 ft] of relief, sub-zero winter temperatures, and less than ten inches of annual precipitation, vegetation development and species diversity are limited. (LCI, 2008a)

3.6.1.1 Vegetation

The applicant conducted vegetation surveys during the 2006 and 2007 growing seasons to obtain vegetative cover and species diversity data; WDEQ reviewed and accepted the study design. Based on the vegetation surveys, two vegetation types were identified within the proposed project area and mapped (Figure 3-11). The upland big sagebrush shrubland type dominates the flat upland areas and gentle slopes, while the lowland big sagebrush shrubland type occurs in deeper soils along the gently sloped, south-facing ephemeral dry washes (LCI, 2008b).

3.6.1.1.1 Upland Big Sagebrush Shrubland

The upland big sagebrush shrubland type dominates the proposed Lost Creek ISR Project area, occupying approximately 85 percent of the total 1,705 ha [4,220 ac] (LCI, 2008b). Trees are sparsely scattered in this region, and grasses and sagebrush intermix with exposed ground. The portions of land in the proposed project area that do not support the upland big sagebrush shrubland habitat are in the deeper soils of the bottomlands and along the drainages, where the lowland big sagebrush shrubland type is found.

Wyoming big sagebrush (*Artemisia tridentata*) accounts for 54 percent of the cover by all species (LCI, 2008a). Perennial grass species that occur in the upland big sagebrush shrubland include Sandberg bluegrass (*Poa secunda*), needle-and-thread grass (*Stipa comata*), Indian ricegrass (*Oryzopsis hymenoides*), and thickspike wheatgrass (*Agropyron dasystachyum*). Cushion plants (compact, low growing, mat forming plants) are most common, but collectively account for only 6 percent of the cover by all plant species. The mean total vegetation cover in the upland big sagebrush shrubland was 26 percent, cover by litter and rock combined was 22 percent, bare soil cover was 52 percent, and the total ground cover (vegetation plus litter and rock) was 48 percent. The percentage cover by bare soil is a reflection of the sparseness of vegetation in the upland big sagebrush shrubland type. Even though there is a considerable amount of bare soil, the vegetation development is very homogeneous across the upland parts of the proposed project area. In general, vegetation development in the region is sparse due to the limited amount of annual precipitation. In all, 36 plant species were observed in the upland big sagebrush shrubland community during the applicant vegetation surveys (LCI, 2008b).

3.6.1.1.2 Lowland Big Sagebrush Shrubland

The lowland big sagebrush shrubland type occurs along and immediately adjacent to the ephemeral drainages that cross the proposed project area from north to south. Overall, the lowland big sagebrush shrubland covers approximately 15 percent of the proposed project area. The soils along the drainages tend to be deeper than those on the adjacent uplands and, thereby, have the potential for holding more moisture than the upland areas. Individual big sagebrush shrubs along these drainages tend to be larger than the shrubs growing on the upland areas. (LCI, 2008b)

The major species in the lowland big sagebrush shrubland type is big sagebrush, accounting for 72 percent of the cover by all species. Rabbitbrush (*Chrysothamnus)* accounts for 8 percent of the total vegetation cover These two shrub species dominate the vegetation to an extent that herbaceous species account for limited amounts of cover. Herbaceous species are present throughout the community with a mean cover value less than 1 percent. Combined, all native perennial grasses encompass a mean cover of 7 percent (16 percent of the total vegetation cover) with Sandberg bluegrass *(Poa secunda),* thickspike wheatgrass *(Agropyron dasystachyum),* and squirreltail grass *(Sitanion longifolium)* occurring as the most prevalent

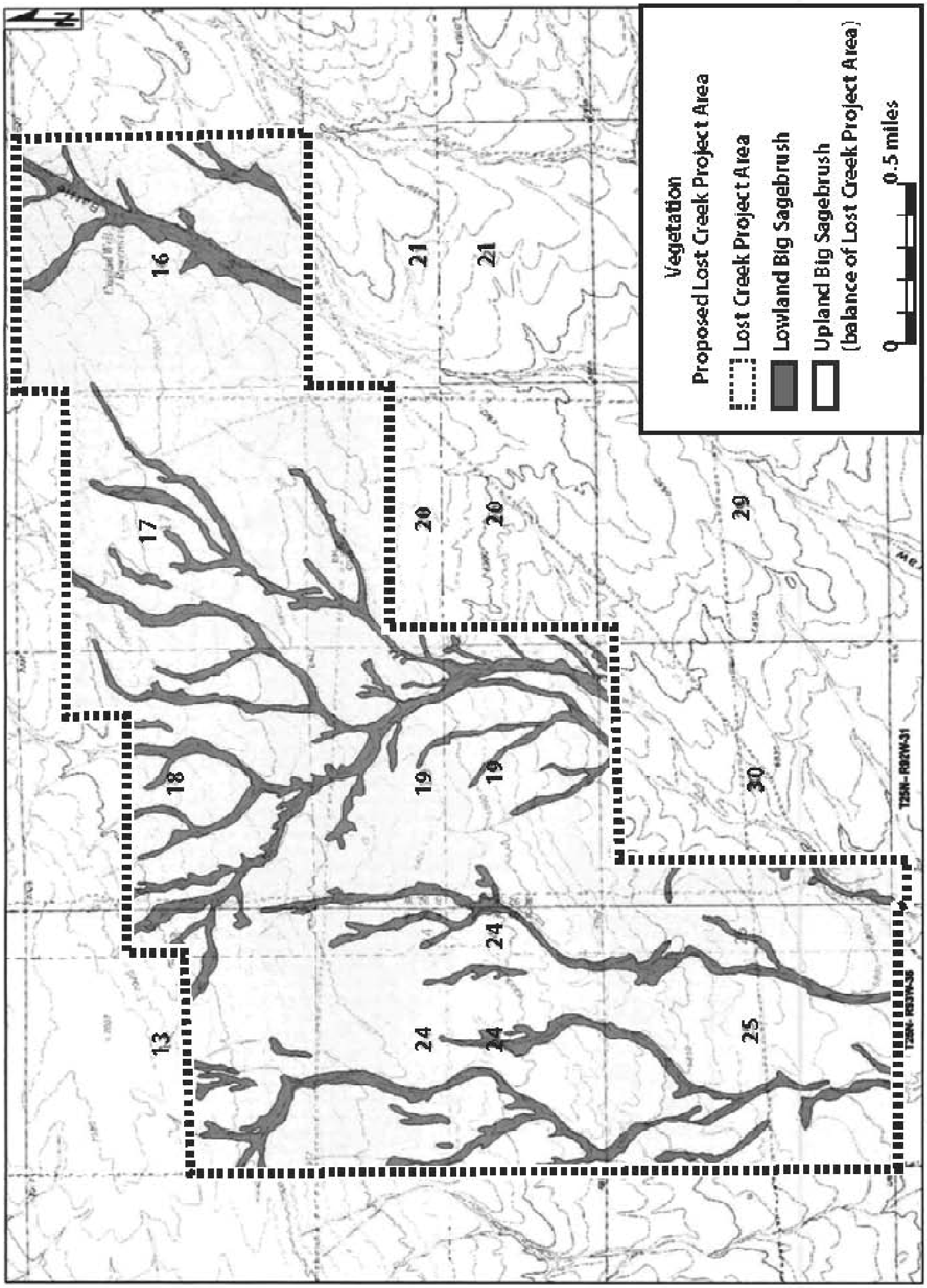

Figure 3-11. Site Vegetation Map
Source: Modified from LCI (2008a)

perennial grass species. Other vegetative communities present on the project site include forbs and cushion plants that account for approximately 3 percent of the total vegetation cover. The mean total vegetation cover is 43 percent, which is 17 percent greater than the cover in the upland big sagebrush shrubland type. The remaining 57 percent of cover in the lowland big sagebrush shrubland community is 34 percent cover by litter and rock and 23 percent bare soil cover. In all, 43 plant species were observed in the lowland big sagebrush shrubland type. (LCI, 2008b)

One federal threatened plant species, Ute ladies'-tresses (*Spiranthes diluvialis*), and one endangered plant species, blowout penstemon (*Penstemon haydenii*), could occur in Sweetwater County; however, no occurrences of these species are recorded at the proposed Lost Creek ISR Project site as further described in SEIS Section 3.6.3. No candidate or proposed plant species, noxious weeds, or invasive plant species are known to occur on or in the vicinity of the proposed Lost Creek ISR Project site. (LCI, 2008b)

3.6.1.2 Wildlife

General ranges for wildlife species in the Wyoming West Uranium Milling Region are presented in the GEIS (NRC, 2009a). However, the applicant conducted detailed inventories of the proposed project area in 2006 and 2007 (LCI, 2008b). Wildlife inventories were designed to provide baseline data for the proposed Lost Creek ISR Project and were conducted in accordance with the applicant work plan developed in consultation with the WGFD, WDEQ, and BLM (LCI, 2008a). Data collection included file searches of State and Federal agency documents, as well as field surveys for raptors, Greater sage-grouse (*Centrocercus urophasianus*), and breeding birds. Applicant wildlife inventories summarized in this section included surveys for threatened and endangered species, Migratory Birds of High Federal Interest (MBHFI), raptors, Greater sage-grouse leks and nesting habitat, breeding birds, and pygmy rabbits, as well as a general wildlife inventory of the proposed project area (LCI, 2008b).

3.6.1.2.1 Wildlife Habitat Description

The upland big sagebrush shrubland wildlife habitat is generally found on flat and rolling hills. This habitat is important for pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), Greater sage-grouse (*Centrocercus urophasianus)*, white-tailed prairie dogs (*Cynomys leucurus)*, and reptiles. Raptors, including eagles, falcons, hawks, harriers, and owls, often hunt in big sagebrush shrubland habitat (LCI, 2008b).

The lowland big sagebrush shrubland wildlife habitat is found along drainages. This habitat type has significantly more vegetation cover than the upland big sagebrush shrubland and provides important food and cover for resident and migratory birds, reptiles, and small mammals. The taller big sagebrush provides nesting sites for raptors and critical forage for ungulates and Greater sage-grouse during winters with extreme snowfall. (LCI, 2008b)

A total of 224 wildlife species potentially occur in the proposed Lost Creek ISR Project area. Of these, 164 species are birds, 51 species are mammals, 4 species are amphibians, and 5 species are reptiles (LCI, 2008b). Species that are known to exist in the study area, from observation or the presence of identifying signs, are listed in Table 3-5.

3.6.1.2.2 Big Game

As described in GEIS Section 3.2.5.1 (NRC, 2009a), a number of different big game animals are found in the Wyoming West Uranium Milling Region that includes the proposed Lost Creek ISR Project area. The habitat in the vicinity of the proposed project area, however, is not equally suitable for all big game animals because of the arid environment and vegetation type. The applicant conducted big game field surveys specific to the proposed Lost Creek ISR Project area during the spring and summer months in 2006 and 2007 (LCI, 2008a,b). The results of these surveys indicated that the upland big sagebrush shrubland habitat (Figure 3-11) that makes up the majority of the area provides suitable habitat for pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and American elk (*Cervus elaphus*). Although big game species are present at the proposed project site, no crucial big game habitat as described by the Wyoming Game and Fish Department (WGFD) occurs on or within several kilometers of the proposed Lost Creek ISR Project area (University of Wyoming, 2008; NRC, 2009a). Crucial habitat is defined as seasonal ranges or habitat (often winter or winter/yearlong range in Wyoming) that needs to be protected or managed to sustain wildlife populations (WGFD, 2011).

According to the WGFD Wildlife Observations System Data, pronghorn antelope are the most abundant big game species in the study area (LCI, 2008a,b). The proposed project area is classified by WGFD as Winter/Yearlong Range, an area where a population of animals makes general use of the habitat on a year-round basis (WGFD, 2009). There is an influx of animals between December and April, and several pronghorn migration corridors are mapped within several kilometers of the project area (Feeney, et al., 2004). The proposed project area comprises a portion of the Red Desert Pronghorn Herd Unit (WGFD Hunt Area 61) (WGFD, 2009). Based on the 2009 Annual Big Game Herd Unit Job Completion Report, the Red Desert Pronghorn Herd population has increased since 2005, and the 9-year (2000 through 2009) average population is about 13,800 (WGFD, 2009).

Although mule deer are abundant in the region (Table 3-5), the proposed project area is outside of any known mule deer range (BLM, 2008; LCI, 2008a,b; WGFD, 2009), and the closest mule deer migration corridors are identified in the northwest corner of Carbon County, more than 40 km [25 mi] to the east (Feeney, et al., 2004). Areas described by WGFD as "out of range" contain few animals or the available habitat is of limited importance to the species (LCI, 2008a). Results from the 2006 and 2007 field work support the conclusion that mule deer are found in relatively low numbers within the proposed project area as the project area is out of mule deer range. Areas described as "out of range" contain few animals or the available habitat is of limited importance to the species. (LCI, 2008a, Table 3.6-5; LCI, 2008b).

There are no crucial habitat or parturition (birthing) areas for elk in the vicinity of the proposed Lost Creek ISR Project area (BLM, 2008). Elk only use the proposed project area as a transitional range while moving to other areas, although no elk migration corridors are mapped within several kilometers of the proposed project area (Feeney, et al., 2004). Within the vicinity of the proposed project area, the WGFD Herd Unit Data describes two herds. The range for the Steamboat Elk Herd Unit (#426) extends to within about 4 km [2.5 mi] of the western boundary of the proposed project area, and the area itself is located within the range for the Shamrock Elk Herd Unit (#643) (LCI, 2008a,b; WGFD, 2009). In 2009, the size of the Shamrock Elk Herd was estimated at 130 individuals, exceeding the WGFD population objectives of 75 (WGFD, 2009).

Table 3-5. Wildlife Species Observed in the Proposed Project Area

Scientific Name	Common Name	Abundance Code*	Status†
Birds			
Branta canadensis	Canada Goose	Uncommon	
Anas platyrhynchos	Mallard	Fairly Common	
Cathartes aura	Turkey Vulture	Common	
Circus cyaneus	Northern Harrier	Common	
Accipiter striatus	Sharp-shinned Hawk	Uncommon	
Buteo swainsoni	Swainson's Hawk	Common	BCC, MBHFI, NSS4
Buteo jamaicensis	Red-tailed Hawk	Common	
Buteo regalis	Ferruginous Hawk	Common	BCC, MBHFI, SSS, NSS3
Buteo lagopus	Rough-legged Hawk	Common	
Aquila chrysaetos	Golden Eagle	Common	BCC
Falco sparverius	American Kestrel	Common	
Falco mexicanus	Prairie Falcon	Uncommon	BCC
Centrocercus urophasianus	Greater sage-grouse	Common	MBHFI, SSS, NSS2
Charadrius vociferus	Killdeer	Common	
Zenaida macroura	Mourning Dove	Abundant	
Eremophila alpestris	Horned Lark	Abundant	
Corvus brachyrhynchos	American Crow	Fairly Common	
Corvus corax	Common Raven	Abundant	
Turdus migratorius	American Robin	Common	
Oreoscoptes montanus	Sage Thrasher	Common	MBHFI, SSS, NSS4
Lanius ludovicianus	Loggerhead Shrike	Common	BCC, MBHFI, SSS
Spizella arborea	American Tree Sparrow	Uncommon	
Spizella passerina	Chipping Sparrow	Uncommon	
Spizella pallida	Clay-colored Sparrow	Rare	
Spizella breweri	Brewer's Sparrow	Common	BCC, MBHFI, SSS, NSS4
Pooecetes gramineus	Vesper Sparrow	Common	MBHFI
Chondestes grammacus	Lard Sparrow	Common	MBHFI
Amphispiza belli	Sage Sparrow	Fairly Common	MBHFI, SSS, NSS4
Sturnella neglecta	Western Meadowlark	Abundant	
Mammals			
Brachylagus idahoensis	Pygmy Rabbit	Common	SSS, NSS3
Sylvilagus audubonii	Desert Cottontail	Common	
Sylvilagus nuttallii	Mountain Cottontail	Fairly Common	
Lepus townsendii	White-tailed Jackrabbit	Common	
Tamias minimus	Least Chipmunk	Common	
Spermophilus elegans	Wyoming Ground Squirrel	Common	
Spermophilus tridecemlineatus	Thirteen-lined Ground Squirrel	Common	
Dipodomys ordii	Ord's Kangaroo Rat	Common	

Table 3-5. Wildlife Species Observed in the Proposed Project Area (continued)

Scientific Name	Common Name	Abundance Code[1]	Status[2]
Peromsycus maniculatus	Deer Mouse	Abundant	
Canis latrans	Coyote	Abundant	
Vulpes vulpes	Red Fox	Common	
Procyon lotor	Raccoon	Rare	
Mastela frenata	Long-tailed Weasel	Fairly Common	
Taxidea taxus	American Badger	Common	
Mephitis mephitis	Striped Skunk	Common	
Lynx rufus	Bobcat	Fairly Common	
Cervus elaphus	American Elk	Common	
Odocoileus hemionus	Mule Deer	Abundant	
Antilocapra americana	Pronghorn	Common	
Equus caballus	Feral Horse	Common	
Reptiles			
Phrynosoma hernandesi	Greater Short-horned Lizard	Common	
Thamnophis elegans	Western Terrestrial Garter Snake	Fairly Common	
Crotalus viridis	Prairie Rattlesnake	Uncommon	

Reference: LCI, 2008a
*Abundance Codes
Abundant–A species that inhabits much of the preferred habitat within its range. The species or its sign is typically encountered while using survey techniques that could be expected to indicate its presence.
Common–A species that inhabits much of the preferred habitat within its range. The species or its sign is usually encountered while using survey techniques that could be expected to indicate its presence.
Uncommon–A species that is common only in limited areas within its range or is found throughout its range in relatively low densities. Intensive surveying is usually required to locate the species or its sign.
Rare–A species that occupies only a small percentage of the preferred habitat within its range or is found throughout its range in extremely low densities. The species or its sign is seldom encountered while using survey techniques that could be expected to indicate its presence.
†Status
Federal–Migratory Bird Treaty Act
BCC–Birds of Conservation Concern species identified by the U.S. Fish and Wildlife Service (FWS) as those migratory nongame birds that without conservation actions are likely to become candidates for listing under the Endangered Species Act.
Federal–Migratory Birds of High Federal Interest in Wyoming
MBHFI–List utilized by the FWS, Wyoming Field Office for reviews concerning existing or proposed coal mine leased land.
BLM–Special Status Species
SSS–BLM Special Status Species are species protected under the Endangered Species Act and those designated by the State Director as Sensitive. Sensitive species are those under status review by the FWS/National Marine and Fisheries Service (NMFS), or whose numbers are declining so rapidly that Federal listing may become necessary, or with typically small or widely dispersed populations, or those inhabiting ecological refugia or other specialized or unique habitats. The minimum level of policy protection for these designated sensitive species would be the same policy as for candidate species.
State–Native Species Status
NSS1–Native Species Status 1–Populations are greatly restricted or declining, extirpation appears possible and ongoing significant loss of habitat.
NSS2–Native Species Status 2–Populations are declining, extirpation appears possible, habitat is restricted or vulnerable but no recent ongoing significant loss; species may be sensitive to human disturbance.
NSS3–Native Species Status 3–Populations are greatly restricted or declining, extirpation appears possible, habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.
NSS4–Native Species Status 4–Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted.

3.6.1.2.3 Upland Game Birds

Greater sage-grouse and mourning doves (*Zenaida macroura*) were the only upland game birds recorded during the applicant surveys (LCI, 2008a). Mourning doves are migrants and only inhabit the area from spring into early fall. The applicant surveyed the proposed Lost Creek ISR Project area and the area within a 3.2-km [2-mi] radius of the proposed Lost Creek ISR Project during the applicant survey for Greater sage-grouse lek activity in April 2006 and April 2007 (LCI, 2008a). The applicant completed three ground surveys and three aerial surveys and used WGFD information from previous monitoring events to determine the potential presence of Greater sage-grouse at the proposed project site. (LCI, 2008a)

Based on the Greater sage-grouse surveys conducted in 2006 and 2007, no active Greater sage-grouse leks were located within the proposed project area (LCI, 2008b). The Crooked Well lek, which is located within the northeast corner of the proposed project area, was deemed to have an unknown status (WDEQ, 2010b). Four males were observed on the lek on April 4, 2007, but no Greater sage-grouse were present in two previous surveys conducted in April 2006 (LCI, 2008b). No other birds were observed on the lek during 2007. According to BLM wildlife survey protocols, leks with unknown status should be observed with sufficient frequency to determine whether the lek is active or inactive, and will be protected during surface disturbing activities until an ‘abandoned’ status is determined. More visits than one a year may be necessary to document the presence of birds during the strutting season. WGFD provided NRC staff with updated Greater sage-grouse information in 2009 and 2010. A total of 11 leks are located within 6.4 km [4.0 mi] of the proposed Lost Creek ISR Project. The locations of the Greater sage-grouse leks surrounding the proposed project are presented in Figure 3-12. The Greater sage-grouse is a candidate species for the federal list of endangered and threatened species and is listed at the state level as a species of special concern. The proposed project is located within a core population area (core area), which is identified by the State of Wyoming as high density Greater sage-grouse nesting and brood-rearing habitat necessary to maintain Greater sage-grouse populations (75 FR 13909). This species is discussed in more detail in SEIS Section 3.6.3.

3.6.1.2.4 Raptors

The applicant reviewed BLM and WGFD files for data on raptor nests in the area as part of the wildlife surveys (LCI, 2008a,b). File searches identified 12 previously documented raptor nests in the vicinity of the proposed project area, all of which were ferruginous hawks. Four of the 12 previously documented nests are identified as being active. One nest located within the proposed project area was identified as inactive/dilapidated, and the remaining seven nests were identified as being gone. Information on the active raptor nests collected during file searches is presented in Table 3-6.

Field surveys for raptor nest sites were completed in the proposed project area between early April and October of 2006; additional nesting raptor surveys were completed during the spring of 2007. Raptor nest surveys included a 1.6-km [1-mi] buffer area around the proposed project area (LCI, 2008b). Based on the 2006 and 2007 surveys the applicant conducted, one active raptor nest on an artificial nest structure occurred within the proposed project area. Other nests

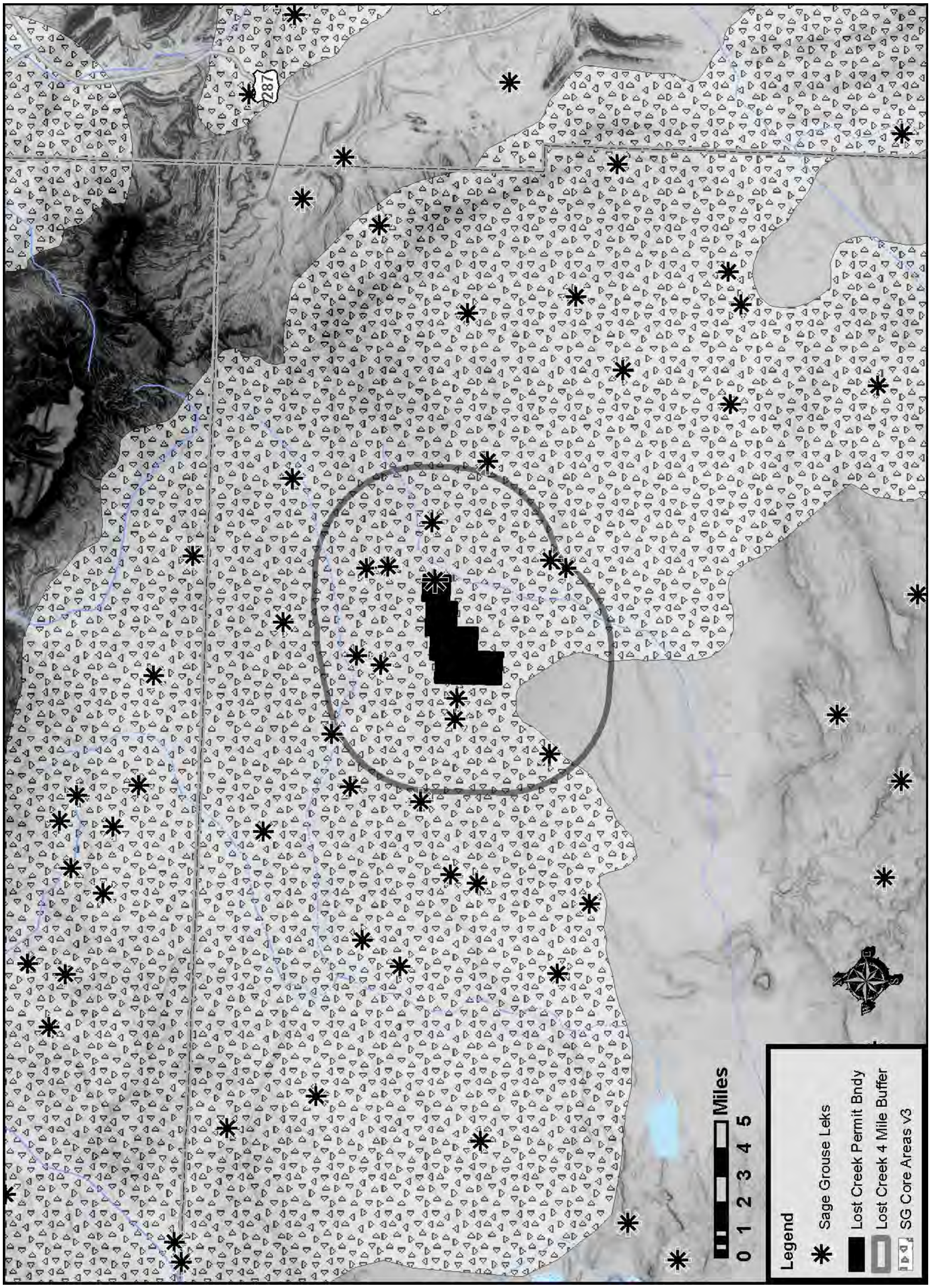

Figure 3-12. Sage-Grouse Leks
Source: Modified From LCI (2008a)

Table 3-6. Active Raptor Nests

Nest ID Number	Species	Nest Status	Nest Substrate	Nest Condition	Notes
AFH25921004	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Within 1-mile buffer
FH25922801	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
FH25923201/AFH25923203	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
No BLM ID Assigned	Ferruginous Hawk	Active	Artificial Nest Structure	Good	Outside 1-mile buffer
Source: LCI, (2008b)					

BLM previously documented in the 1.6-km [1.0-mi] buffer zone (LCI, 2008a, Table 3.6-7; SEIS Table 3-5 and Figure 3-13) were not located during the 2006 and 2007 surveys. Global Positioning System (GPS) units were used to locate these nest sites, but none were found. No new raptor nests were identified during the 2006 or 2007 field surveys (LCI, 2008b).

Several other raptor species were recorded within the study area, but nesting was not documented. These species include the Swainson's hawk, red-tailed hawk, northern harrier (*Circus cyaneus*), golden eagle, American kestrel (*Falco sparverius)*, prairie falcon (*Falco mexicanus*), and turkey vulture (*Cathartes aura)*. While the conditions are present for the northern harrier and American kestrel nests within the proposed project area, specific nest sites were not located. Northern goshawk (*Accipiter gentilis)*, merlin (*Falco columbarius*), and peregrine falcons (*Falco peregrinus*) were not observed in the study area (LCI, 2008b).

3.6.1.2.5 Waterfowl and Shorebirds

One shorebird species was observed during bird and wildlife surveys: the killdeer (*Charadrius vociferus*), which is included in the listing ofwildlife species observed on the proposed project area as shown in Table 3-4. Most recorded waterfowl and shorebird species are designated "uncommon" to "fairly common" in the region (LCI, 2008b).

In the proposed Lost Creek ISR Project area, habitat for waterfowl and shorebirds is sparse. The manmade Crooked Well Reservoir was dry during the 2006 field survey and contained a small amount of water during the spring of 2007 (LCI, 2008a). As previously described in SEIS Section 3.5.1.2, the proposed Lost Creek ISR Project area contains numerous ephemeral channels and washes that only flow in response to heavy snow melt and large intense rainfall events, and no perennial or intermittent streams exist within the proposed project area. The channels offer limited habitat for aquatic life; rather, the principal function of the surface water features is simply conveyance of surface runoff and groundwater recharge (LCI, 2008a). According to USACE, isolated water found in the proposed project area does not provide suitable habitat for migratory birds or interstate commerce (USACE, 2010).

Because no open-water systems occur on the proposed project site, waterfowl and shorebird species would not be expected in the proposed project area with the exception of during migrations in the spring and fall, with limited use in the summer and winter months.
(LCI, 2008b)

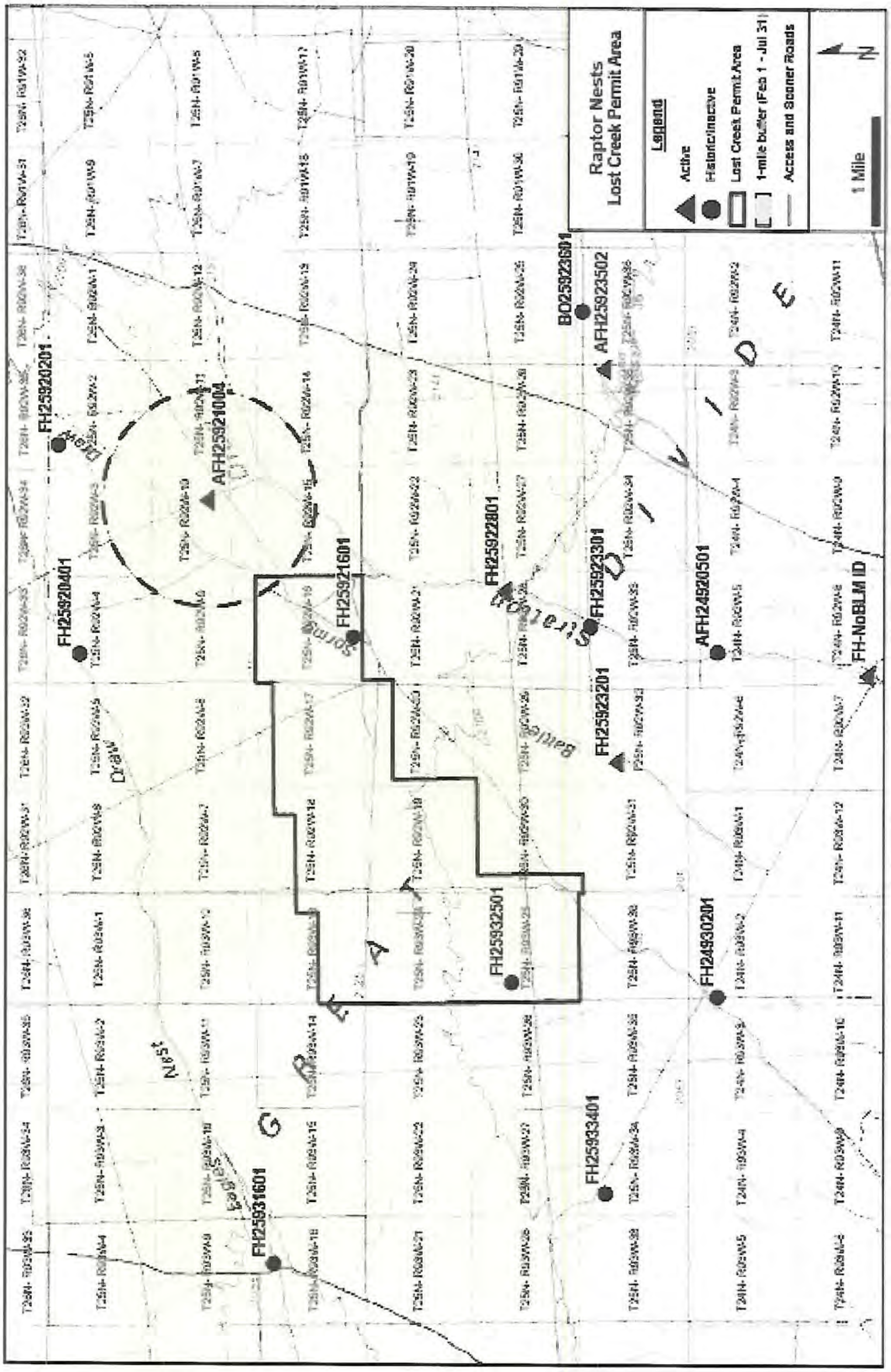

Figure 3-13. Raptor Nests
(Source: Modified From LCI (2008a)

3.6.1.2.6 Nongame and Migratory Birds

The applicant conducted a breeding bird survey within the proposed Lost Creek ISR Project area in June 2006 (LCI, 2008a). All avian species that the applicant observed during the wildlife inventories are listed in Table 3-4. A total of 31 passerine species, 12 of which were breeding, were recorded during the applicant surveys. The most common species in the proposed project area were the horned lark (*Eremophila alpestris*), Brewer's sparrow (*Spizella breweri)*, and sage sparrow (*Amphispiza belli*) (LCI, 2008b).

The applicant recorded sightings of Migratory Birds of High Federal Interest (MBHFI) that are protected by the *Migratory Bird Treaty Act* (MBTA) and BLM sensitive species during the wildlife surveys conducted at the proposed Lost Creek ISR Project. Several species that warrant conservation or monitoring are known to occur in the shrub-steppe habitat in the region (Nicholoff, 2003). Level I species are described as in need of conservation, while Level II species are described as in need of monitoring. Level I species documented in the proposed project area includes the ferruginous hawk, Greater sage-grouse, Brewer's sparrow, and sage sparrow. The mountain plover (*Charadrius montanus*) and burrowing owl (*Athene cunicularia*) have been noted in adjacent areas (LCI, 2008b); however, no mountain plover were observed on or near the proposed project area during the applicant wildlife surveys conducted in 2006 and 2007. Level II species documented in the proposed project area include the sage thrasher (*Oreoscoptes montanus)*, loggerhead shrike (*Lanius ludovicianus*), vesper sparrow (*Pooecetes gramineus)*, and lark sparrow (*Chondestes grammacus)*. The sage thrasher, loggerhead shrike, vesper sparrow, and lark sparrow were observed breeding within the proposed project area (LCI, 2008b). Greater sage-grouse observations and lek locations are discussed SEIS Section 3.6.1.2.3. Ferruginous hawk nests in the study area are discussed in SEIS Section 3.6.1.2.4. The mountain plover is further discussed in SEIS Section 3.6.3.

3.6.1.2.7 Other Mammals

The applicant recorded sightings of 19 mammal species and abundance of presence during 2006 and 2007 wildlife inventories (SEIS Table 3-4). The applicant observed the majority of mammalian species in big sagebrush habitats). The most common species observed during the surveys were the whitetailed jackrabbit (*Lepus townsendii)*, desert cottontail (*Sylvilagus audubonii*), Wyoming ground squirrel (*Spermophilus elegans*), 13-lined ground squirrel (*Spermophilus tridecemlineatus*), deer mouse (*Peromsycus maniculatus)*, meadow vole (*Microtus pennsylvanicus*), and coyote (*Canis latrans*) (LCI, 2008a,b).

Two wild horse (*Equus caballus)* Herd Management Areas (HMA), the Stewart Creek HMA and the Lost Creek HMA, overlap with the proposed project area (BLM, 2004a). The Stewart Creek HMA encompasses 93,572 ha [231,124 ac], of which 87,194 ha [215,369 ac] are BLM-administered public lands. The Continental Divide (eastern boundary of the Great Divide Basin) traverses the Stewart Creek HMA in a north-south direction in its eastern portion along Lost Soldier and Bull Springs rims. The surrounding landscape transitions to gently rolling uplands, which comprise the majority of the Stewart Creek HMA (BLM, 2008).

The Lost Creek HMA lies within the Great Divide Basin and encompasses 101,215 ha [250,000 ac], of which 95,140 ha [235,000 ac] are BLM-administered public lands. Some vegetation desert playa and vegetated dune areas are interspersed throughout the Lost Creek HMA. Several sensitive desert wetland riparian areas also occur throughout the area, including both intermittent and perennial lakes and streams. Similar to the Stewart Creek horses, the present population of the Lost Creek HMA has also interbred with domestic stock. Testing on

the Lost Creek herd revealed that the horses are genetically related to the Spanish Mustang and other New World Iberian breeds (BLM, 2008). This characteristic makes the Lost Creek herd unique among the wild horse herds of Wyoming. (BLM, 2008)

The applicant conducted surveys for prairie dogs, which were not observed on the proposed Lost Creek ISR Project. Prairie dog towns provide suitable habitat for the black-footed ferret (*Mustela nigripes*). Black-footed ferrets are members of the weasel family (Mustelidae) and are considered one of the most endangered mammals in the United States (FWS, 2000). Typical wild ferret behavior revolves around prairie dog towns, and ferrets hunt prairie dogs mostly at night (FWS, 2000). Main causes of the decline in the ferret population include habitat loss from farming; efforts to eliminate prairie dogs, which competed with livestock for available prairie forage; and sylvatic plague, a disease that wiped out large numbers of prairie dogs and has also killed ferrets (FWS, 2000). The black-footed ferret is further discussed in Section 3.6.3.

3.6.1.2.8 Reptiles and Amphibians

As shown in Table 3-4, several species were observed during general surveys, including the greater short-horned lizard (*Phrynosoma hernandesi)*, prairie rattlesnake (*Crotalus viridis)*, and western terrestrial garter snake (*Thamnophis elegans* (LCI, 2008b*)*. Although not observed during the applicant surveys, another reptile species that might be expected to occur on the proposed project site is the Northern sagebrush lizard (*Sceloporus graciosus*) (WDEQ, 2010b). Amphibian species that could occur but were not observed on the proposed site include the tiger salamander (*Ambystoma tigrinum*), Great Basin spadefoot (*Spea intermontana*), Northern leopard frog (*Rana pipiens)*, and boreal chorus frog (*Pseudacris maculata*) (WDEQ, 2010b). The Great Basin spadefoot and Northern leopard frog are BLM (2010) sensitive species.

3.6.2 Aquatic Ecology

After conducting field investigations and research described in SEIS Section 3.5.1.5, the applicant determined that no aquatic life or wetlands existed within the boundaries of the proposed project area (LCI, 2008a). Surface water is present seasonally, depending on precipitation but, based on the results of applicant surveys, does not sustain aquatic life or wetland species (LCI, 2008a). A more detailed discussion of surface water features and wetlands can be found in SEIS Sections 3.5.1 and 3.5.2.

3.6.3 Protected Species

Based on consultation with the FWS (2008a), federally listed threatened and endangered species (or their designated habitat) that may potentially be present in the proposed project area include the following:

> The Ute ladies'-tresses orchid *(Spiranthes diluvialis)* is listed as a threatened species, which is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes in early succession point bars or sandy edges.

The species is a perennial, terrestrial orchid that occurs in Nebraska, Wyoming, Colorado, Utah, Idaho, Montana, and Washington. Within Wyoming, it inhabits moist meadows with moderately dense, but short vegetative cover. The species is found at elevations of 1,280 to 2,130 m [4,200 to 7,000 ft], though no known populations occur in Wyoming above 1,680 m [5,500 ft] (FWS, 2008a). Generally, this orchid is found in low densities of four to eight flowering plants per square meter (Fertig, 2000). The species is likely to inhabit silt, sand, or gravely soils in

areas with ample sunlight (FWS, 2008a). It is characterized by 12- to 50-cm [4.7- to 20-in] stems with linear basal leaves up to 28 cm [11 in] long and spikes of small, white-to-ivory flowers that bloom between early August and early September (Fertig, 2000). Urbanization, livestock grazing, pesticide use, competition with noxious weeds, and loss of pollinators threaten this species' survival (Fertig, 2000). This species was not observed during applicant surveys, nor is it known to occur within the proposed project area.

> Blowout penstemon (*Penstemon haydenii*) is federally listed as endangered and is a regional endemic species of the Sand Hills of west-central Nebraska and the northeastern Great Divide Basin in Wyoming.

The blowout penstemon is a pioneer species, one of the first plants to establish itself, on sand dunes and sandy aprons at the base of mountains and ridges (BLM, 2009). This species is known to typically occur in three locations in Carbon, Freemont, and Sweetwater Counties, Wyoming, in "blowouts," which are defined as "sparsely vegetated depressions in active sand dunes created by wind erosion. In Wyoming it occurs on sandy aprons or the lower half of steep sandy slopes deposited at the base of granitic or sedimentary mountains or ridges" (WYNDD, 2003). It was initially discovered in Wyoming in 1996 and is characterized as a hairless perennial herb that grows 0.3 to 0.6 m [1 to 2 ft] high and has greenish-blue, waxy, linear leaves (BLM, 2009). The flowers are arranged in a cluster 6 to 16 cm [2.4 to 6.3 in] long with compact, leafy whorls of milky blue to pale lavender flowers. Threats to the viability of the species include changes in habitat quality, livestock trampling and grazing, overcollection, off-road vehicles (ORV), pesticides, construction activities, and natural threats (Fertig, 2001). This species was not observed during applicant surveys, nor is it known to occur within the proposed project area.

> The black-footed ferret (*Mustela nigripes*) is listed as an endangered species that inhabits prairie dog colonies.

The species is endemic to North America and primarily inhabits the Great Plains region. It is the only species of ferret native to the Americas. The species was believed to be extinct by the late 1980s, but in 1981, a small relic population was discovered near Meeteetse, Wyoming (WGFD, 2005b). From this population, 18 individuals were captured to start a captive breeding program, which WGFD initiated (WGFD, 2005a). Nonessential experimental populations have been reintroduced to 18 locations in 8 states and Mexico (FWS, 2008a). Four of these reintroduced populations—those in Aubrey Valley, Arizona; Cheyenne River and Conata Basin, South Dakota; and Shirley Basin, Wyoming—have successfully stabilized and no longer require supplemental individuals from captive breeding (FWS, 2008a). Six additional locations are considered marginal to improving (FWS, 2008a).

The black-footed ferret is a small mammal in the weasel family with a natural to buff-colored body and black face, feet, and tail. Generally, black-footed ferret occurrences coincide with prairie dog habitat [black-tailed (*Cynomys ludovicianus*), Gunnison's (*C. gunnisoni*), and white-tailed (*C. leucurus*)] because prairie dog is the main prey of the ferret, and the ferret also uses prairie dog burrows for shelter (FWS, 2008a). Black-footed ferrets are more likely to occur in black-tailed prairie dog habitat than in other prairie dog species' habitat; historically, it is estimated that 85 percent of all black-footed ferrets occurred in black-tailed prairie dog habitat, 8 percent in Gunnison's prairie dog habitat, and 7 percent in white-tailed prairie dog habitat (FWS, 2008a). In a 2004 letter (FWS, 2004a), FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations. FWS consider incidental takes of

individual ferrets in black-tailed prairie dog habitat, that is “block cleared” to not be an issue and would not result in an effect on any wild population. However, this block clearance does not relieve Federal agencies of the need to assess a proposed action’s effect on the species’ survival and recovery. Further, FWS directs Federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2004a). A black-footed ferret survey was not required, because black-footed ferrets live exclusively in prairie dog colonies, which are not present within the proposed project area. (LCI, 2008b).

> The bald eagle (*Haliaeetus leucocephalus*), which was delisted from the Federal List of Endangered and Threatened Wildlife in July 2007 (72 FR 37346), is still protected under the *Bald and Golden Eagle Protection Act* and the *Migratory Bird Treaty Act*, and at the state level as a species of concern.

Bald eagle nesting habitat does not exist within the study area, but bald eagles might be found in the proposed project area during migration. According to WGFD Wildlife Observations System Data, the bald eagle has not been recorded in the study area (LCI, 2008b). The bald eagle is a large raptor species with a white head and tail and brown body feathers and is generally associated with lakes and other large, open bodies of water. Bald eagles prey on fish, small mammals, birds, and occasionally carrion.

> The Greater sage-grouse (*Centrocercus urophasianus*) is federally listed as a candidate species, a State of Wyoming species of concern, and a BLM-designated sensitive species. On March 5, 2010, FWS published a finding in the *Federal Register* stating that listing of the species was warranted but precluded by higher priority listing actions (75 FR 13909). The species inhabits open sagebrush plains in the western United States and is found at elevations of 1,200 to 2,700 m [4,000 to 9,000 ft], corresponding with the occurrence of sagebrush habitat (FWS, 2004b).

The Greater sage-grouse is a mottled brown, black, and white ground-dwelling bird that can be up to 0.6 m [2 ft] tall and 76 cm [30 in] long (FWS, 2004b). Leks and stands of sagebrush surrounding leks are used in early spring and are particularly important habitat because birds often return to the same leks and nesting areas each year. Leks are generally in more sparsely vegetated areas, such as ridgelines or disturbed areas adjacent to stands of sagebrush habitat. Threats to this species’ survival include loss of habitat, agricultural practices, livestock grazing, hunting, and land disturbances from energy/mineral development and the oil and gas industry (Sage-Grouse Working Group, 2006).

On March 5, 2010, FWS published a finding in the *Federal Register* that listing of the species was warranted but precluded by higher priority listing actions (75 FR 13909). In effect, the species has been put on the federal list of candidate species, which contains plants and animals that are proposed for listing under the Endangered Species Act Section 4 (75 FR 13909). FWS reevaluates the potential listing of candidate species every 12 months to determine whether the species’ status should change to threatened or endangered at that time. WGFD published revisions to its Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats in November 2009 to be consistent with the Governor’s Executive Order (EO). This guidance was updated again in April 2010 (WGFD, 2010a) in response to the FWS rule listing the Greater sage-grouse as a candidate species. Also, in response to the species’ listing as a candidate species, Wyoming BLM issued an instructional memorandum on March 5, 2010, which supplements BLM’s previous National Sage-Grouse Habitat Conservation Strategy published in 2004 (BLM, 2004b, 2010c). The BLM guidance closely follows the

recommendations WGFD put forth in its Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats (WGFD, 2010b). Finally, on August 18, 2010, the Governor signed EO 2010-4, updating the previous EO (2008-2) regarding the protection of Greater sage-grouse (EO 2010-4). The most restrictive conservation measures and recommended protective stipulations for development are for the Greater sage-grouse core population areas (core areas), which are areas identified by the State of Wyoming as high quality habitat for Greater sage-grouse nesting and brood-rearing and necessary to maintain Greater sage-grouse populations. The proposed project area is located within a Greater sage-grouse core area as delineated by the Wyoming Governor's Sage-Grouse Implementation Team (SGIT) and shown in Figure 4-4 (WGFD, 2010b). Appendix B of the EO (2010-4), Permitting Process and Stipulations for Development in Sage Grouse Core Areas, contains the SSIT final recommendations stipulations for development in Greater sage-grouse core areas. The applicable stipulations in this document are described in SEIS Section 4.6.1.1.4.

The mountain plover (*Charadrius montanus)* is federally proposed as threatened and a Wyoming species of greatest conservation need. This bird is a native of the short-grass prairie and is found in open, dry shrublands or agricultural fields with short vegetation and bare ground.

Mountain plover breeding habitat includes the western Great Plains and Rocky Mountain states extending from the Canadian border to northern Mexico (75 FR 37353). The prime breeding and nesting period for the mountain plover is from April 10 through July 10 (BLM, 2007b). In Wyoming, the greatest concentration of mountain plovers is found in the south central part of the state, but, they can be found in every county (Andres, 2009; WYNDD, 2010a). Prairie dogs and other burrowing animals provide highly suitable habitat for the mountain plover. The mountain plover is often found in areas with heavy grazing and landscapes with excessive surface disturbance (64 FR 7587). This species is a small bird about 17.5 cm [7 in] in height with light brown and white coloring. FWS originally proposed this species as threatened on February 16, 1999 (64 FR 7587). The proposal was withdrawn on September 9, 2003, and was reinstated on June 29, 2010 (68 FR 53083; 75 FR 37353). This species was not observed during the 2006 applicant wildlife inventories (LCI, 2008a). According to the Wyoming Natural Diversity Database (WYNDD) and BLM records, mountain plovers are known to reside in the area of the proposed site (WYNDD, 2010a; BLM, 2007b).

Species of Concern

Thirteen rare plant species are known to occur in Sweetwater County (USGS, 2006). During the applicant vegetation surveys, special consideration was given to these species; however, no rare plant species were observed within the proposed Lost Creek ISR Project area.
The state-listed wildlife species of special concern (WGFD, 2005a) and their probability of occurrence in the project area (LCI, 2008b) are listed in SEIS Table 3-7. The WGFD matrix of habitat and population variables to determine the conservation priority of all native, breeding bird and nongame mammal species in the state includes six categories, of which native species status (NSS) 1, 2, and 3 are considered to be high priorities for conservation attention, with NSS 1 being the highest priority (WYNDD, 2010b). Wyoming species of concern that may occur in the proposed project area are classified as NSS 2, 3, or 4 (WGFD, 2005a). There are no NSS 1 species listed as potentially occurring in the proposed project area (SEIS Table 3-7). Status 4 species have (i) populations that are restricted or declining with stable habitat, (ii) widely distributed stable populations with restricted habitat that are sensitive to human disturbance, or (iii) stable or increasing populations with significant loss of habitat.

Table 3-7. Wildlife Species of Special Concern

Species	Status*	Preferred Habitat	Potential Occurrence	Identified on the Project Site
		Birds		
American White Pelican	NSS3	Big rivers, lakes, reservoirs, estuaries, islands, peninsulas	Unlikely	
Great Blue Heron	NSS4	Wetlands, water banks, rivers, lakes, fields, meadows	Present	
Snowy Egret	NSS3	Marshes' water banks; and shallow rivers, lakes, ponds	Possible	
Northern Pintail	NSS3	Riparian/wetlands, rivers, lakes, ponds in grasslands, fields, boreal forest	Likely	
Canvasback	NSS3	Riparian/wetlands, big rivers, lakes	Present	
Redhead	NSS3	Wetlands, lakes, rivers	Likely	
Sandhill Crane	NSS3	Wetlands; grasslands; banks of rivers, lakes, ponds	Possible	
Upland Sandpiper	NSS4	Fen, cropland, grassland, fields	Unlikely	
Long-billed Curlew	NSS3	Wetland/riparian, grassland, meadows	Unlikely	
Western Burrowing Owl	NSS4	Grasslands, deserts, and savannas in burrows	Likely	
Short-eared Owl	NSS4	Wetland, fen, grassland, cropland	Possible	
Willow Flycatcher	NSS3	Riparian, shrubland, woodland	Possible	
Sage Thrasher	NSS4	Desert, shrubland, sagebrush plains	Present	X
Brewer's Sparrow	NSS4	Desert, shrubland, sagebrush plains	Present	X
Sage Sparrow	NSS4	Desert, shrubland, sagebrush	Present	X
Lark Bunting	NSS4	Cropland, desert, grassland	Likely	
Grasshopper Sparrow	NSS4	Grasslands, fields, savanna	Present	X
McCown's Longspur	NSS4	Cropland, grassland	Unlikely	
Chestnut-collard Longspur	NSS4	Cropland, desert, grassland	Unlikely	
Bobolink	NSS4	Wetland, cropland, grassland	Unlikely	
		Mammals		
Dwarf Shrew	NSS3	Wetlands in alpine, scree, conifer forest, grassland, shrubland, woodland	Possible	
Vagrant Shrew	NSS3	Wetland/riparian, fen, conifer forest, woodland, grassland, field, shrubland	Possible	
Western Small-footed Myotis	NSS3	Roost in rock-crevices, caves, tunnels; under boulders, loose bark, buildings, mines in desert, badland, semiarid habitat	Possible	
Little Brown Myotis	NSS3	Roost in buildings, caves, hollow trees in fens, wetland/riparian, forest, shrublands, woodlands	Possible	

Table 3-6. Wildlife Species of Special Concern (continued)

Species	Status*	Preferred Habitat	Potential Occurrence	Identified on the Project Site
Long-legged Myotis	NSS2	Roosts in caves, mines, buildings, and rock crevices; under bark, hollow trees in riparian, desert, forest, woodland	Possible	
Hoary Bat	NSS4	Roosts in tree foliage, rock crevices, tree trunks, and cavities in riparian, conifer forest, woodland	Unlikely	
Silver-haired Bat	NSS4	Tree cavities of conifer forest adjacent to lakes, ponds, streams	Unlikely	
Big Brown Bat	NSS3	Roost in buildings, trees, rock crevices, tunnels, caves in woodlands, and conifer forests	Possible	
Townsend's Big-eared Bat	NSS2	Roost in caves, mines, buildings, tree cavities in conifer forest, woodland sagebrush, riparian	Possible	
Pallid Bat	NSS2	Roost in rock crevices in desert and grasslands	Possible	
Pygmy Rabbit	NSS3	Burrows in dense big sagebrush	Present	X
Olive-backed Pocket Mouse	NSS3	Burrows in cropland, grassland, shrubland	Likely	
Prairie Vole	NSS3	Burrows in grasslands, fields	Likely	

Source: LCI (2008b)

* __State–Native Species Status__

NSS1–Native Species Status 1–Populations are greatly restricted or declining, extirpation appears possible, and significant loss of habitat is ongoing.
NSS2–Native Species Status 2–Populations are declining, extirpation appears possible, habitat is restricted or vulnerable but no recent ongoing significant loss; species may be sensitive to human disturbance.
NSS3–Native Species Status 3–Populations are greatly restricted or declining, extirpation appears possible, habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.
NSS4–Native Species Status 4–Populations are greatly restricted or declining, extirpation appears possible; habitat is stable and not restricted.

Listed waterfowl and shorebird species such as the American white pelican (*Pelecanus erythrorhynchos*), upland sandpiper (*Bartramia longicauda)*, long-billed curlew (*Numenius americanus)*, passerines [such as McCown's longspur (*Calcarius mccownii*)], chestnut-collared longspur (*Calcarius ornatus)*, and bobolink (*Dolichonyx oryzivorus)* are unlikely to be in the proposed project area because there is no suitable habitat for these species, though they may pass through the proposed project area during migration. The sage thrasher, Brewer's sparrow, and sage sparrow (all NSS 4 species) were observed in the proposed project area. Suitable habitat exists for the lark bunting (*Calamospiza melanocorys)*, though this species was not observed. LCI (2008b)

State-listed mammal species that may occur in the proposed project area have been classified as NSS 2, 3, or 4 (WGFD, 2005a). Several listed shrew and bat species, such as the dwarf shrew (*Sorex nanus*), vagrant shrew (*Sorex vagrans*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*), have ranges that include the proposed project area; are unlikely to be present (LCI, 2008b). Suitable roosting habitats for the western

small-footed myotis (*Myotis ciliolabrum*), little brown myotis (*Myotis lucifugus*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and pallid bat (*Antrozous pallidus*) may be present in rock crevices, rock outcrops, or trees near the Stratton Rim to the north of the proposed project area. These species could also potentially roost in the vertical walls of eroded streambeds in the proposed project area (LCI, 2008b). None of these species were observed during the applicant wildlife surveys. The state-listed olive-backed pocket mouse (*Perognathus fasciatus*) and prairie vole (*Microtus ochrogaster*) were also not observed in the proposed project area; however, suitable habitat exists in the proposed project area and these species are known to be in the region (WGFD, 2004).

The applicant conducted surveys for pygmy rabbits (*Brachylagus idahoensis*; NSS3) at the proposed project area during the summer of 2007. Based on these surveys, pygmy rabbits were found sporadically in the lowland big sagebrush shrubland habitat. Scat, burrows, and individual pygmy rabbits were observed along all transects completed within the lowland big sagebrush shrubland communities at the proposed project area.

3.7 Meteorology, Climatology, and Air Quality

3.7.1 Meteorology and Climatology

The majority of Wyoming is dominated by mountain ranges and rangelands of the Rocky Mountains and high plains. The mountain ranges are oriented perpendicular to the prevailing westerly winds and provide effective barriers to the significant Pacific-generated weather systems. Much of the moisture produced from these systems is dropped along the western slopes, thereby leaving a majority of the state east of the mountains in a semiarid condition. (University of Wyoming, 2004)

The Continental Divide traverses the state from the northwest corner to the center of the southern border with Colorado. This high-altitude uplift separates the major drainages that flow to the Pacific Ocean from those that flow to the Atlantic Ocean. Along the way, the divide splits and creates an oblong basin. This approximate 9,065-km^2 [3,500-mi^2] basin was created during the uplift in south-central Wyoming. Precipitation, averaging only 18 to 25 cm [7 to 10 in] a year, that falls within this basin is trapped and does not drain to either ocean, but rather evaporates or percolates into the ground. (WSGS, 2011)

The proposed Lost Creek ISR Project area is located within the Great Divide Basin, at an elevation of approximately 2,133 m [7,000 ft]. This region of the state experiences diverse weather patterns that fluctuate throughout the year, due in large part to its proximity to the Rocky Mountain system and its relatively high elevation. The area is characterized by long winters, generally from December to April, which can bring frequent snow storms. Summer can be hot in the Great Divide Basin due to the lack of moisture; however, the summer season tends to be short, with occasional hail, thunder, or snow storms. (University of Wyoming, 2004)

Meteorological stations within an 80-km [50-mi] radius of Lost Creek are shown in Figure 3-14. The applicant installed the stations nearest to the proposed Lost Creek ISR Project (Lost Creek, Lost Soldier). The Lost Soldier station, located near Bairoil, Wyoming, 19 km [12 mi] northeast from the proposed licensed area, was installed in April 2006, and the Lost Creek station, located at the proposed Lost Creek ISR Project, was installed at the proposed site in May of 2007. Both stations, therefore, have a brief period of record. The applicant described the Muddy Gap station, 45 km [28 mi] northeast of the proposed Lost Creek ISR Project, as the nearest National

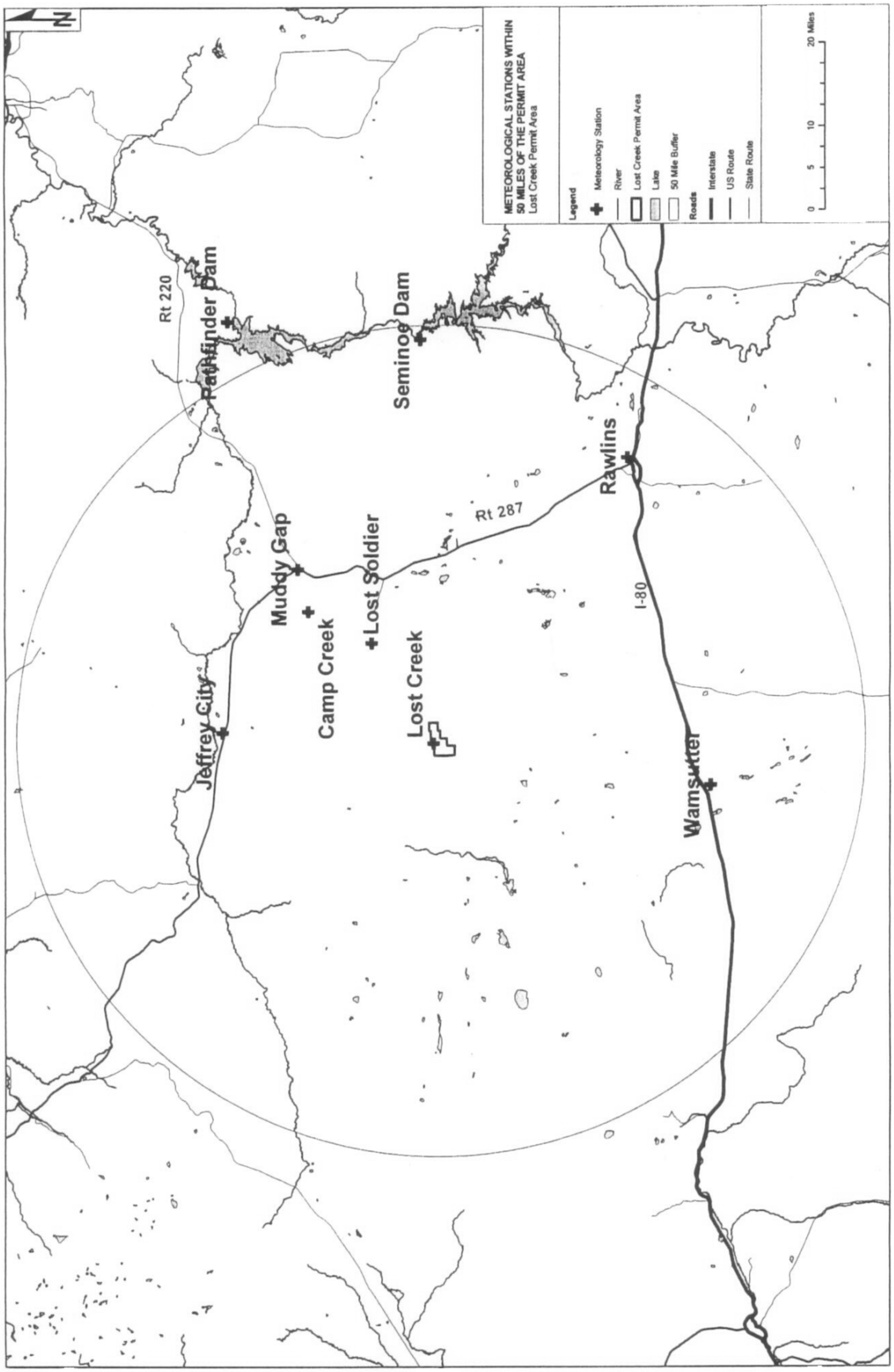

Figure 3-14. Regional NOAA Weather Stations
Sourece: Modeified from LCI (2010a)

Weather Service station with a long period of record that is located in an area with similar climate characteristics to the proposed site. The Muddy Gap station, however, discontinued operation in 2008, thereby limiting the available concurrent measurements that the applicant could use to validate the data from the aforementioned applicant-installed stations. After additional data collection and subsequent revision to LCI (2010a), the applicant stated that microclimatological differences between the project sites and regional meteorological stations had been observed. The applicant has, therefore, committed to continued operation of both the Lost Creek and Lost Soldier stations until sufficient data have been collected to support site operations without the need for additional measurements at one or both of the stations (LCI, 2010). The NRC would require by license condition that the applicant collect additional meteorological data on a continuous basis at a data recovery rate of 90 percent until the data are determined to be representative of long-term conditions.

The following summary of climatic and meteorological conditions in the vicinity of the proposed Lost Creek ISR Project assumes the applicant's meteorological data are representative of long-term site meteorological conditions. When the applicant submits its additional data for NRC review, the NRC staff will evaluate whether the information reported in this section (and any related impact conclusions in Chapter 4) would change based on the additional information and issue a supplement if changes are warranted.

3.7.1.1 Temperature

Temperatures fluctuate greatly throughout the year in the Great Divide Basin. General regional conditions described in the GEIS show that summer nights are normally cool, although daytime temperatures may be quite warm. The fall, winter, and spring can experience rapid changes with frequent variations from cold to mild periods. Freezes in early fall and late spring are typical and result in long winters and a short growing season. In the mountains and high valleys, freezes can occur any time in the summer. During winter warm spells, night-time temperatures can remain above freezing. Valleys protected from the wind by mountain ranges can provide ideal pockets for cold air to settle, and temperatures in the valley can be considerably lower than on nearby mountainsides. (NRC, 2009a)

The environment surrounding the proposed Lost Creek ISR Project was described in the license application as a semi-desert ecoregion, which has cold winters and short, hot summers (LCI, 2010). Average monthly temperature data the applicant compiled for several monitoring sites in the vicinity of the proposed Lost Creek site are shown in Table 3-8. These data show July was the warmest month recorded at the four stations. At the Lost Creek station (nearest the proposed site), the July average maximum and minimum daily temperatures were 29 and 11 °C [84 and 51 °F], respectively. December, however, was the coldest month recorded at the four stations. At the Lost Creek station, the December average maximum and minimum temperatures were −2.2 and −16 °C [28 and 4°F], respectively (NCDC, 2009).

3.7.1.2 Wind

Wyoming is windy, and frequently during the winter winds speeds reach 48 to 64 kph [30 to 40 mph] with gusts to 80 to 97 kph [50 to 60 mph]. Prevailing wind directions vary from west-southwest through west to northwest. In many localities winds are so strong and constant that trees (when present) show a definite lean toward the east or southeast. Wind farms have been established over southern Wyoming in places such as Arlington, Medicine Bow, Rock River, and just south of Cheyenne to take advantage of this renewable energy source. The high plains area near the proposed project site experiences moderate westerly winds throughout the year.

Table 3-8. Average Temperature Monitoring Data (°F) Collected at the Lost Creek, Lost Soldier, Jeffrey City, and Rawlins Meteorological Stations*

Month	Lost Creek		Lost Soldier		Jeffrey City		Rawlins	
	Average High	Average Low	Average High	Average Low	Average High	Average Low	Average High	Average Low
January	31.8	5.6	30.1	12.3	35.2	10.2	33.7	13.0
February	34.1	9.8	32.7	15.6	40.0	15.3	35.4	17.9
March	35.9	11.9	34.6	17.4	40.3	15.0	40.5	19.0
April	47.3	22.7	45.1	25.1	49.8	24.3	49.7	25.3
May	61.1	34.4	58.8	36.9	62.9	35.6	62.9	36.4
June	70.4	41.1	68.0	44.1	71.8	42.5	72.9	42.5
July	84.3	50.6	81.5	54.9	85.8	51.0	86.0	51.4
August	80.7	48.3	78.3	52.7	82.5	48.2	82.5	49.0
September	69.7	38.7	67.7	43.4	72.8	38.9	72.1	40.4
October	52.4	26.4	50.3	29.9	54.8	27.8	54.6	28.8
November	44.8	18.1	43.1	23.2	48.9	19.4	46.7	22.8
December	27.9	4	26.7	8.4	30.6	7.5	31.2	12.5

Source: LCI (2010a, Table 2.5-1b)
*Data collected 7/2007 through 11/2007; 3/2008 through 11/2009. To convert units from Fahrenheit to Celsius, subtract 32 and divide by 1.8.

These prevailing winds are generated by high-pressure systems that originate in the north Pacific and Canadian Rocky Mountains. These systems move east across the mountainous western U.S. and Canada, where most of the precipitation is released, leaving fairly dry, steady winds that empty into the eastern foothills and plain regions such as the Great Divide Basin (University of Wyoming, 2004). Figure 3-15 shows wind roses that reflect annual wind patterns for the Lost Creek and Lost Soldier meteorological stations (Section 3.7.1) (LCI, 2010). These data, collected between September 1 and November 30, 2007, and March 1, 2008, and August 31, 2009, show predominant winds at the Lost Creek station are westerly, while winds at the Lost Soldier station are west- northwesterly (LCI, 2010).

Wind speed measurements in the vicinity of the proposed Lost Creek site are described in the license application. The annual average wind speed measured at the Lost Soldier station (Section 3.7.1) was 7 m per second (m/s) [16 miles per hour (mph)] from May, 2006 to April 2007. The wind speed was highest in February and November and was approximately 9 m/s [20 mph]. The lowest wind speed occurred in July and August and was approximately 5 m/s [11 mph]. (LCI, 2010)

3.7.1.3 Precipitation

The proposed Lost Creek ISR Project area receives relatively little rainfall, lending itself to semiarid conditions. Generally, the Rocky Mountain range that surrounds the Great Divide Basin absorbs the majority of the rain and snowfalls. The mean annual precipitation within the region as measured at the Muddy Gap station from 1949 through 2005 is approximately 25 cm [10 in] (LCI, 2010). While precipitation occurs throughout the year, the mean monthly precipitation exceeds 3 cm [1 in] only in April, May, and June. May is the wettest month, with 5 cm [2 in] of mean precipitation. Due to the extreme windy conditions in the winter, gauges may actually underestimate the annual snowfall moisture. Storms generated from severe weather conditions could bring wind, rain, snow, or hail from any given direction. However,

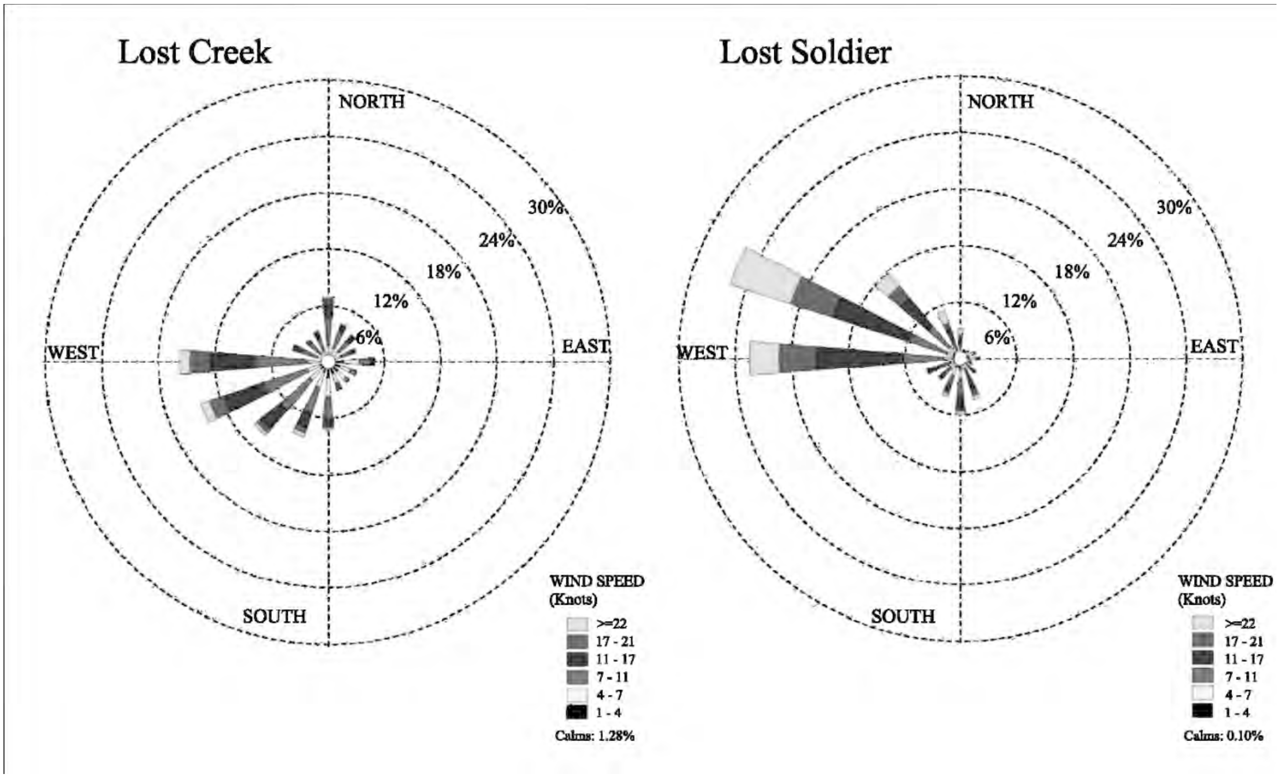

Figure 3-15. Wind Rose (Lost Creek and Lost Soldier Stations)
Source: Modified from LCI (2010a)

severe storms are rare in this area due to the surrounding mountains that effectively block or weaken storms (University of Wyoming, 2004).

Table 3-8 highlights the low and high monthly mean, the annual mean temperature, precipitation, and snowfall within the proposed Lost Creek ISR Project area climatic zone. Climate data were received from a weather station in Jeffery City, approximately 38 km [24 mi] north of the proposed project area. The climate data cover the period 1971–2000 (NOAA, 2004).

3.7.1.4 Evaporation

The majority of the United States west of the 105th meridian has evaporation rates that exceed precipitation. The exceptions are the coastal Pacific Northwest and high mountain areas of the Rockies, Sierras, and in the Basin and Range. In the area of the Great Divide Basin, theaverage annual evaporation is about 3.5 times the annual precipitation (University of Wyoming, 2004). Stations at Rock Springs (west of the proposed Lost Creek ISR Project area) and the Pathfinder Reservoir (east of the proposed Lost Creek ISR Project area) average 95.6 and 84.6 cm [37.7 and 33.3 in] of evaporation annually (Pochop, et al.,1985). The highest rates are during the months of June, July, and August, when 12.7 to 17.8 cm [5 to 7 in] per month evaporate. The lowest monthly rates are in December and January, when less than 3 cm [1 in] evaporates. Pochop, et al. (1985) also studied evaporation rates of a variety of wastewaters. He found that uranium wastewater evaporated at a rate 3 percent lower than tap water.

3.7.1.5 Atmospheric Stability Classification and Mixing Height

Atmospheric stability classification and mixing height are environmental variables that influence the ability of the atmosphere to disperse emitted air pollutants. The stability class is a measure of atmospheric turbulence, and mixing height characterizes the vertical extent of pollutant mixing in the atmosphere. The applicant classified stability according to Pasquill based on site-specific wind speed and solar radiation measurements (LCI, 2010). The resulting stability class distributions at the Lost Creek and Lost Soldier stations are predominantly neutral (approximately 75 percent of the time the calculated conditions were stability class D) with lower percentages of time (approximately 10 percent or less) represented by each of the remaining stability classes. The classification that results in the least vertical mixing (Class F) was approximately 1 percent at Lost Creek and approximately 6 percent at Lost Soldier. The applicant stated that data for mixing height were collected at a National Climatic Data Center (NCDC) station at Lander/Riverton, Wyoming, approximately 110 km [70 mi] north-northwest of the Lost Creek site, and reported that the average annual mixing height is 348 m [1,142 ft] in the morning and 2,300 m [7,546 ft] in the afternoon. The applicant correlated the mixing height data collected at the proposed Lost Creek ISR Project with technical data documented in journal articles by Fearon and Brown (2000) and Martner and Marwitz (1982), and found it to correlate well.

3.7.1.6 Climate Change and Greenhouse Gases

On a larger scale, climate change is a subject of national and international interest. The recent compilation of the state of knowledge in this area by the U.S. Global Change Research Program (GCRP), a Federal Advisory Committee (GCRP, 2009), has been considered in preparation of this SEIS. Average U.S. temperatures have increased more than 1.1 °C [2 °F] over the past 50 years and are projected to rise more in the future. In the period from 1993 to 2008, the average temperature in the Great Plains (the proposed Lost Creek site is considered part of the Great Plains in this study) increased by approximately 0.83 °C [1.5 °F] from the 1961 to 1979 baseline (GCRP, 2009). The projected change in temperature over the period from 2000 to 2020, which encompasses the period the proposed Lost Creek ISR Project would be licensed, ranges from a decrease of approximately 0.28 °C [0.5 °F] to an increase of approximately 1.1 °C [2 °F]. Although GCRP did not incrementally forecast a change in precipitation by decade, it did project a change in spring precipitation from the baseline period (1961 to 1979) to the next century (2080 to 2099). For the region of Wyoming where the Lost Creek ISR Project is proposed to be located, GCRP forecasted a 10 to 15 percent increase in spring precipitation (GCRP, 2009).

EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare based on a body of scientific evidence assessed by the GCRP, the Intergovernmental Panel on Climate Change, and the National Research Council (74 FR 66496). An endangerment finding based on the technical support document compiled by the previously referenced scientific organizations indicates that while ambient concentrations of GHG emissions do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. Based on EPA's determination, NRC recognizes that GHGs may have an effect on climate change. In the Commission's Memorandum and Order CLI–09–21, the Commission provided guidance to NRC staff to consider carbon dioxide and other GHG emissions in its *National Environmental Policy Act (NEPA*) reviews. GHG emissions were considered as an element of the existing air quality assessment. Relevant GHG emissions discussions are presented in SEIS Chapters 4 and 5.

Specific GHG Emissions were estimated for the Lost Creek facility and are presented in Appendix D.

3.7.2 Air Quality

The proposed Lost Creek ISR Project is located in Sweetwater County, Wyoming, which is an attainment area for all the primary pollutants (WDEQ, 2009; NRC, 2009a). The terrain, combined with windy conditions, provides good conditions for dispersion of air pollutants. The closest residents are located approximately 24 km [15 mi] northeast of the proposed Lost Creek ISR Project (LCI, 2008a).

As discussed in GEIS Section 3.3.6.2, EPA has established air quality standards to promote and sustain healthy living conditions. These standards, known as the National Ambient Air Quality Standards (NAAQS), address carbon oxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), and sulfur dioxide (SO_2). EPA revised the NAAQS standards after the preparation of the GEIS. This includes a new rolling 3-month average standard for lead at 0.15 μg/m^3 and a new 1-hour nitrogen dioxide standard at 100 parts per billion. EPA revisions to SO_2 and O_3 standards are under consideration but are not finalized (EPA, 2010). WDEQ adopted the EPA NAAQS, as summarized in the GEIS (NRC, 2009a, Table 3.2-8). States may develop standards that are stricter or that supplement the NAAQS. Wyoming has a more restrictive standard for SO_2 (annual at 60 μg/m^3 and 24 hours at 260 μg/m^3) and supplemental standards for particulate matter (annual PM_{10} at 50 μg/m^3 and 24-hour $PM_{2.5}$ at 65 μg/m^3) (WDEQ, 2008). WDEQ adopted the EPA NAAQS, as summarized in the GEIS (NRC, 2009a, Table 3.2-8). The principal nonradiological emissions from activities at the proposed Lost Creek ISR Project include diesel combustion engine emissions and fugitive road dust (particulate matter) described in Section 2.1.1.1.6.1.

Particulate matter refers to particles found in the air. Some particles are large enough to be seen as dust, soot, or smoke, while others are too small to be visible. As noted previously, the NAAQS for PM_{10} and $PM_{2.5}$ limit the allowable concentration of particulate matter (PM) particles to smaller than 10 and 2.5 μm. Emissions from highway and nonroad construction vehicles compose approximately 28 percent of total PM_{10} and $PM_{2.5}$ emissions. The large sources of PM include fugitive dust from paved and unpaved roads, agricultural and forestry activities, wind erosion, wildfires, and managed burning.

The WDEQ Air Quality Division analyzes measurements from 26 stations located throughout Wyoming to ensure ambient air quality is maintained, in accordance with NAAQS. The results are synthesized into the Wyoming Ambient Air Monitoring Annual Network Plan (WDEQ, 2009). The baseline air quality conditions of the proposed Lost Creek ISR Project were determined by evaluating data from four monitoring stations in the region to provide a reasonable representation of the air pollutant levels that could be expected to occur at the site. Monitoring data were reviewed by NRC staff for the Wamsutter, Casper, Lander, and Murphy Ridge monitoring locations. Furthermore, the GEIS reported that all areas within the Wyoming West Uranium Milling Region were classified as being in attainment for NAAQS (NRC, 2009b). Sweetwater County, where the Lost Creek ISR Project is proposed, lies within the Wyoming West Uranium Milling Region evaluated in the GEIS.

WDEQ monitors air quality and annually reports the results to EPA. Table 3-9 presents the annual air quality monitoring results for the monitoring stations in the region surrounding the proposed Lost Creek ISR Project. These monitoring sites are located south, northwest, northeast, and west of the proposed project area. No sites in the monitoring network are

Table. 3-9. Existing Conditions–2007* Ambient Air Quality Monitoring Data

Monitoring Stations	Wamsutter	Casper	Lander	Murphy Ridge	
Distance to Site	**40 km [25 mi]**	**161 km [100 mi]**	**80 km [50 mi]**	**241 km [150 mi]**	
Pollutant					**Averaging Time (Standard)†**
Carbon Monoxide	N/A	N/A	N/A	0.7 ppm	8-hour (9 ppm)
	N/A	N/A	N/A	0.9 ppm	1-hour (35 ppm)
Lead	1.5 μg/m	N/A	N/A	N/A	Quarterly (1.5 μg/m)
Nitrogen Dioxide	0.007 ppm	N/A	N/A	0.003 ppm	Annual (0.053 ppm)
Particulate Matter (PM_{10})	227.0 μg/m (Note: 2006 was 73.0 μg/m^3)	30 μg/m	40 μg/m	64 μg/m^3	24-hour (150 μg/m)
Particulate Matter ($PM_{2.5}$)	N/A	N/A	26.0 μg/m	N/A	Annual (15 μg/m)
	N/A	N/A	7.6 μg/m	N/A	24-hour (35 μg/m)
Ozone	0.064 ppm	N/A	N/A	0.070 ppm	4th highest 8-hour average (0.08 ppm)
Sulfur Dioxide	0.001 ppm	N/A	N/A	0.001 ppm	Annual (0.03 ppm)
	0.001 ppm	N/A	N/A	0.003 ppm	2nd highest 24-hour average (0.14 ppm)
	0.006 ppm	N/A	N/A	0.003 ppm	2nd highest 3-hour average (0.5 ppm)

Source: WDEQ, 2009
*Values for sulfur dioxide and carbon monoxide are from 2008, the only year the source document provided data.
†Averaging time shown is for the reported measurement results; standards are shown for reference purposes; however, assessment of compliance with NAAQS for particulate matter, ozone, and sulfur dioxide involves 3 years of measurement data, which are not shown here but are provided in the source document.

located in the direct path of prevailing winds (Figure 3-15). The annual monitoring results for 2007 are consistent with the area's attainment status (WDEQ, 2009; EPA, 2010). Construction activities at two locations resulted in a couple of elevated PM_{10} readings; however, these were attributable to localized, temporary construction activities and, therefore, were not representative. WDEQ uses the entire monitoring network to meet various objectives; therefore,

all criteria pollutants are not monitored at each site and the data for monitoring sites in the vicinity of the proposed Lost Creek ISR Project are limited (WDEQ, 2009).

As discussed in GEIS Section 3.3.6.2, Prevention of Significant Deterioration (PSD) requirements identify maximum allowable increases in concentrations for particulate matter, SO_2, and NO_2 for areas designated as in attainment. There are several different classes of PSD areas, with Class I areas having the most stringent requirements. No Class I areas are present in the Wyoming West Uranium Milling Region (NRC, 2009a). GEIS Table 3.4-9 identifies the Class I areas in Wyoming, South Dakota, Montana, and Nebraska. GEIS Figures 3.2-16 and 3.4-20 map the locations of Class I areas. These Class I areas—Bridger Wilderness, Fitzpatrick Wilderness, and Mt. Zirkel—are located approximately 96.6, 161, and 145 km [60, 100, and 90 mi], respectively, to the northwest and south of the Lost Creek site (USDOI, 2008). Popo Agie Wilderness Area, the closest Class II area to the proposed action, is located about 93.4 km [58 mi] northwest of the Lost Creek site.

3.8 Noise

Existing ambient noise levels are used to establish baseline conditions and determine potential site-specific disturbances associated with ISR milling activities. As described in the GEIS, the Wyoming West Uranium Milling Region is predominantly rural and undeveloped. Rural areas tend to be quiet, open sagebrush-grass and forested areas where natural phenomena, such as wind, rain, insects, birds, and other wildlife, account for most natural background sounds. Baseline noise levels for typical undeveloped desert or arid environments range from day-night sound levels of 22 decibels (dBA) on calm days to 38 dB on windy days where wind accounts for most of the noise (NRC, 2009a).

Considering this setting, land uses within the proposed project area, and those beyond, generate very little noise for offsite receptors. The isolated setting currently experiences typical rural sound levels. The hilly terrain, sparse sagebrush vegetation, and windy conditions contribute to attenuating sound levels as they travel over distances.

Sound level measurements were attempted on June 13, 2007, but yielded no results, as all sound pressure levels fell below the instrument range of 40 dB (LCI, 2008a). As a result, it was assumed that the existing (ambient) sound levels were less than 40 dBA, consistent with the statement in the GEIS that existing ambient noise levels in this region would be 22 to 38 dBA without the wind being a factor (NRC, 2009a).

Table 3-10 describes noise abatement criteria according to land use, recognizing that different areas are sensitive to noise in different ways. A person is considered to be impacted by noise according to Wyoming Department of Transportation procedures when existing or expected future sound levels approach (within 1 dBA), are, or exceed the Noise Abatement Criteria, or when expected future sound levels exceed existing sound levels by a substantial amount (15 dBA).

Sound level measurements were obtained on June 13, 2007, but all sound pressure levels fell below the instrument range of 40 dB (LCI, 2008a). As a result, it was assumed that the existing (ambient) sound levels were less than 40 dBA, consistent with the statement in the GEIS that existing ambient noise levels in this region would range from 22 to 38 dBA (NRC, 2009).

Table 3-10. Noise Abatement Criteria: 1-Hour, A-Weighted Sound Levels in Decibels (dBA)

Activity Category	$L_{eq}(h)$*	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	—	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

*$L_{eq}(h)$ is an energy-averaged, 1-hour, A-weighted sound level in decibels (dBA).
Source: 23 CFR Part 772

Noise is only a concern to the areas surrounding the proposed project site because it can interfere with wildlife activities. There are no occupied residential units or other sensitive receptors in, or near, the proposed project area. The nearest residential receptors are located in the community of Bairoil, which is approximately 24 km [15 mi] northeast of the Lost Creek site (LCI, 2008a). Regarding onsite wildlife receptors, observations suggest that noise from oil and gas operations may affect lek activity for the Greater sage-grouse (Braun, et al., 2002). As of 2007, the closest known lek just inside the northeast project boundary (called the Crooked Well Lek) was deemed to have an unknown status (WDEQ, 2010b). Including the Crooked Well Lek, a total of 11 leks were observed within 6.4 km [4 mi] of the proposed Lost Creek ISR Project boundary (Figure 3-12).

3.9 Historical, Cultural, and Paleontological Resources

GEIS Section 3.2.8 provides a general overview of historic and cultural resources for the Wyoming West Uranium Milling Region (NRC, 2009a). This section discusses the cultural background and historic and cultural resources identified at the proposed Lost Creek ISR Project and in the surrounding area. A single man-made structure is located within the project area: the Crooked Well Reservoir, located in the northeastern quadrant of the project. The reservoir is a stock pond covering approximately 0.1 ha [0.25 ac] (LCI, 2008a). The structure is a common landscape feature in the region, and it was not evaluated for cultural resources significance.

The National Historic Preservation Act of 1966 (NHPA), as amended, requires Federal agencies to consider the effects of their undertakings on historic properties. The historic preservation review process (Section 106 of the NHPA) is outlined in regulations the Advisory Council on

Historic Preservation issued in 36 CFR Part 800. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places (NRHP). The criteria for eligibility are listed in 36 CFR Part 60.4 and include (i) association with significant events in history; (ii) association with the lives of persons significant in the past; (iii) embodiment of distinctive characteristics of type, period, or construction and (iv) sites or places that have yielded or are likely to yield important information (ACHP, 2010).

The issuance of an NRC materials license for the proposed Lost Creek ISR Project is a federal action (undertaking) that could possibly affect either known or undiscovered historic properties located on or near the proposed project area. In accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to identify historic properties in the area of potential effect (APE). The APE for this review is the area that may be impacted by construction, operation, aquifer restoration, and decommissioning activities associated with the proposed action. If no historic properties are present or affected, the NRC is required to notify the Wyoming State Historic Preservation Office (WY SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to identify, assess and resolve potential adverse effects of the undertaking.

Cultural resources identification and assessment also consider the *Archaeological Resources Protection Act* (ARPA) [16 United States Code (USC) 469-469c-e], as amended, which covers permitting of archaeological investigations on public land such as that which the BLM manages. As discussed in SEIS Section 3.2, the entire proposed project area is composed of public lands which are owned and administered by the Federal and State governments. In addition to the Federal laws discussed above, State of Wyoming laws dealing with protection of archaeological resources are also considered. These various laws and regulations were discussed in GEIS Appendix B.

Prior to UR-Energy submitting its license application to the NRC, the BLM was the lead Federal agency for Section 106 consultation. Subsequently, when UR-Energy submitted its license application in March 2008, the NRC became the lead Federal agency. By letter dated October 3, 2008, the NRC initiated consultation with the WY SHPO under Section 106 of the NHPA (NRC, 2008). A response from the WY SHPO, dated October 23, 2008, stated that while several cultural resource surveys were conducted in the area, a majority of the proposed project area had not been surveyed (WY SHPO, 2008). On January 12, 2009, NRC staff met with a representative of the WY SHPO to discuss site-specific issues, including the WY SHPO review process, cumulative impacts to historic properties from the proposed undertaking and other energy development projects occurring in the region, and mitigation strategies such as data recovery and public education (NRC, 2009b). NRC staff also met with the WY SHPO on June 25, 2009, to discuss protocol for archaeological sites found eligible for inclusion on the NRHP.

As discussed in SEIS Section 3.9.3, of the three NRHP-eligible archaeological sites identified within the APE, only one prehistoric site (48SW16604) would be adversely affected by the proposed action. By letter dated June 30, 2009, the NRC forwarded the applicant's treatment plan for prehistoric site 48SW16604 to WY SHPO (NRC, 2009c). In addition, this letter stated that a Memorandum of Agreement (MOA) would be executed between the consulting parties. NRC staff developed and executed an MOA among the WY SHPO, BLM, Northern Arapaho Tribe, Eastern Shoshone Tribe, and the applicant. The MOA was finalized in October 2010. Documentation regarding the MOA is presented in Appendices A and E.

3.9.1 Cultural History

The proposed Lost Creek ISR Project lies on the desiccated High Plains within the Great Divide Basin, which is most commonly regarded as a high-elevation, closed basin with semiarid characteristics. The basin is marked by the presence of shallow drainages and rolling topography characterized by breaks and occasional buttes. In the proposed project proper, there are no permanent or intermittent water sources. (Kinneer, 2008; Kalasz, et. al., 1990).

Floral and faunal resources that could have been exploited in the prehistoric periods are present in the proposed project area. Except for Indian rice grass, most of the floral resources represent species used ethnographically for basketry, dyes, or medicines rather than foodstuffs. This is not the case with the faunal resources. In the historic eras, large mammals, including pronghorn antelope, bison, mule deer, and elk, were present and supported Shoshone and Ute populations and westward-bound emigrants using the Cherokee, Mormon, Oregon, and Overland trails that cut through the basin, though not through the proposed project area.

The archaeological, cultural sequence for the proposed project is divided between the prehistoric periods (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The prehistoric periods encompass about 11,000 years between 12,000 B.P. (A.D. 1950) and 250 B.P. (about A.D. 1700). The latter extends from about A.D. 1700 to A.D. 1959.

3.9.1.1 Prehistoric Era

The prehistoric periods summarized in the following sections are based on information presented in Kinneer, et al. (2007) and Kinneer (2008) Class III survey and treatment plan for the proposed Lost Creek ISR Project. The Paleoindian period (12,000 to 8,500 B.P.) is not formally broken in phases; however, named complexes have been developed based on changes in projectile point styles such as Clovis, Folsom, Agate Basin, Hell Gap, Eden, Scottsbluff, and Cody. Few Paleoindian sites have been identified in Wyoming, but those that have represent some of the most important in the nation.

Paleoindian populations colonized North America at the close of the last glaciation (Kinneer, et al., 2007). These groups were highly mobile and left little evidence of their activities. Most Paleoindian sites would have been short-term occupations (campsites). Paleoindian people subsisted on hunted big game and gathered plant material. According to Kinneer, et al. (2007), the closest possible Paleoindian site to the proposed project is the Union Pacific Mammoth site, located in Rawlins. The site, which contained bison (*Bison bison*), Columbian mammoth (*Mammuthus columbi*), and Woodland muskox (*Bootherium bombifions*) remains, did not yield Paleoindian artifacts, but the bones appeared to show signs of butchering. The site dates to approximately 11,280 to 350 B.P. based on associated charcoal, which is roughly contemporaneous with Clovis-age sites in the region (Pitblado, 2009). Confirmed Paleoindian sites in the region, yielding both Pleistocene megafauna and Paleoindian artifacts, include the James Allen site in southwestern Wyoming, Hell Gap and Agate Basin in eastern Wyoming, and Medicine Lodge Creek in central Wyoming.

The Paleoindian period comes to a close in the terminal Pleistocene/early Holocene era. The Pleistocene megafauna (e.g., mammoth, muskox) are replaced by modern bison, elk, deer, and antelope. These smaller grazers were better adapted to the change from savannah to grassland communities that resulted from the onset of warmer and drier conditions in the Holocene. The Archaic period (8500 to 1800 B.P.) in southwestern Wyoming is broken into four

phases. The Early Archaic (8500 to 5000 B.P.) phases are Great Divide and Opal; the Late Archaic (5000 to 1800 B.P.) phases are Pine Spring and Deadman Wash.

Early Archaic sites are marked by the presence of various side- and corner-notched projectile points and side-notched knives. Basin houses are identified in both phases. The economic focus continues to be broad-spectrum hunting and gathering with increasing emphasis on smaller game species in the Opal phase. The emphasis shifts, however, in the subsequent Late Archaic phases. Modern bison was the preferred game of Late Archaic hunters. Diagnostics recovered from archaeological sites from this period show that large corner-notched projectile points were the preferred weapon. Late Archaic faunal assemblages are also marked by the presence of smaller game animals and mid-size ungulates such as deer and antelope.

The acceptance of new technologies heralds the subsequent Late Prehistoric period (1800 to 250 B.P.). Smaller projectile points adapted to use with arrows are accepted by the Native American hunters. Prior to the Late Prehistoric era, the points were hafted on spears. Earthenware technology also is introduced to the region from the south and east, and this technology allows for additional food preparation techniques. Techniques such as stewing, braising, and boiling were now possible, and this significantly broadened the number of species, both floral and faunal, that could be utilized.

3.9.1.2 Protohistoric/Historic Era

The Protohistoric Period dates between about A.D. 1700 and 1840. It represents the period when European goods and the domesticated horse are introduced into the region but Late Prehistoric lifeways were still predominant. There is no appreciable European presence in the region, though French fur traders are moving up and down the Missouri River. Across the northern High Plains, there was active trading in European material goods including metal knives, pots, and glass beads (Brooks, 2009; Johnson, 2009). However, Native American goods in similar styles also continued to be produced.

The Historic era is subdivided into seven periods: Early Historic (A.D. 1801 to 1842), Preterritorial (A.D. 1843 to 1867), Territorial (A.D. 1868 to 1889), Expansion (A.D. 1890 to 1919), Depression (A.D. 1920 to 1939), World War II (A.D. 1940 to 1946), and Post-World War II (A.D. 1947 to 1959). Various themes have been identified that crosscut the periods. The themes that are called out in Kinneer, et al. (2007) include Early Transportation and Oil and Mineral Exploration.

The proposed project area was historically used for cattle ranching with limited oil and gas exploration in the nearby vicinity. There is no indication from the sites identified to date in the proposed project area that there were earlier historic occupations of the area. This suggests that historic occupations are limited to the Expansion and Postexpansion periods.

3.9.2 Historic and Cultural Resources Identified Within the Area of Potential Effect

3.9.3 Previous Cultural Resources Investigations

The project and study areas were subjected to three Class III surveys. These three included: WY SHPO Cultural Resources Office (WYCRO) project numbers 80-278, 88-875, and 93-1306. Western Wyoming College completed project 80-278 for a proposed uranium drill site. BLM

conducted project 88-875 for a proposed fence line. Pronghorn Archaeological Services performed an intensive survey for the Wamsutter Road Expansion. (Kinneer, et al., 2007)

The proposed Lost Creek ISR project area and associated study areas were subjected to systematic cultural resources investigations in 2007 (Kinneer, et al., 2007). The work was conducted under BLM Cultural Resource Use Permit (CRUP) No. 033–WY–SR06. The archaeological work was completed in two phases: July to October 2006 and May 2007.

A Class I site file search was conducted prior to fieldwork. The site file research identified the three previous surveys and also found that project 88-875 located archaeological site 48SW7633, a possible sheepherder’s camp. This site was recommended not eligible for listing on the NRHP by the original investigators (Kinneer, et al., 2007). Kinneer, et al. (2007) relocated the site and also recommended the site not be eligible for the NRHP.

Systematic survey of the proposed project area covered 1,523 ha [3,764 ac] of BLM-managed land and 270 ha [666 ac] of State of Wyoming land. The 2007 fieldwork was conducted using a BLM-mandated survey approach using of standard interval survey transects, not exceeding 30 m [100 ft] in separation. All sites and isolated resources were documented when initially found. No part of the proposed project area was excluded from survey. (Kinneer, et al., 2007)

The survey resulted in the relocation of Site 48SW7633 and the identification of 17 new sites and 75 isolated resources (Kinneer, et al., 2007). The WY SHPO has determined that isolated resources throughout the State of Wyoming are categorically ineligible for listing on the NRHP. The archaeological sites are listed and characterized by site type in Table 3-8.

Seven of the newly identified archaeological sites were recommended ineligible for the NRHP. These sites are dominated by historic debris with minor Native American components. The latter are of indeterminate age and could date to either the prehistoric or historic periods. The remaining 10 newly identified sites were subjected to evaluative testing. Methods utilized included systematic probes, shovel test, and 1 × 1 m [3.3 × 3.3 ft] test units. Based on the identification and testing results, three prehistoric sites (48SW16604, 48SW16608, and 48SW16765) were recommended as eligible for the NRHP. (Kinneer, et al., 2007)

3.9.4 Historic Properties Listed in the National Register of Historic Places

No cultural resources in the proposed project area are currently listed on the NRHP. Kinneer, et al. (2007) recommended three archaeological sites (48SW16604, 48SW16608, and 48SW16765) eligible for listing the NRHP (Kinneer, et al., 2007). BLM and WY SHPO concurred. The sites recommended as eligible to the NRHP are prehistoric lithic scatters with and without features.

Site 48SW16604 encompasses approximately 14,973 m^2 [161,708 ft^2], but the artifact densities are lighter in the western part of the site than in the eastern part along an ephemeral drainage (Kinneer, et al., 2007). Testing at the site found a basin-shaped hearth. Diagnostic artifacts and radiocarbon dating suggested that intermittent occupation of the site occurred between the Paleoindian and Late Prehistoric eras. Kinneer, et al. (2007) noted that the site has the potential to address research issues concerning chronology, lithic technology, paleoenvironments, and subsistence strategies.

Subsequently, Kinneer (2008) developed a treatment plan (data recovery plan) for site 48SW16604 and submitted it to BLM. BLM accepted the plan and has issued Wyoming BLM

CRUP No. 568-WY-AR09, which authorizes data recovery at the site. BLM submitted the plan to the WY SHPO; and by letter dated July 24, 2008, the WY SHPO concurred with BLM's determination of eligibility and acceptance of the treatment plan. Subsequently, NRC also reviewed and accepted the treatment plan and submitted it to WY SHPO on June 30, 2009 (NRC, 2009c). The treatment plan was formalized in the MOA among the NRC, WY SHPO, BLM, Northern Arapaho Tribe, Eastern Shoshone Tribe, and the applicant (SEIS Appendix F).

Site 48SW16608 encompasses about 4,613 m^2 [49.820 ft^2] with the highest artifact densities in the deflated eastern half of the site (Kinneer, et al., 2007). Diagnostic artifacts and radiocarbon dating suggested that the site had been occupied during Paleoindian times. Site 48SW16608 has the potential to address research issues concerning chronology, lithic technology, paleoenvironments, and subsistence strategies (Kinneer, et al., 2007).

Site 48SW16765 encompasses about 1,079 m^2 [11,653 ft^2], and the area is marked by a thin but persistent scatter of chipped stone tools and debitage. There is also a small amount of historic trash (Kinneer, et al., 2007). Testing at the site found an ill-defined pit feature in association with a well-defined, stratified midden. A single fragmentary Archaic point was recovered. Kinneer, et al. (2007) noted that the site has the potential to address research issues regarding Archaic subsistence strategies.

3.9.5 Tribal Consultation

No Native American reservation land is located within or near the proposed project area. The only Tribal reservation in Wyoming is the Wind River Indian Reservation, which is about 168 km [105 mi] northwest of the proposed project area. Additionally, no properties having religious and/or cultural significance are known to exist within or near the project area. (LCI, 2008a)

The NRC has made a reasonable and good faith effort to identify Native American tribes that shall be consulted during the Section 106 consultation process and to provide the identified Native American tribes a reasonable opportunity to participate in the Section 106 consultation process, as is required by 36 CFR 800.2(c)(B)(ii)(A). As mentioned in Section 1.7.3.3 in the SEIS, NRC sent Section 106 consultation letters to Eastern Shoshone and Northern Arapaho Tribes. For reference, consultation letters are presented in Appendix A. In September 2008, the THPO from the Eastern Shoshone Tribe visited prehistoric site 48SW16604 and reviewed the proposed treatment plan. Per e-mail communication from the BLM, the Eastern Shoshone tribe found the proposed treatment plan adequate, meeting the approval of tribal elders NRC, 2009c). Subsequently, the Eastern Shoshone requested to be a signatory on an MOA. The Northern Arapaho THPO also requested to be an invited signatory. The MOA (SEIS, Appendix F) was developed and executed in October 2010 and is included as SEIS Appendix E.

3.9.6 Paleontological Resources

BLM Instruction Memorandum No. 2008-009 (October 15, 2007; Memo 2008-009) was used to evaluate the potential for geologic units to occur within the proposed Lost Creek ISR Project area. The BLM's system rates the likelihood that specific geological units would contain fossils (BLM, 2007a).

According to Love and Christianson (1985), the proposed project area is marked by the presence of Quaternary age, near-surface deposits, and Tertiary age formations. Under the BLM's Potential Fossil Yield Classification (PFYC) system, the Quaternary age deposits are assigned a Class 2 ranking. Class 2 rankings are assigned to recent, sedimentary units

considered unlikely to have vertebrate fossils or significant nonvertebrate fossils. The near-surface deposits are usually younger than 10,000 years old and may include aeolian materials and deposits that have undergone significant diagenetic alteration. While important localities might exist in such deposits, their level of occurrence is considered low (BLM, 2007a). No significant paleontological resources are known to occur within the project area.

The project area Tertiary age deposits are capped by Battle Spring Formation sandstone and shale. The Battle Spring Formation in the proposed Lost Creek ISR Project area is part of a major alluvial system consisting of thick beds of very fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and siltstones (LCI, 2008a). The unit is thick in the proposed project area, and the underlying Wasatch Formation, of the same age, is considered unlikely to be exposed. Under the PFYC system, the Battle Spring Formation is assigned a ranking of Class 3A to 3B. These rankings range from moderate (3A) to unknown (3B) sensitivity for the occurrence of significant vertebrate or invertebrate fossils (BLM, 2007a).

As stated above, the near surface Quaternary deposits are not likely to yield paleontological deposits. Under the PYFC, while the older Tertiary deposits have a moderate to unknown potential for vertebrate or significant nonvertebrate fossils. To date, no significant paleontological resources are known to occur within the project area.

3.10 Visual and Scenic Resources

The proposed Lost Creek ISR Project area is characterized by low-relief, sagebrush-dominated land, dissected by a small network of ephemeral drainages. The scenery is characteristic of surrounding areas in the Great Divide Basin, though less visually appealing than many other locations. Few intermittent meandering streams, creeks, and associated riparian vegetation cross the open steppe, providing localized visual diversity to the otherwise homogeneous landscapes. More rugged, mountainous landscapes can be seen in the background to the north and to the south. Previous modifications to the natural environment include fencing (from ranchers), power lines, and four-wheel drive (two-track) roads, mostly from mineral exploration. Drilling rigs can currently be seen in the proposed project area. (LCI, 2008a)

BLM administers approximately 85 percent of the surface estate {1,462 ha [3,611 ac]} of the proposed project area (LCI, 2008a) and evaluates the scenic quality of the land it administers through a Visual Resource Inventory (VRI). The objective of the VRI is “to manage public lands in a manner which will protect the quality of the scenic (visual) values of these lands” (BLM, 2007c). The BLM VRI process consists of a scenic quality evaluation, a sensitivity level analysis, and a delineation of distance zones. Together, these evaluations are used to group areas into Visual Resource Management (VRM) classes, which provide guidance for management decisions. Areas are classified on a four-level scale, with Class I being the most protective of visual and scenic resources (and restrictive on allowable land uses) and Class IV being the least restrictive on uses due to the lack of visual landscape concerns (BLM, 2007c).

Visual resources consist of landforms, flora, rock and water features, and man-made features that create the visual character and sensitivity of landscapes. Examples in the proposed Lost Creek ISR Project area would include the ephemeral drainages crossing the landscape, roads, as well as the views of the mountains in the distance. Important visual resources are areas that have landscape qualities of unusual or intrinsic scenic value and areas of human and cultural use that are valued for their visual settings. Factors considered in evaluating the importance of visual resources include the visual quality and visual sensitivity, as described in the following paragraphs. (BLM, 2007c)

Distance zones also influence the potential impact of scenery changes on receptors. Potentially sensitive view areas are discussed with respect to three distance zones:

- Foreground {within 0.8 km [0.5 mi]}
- Middle ground {0.8 to 3.2 km [0.5 to 2 mi]}
- Background {beyond 3.2 km [2 mi]}

BLM has established VRM classifications and has resources management plans for all of the Wyoming West Uranium Milling Region, which includes the Lost Creek site (NRC, 2009a).

The following is the BLM objectives for each visual classification BLM (2007c).

Class I

The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II

The objective of this class is 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 partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV

The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The VRM classifications for the region are shown in the GEIS (NRC, 2009a, Figure 3.2-20). The landscape has been modified by mineral extraction activities. The bulk of the Wyoming West Uranium Milling Region is categorized as VRM Class III (along highways) and Class IV (open grassland, oil and gas). The closest VRM Class I resource area is located in the Ferris Mountains, about 48 km [30 mi] east-northeast of the Lost Creek site.

The area considered for visual resources includes the proposed project area, access roads, and a 3.2-km [2-mi] buffer area outside of the proposed project area. Beyond this distance, any changes to the landscape would be in the background distance zone and either unobtrusive or imperceptible to viewers (LCI, 2008a).

Visual quality, defined by the overall visual impression or attractiveness of an area, considers the variety, vividness, coherence, harmony or pattern of landscape features and is characterized according to three levels: (i) distinctive resources that are unique or exemplary in quality, (ii) representative resources that are typical of the physiographic region and commonly encountered, and (iii) indistinctive resources that are landscape or cultural areas that either lack visual resource amenities or have been degraded. (BLM, 2007c)

The scenic quality inventory conducted by the applicant (AATA, 2007) was based on methods provided in BLM (2007c) as well as a review of the factors that contribute to the existing VRM Class IV inventory for the proposed project area. The key factors of landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modifications were evaluated and scored according to the rating criteria. According to NUREG–1569, if the visual resource evaluation rating is 19 or less, no further evaluation is required (NRC, 2003). The scenic quality field inventory score calculated for the Lost Creek Site according to BLM methodology was 7 out of a possible 32 (LCI, 2008a).

Visual sensitivity, defined as a measure of an area's potential sensitivity to visual change, considers viewer types and numbers, viewer exposure, and viewing distance zones. Areas and associated viewer types considered to be potentially sensitive to visual changes include parks, recreation and wilderness study areas, major travel routes, and residential areas. (BLM, 2007c)

Visually sensitive areas include parks, recreation and natural areas, major travel routes, and residential areas within 3.2 km [2 mi] of the proposed project area. Potentially sensitive areas located 3.2 km [2 mi] or more from the proposed project area are not considered in this study, because beyond this distance changes from the project would be indistinguishable from the existing conditions. The viewer groups and use areas described next are considered to be moderately or highly sensitive to visual impacts when in the foreground or middle ground distance. (LCI, 2008a)

No developed parks or recreation areas are located within the visual resources study area. Travel routes in the visual resources study area include the lightly traveled CR 63, CR 23, and Sooner Road. These roads are used primarily by workers. The project area is not visible from any of these transportation corridors from viewpoints within the visual resources study area. Additionally, there are no residences within the visual resources study area. (Sweetwater County, 2004)

The project area is approximately 48 km [30 mi] southwest from the Ferris Mountain Wilderness Study Area. No Wilderness Areas or Areas of Critical Environmental Concern, however, are located within the visual resources study area. The proposed project area is near recreation areas; activities such as hiking, sightseeing, antler collecting, OHV use, hunting, and wild horse viewing are dispersed. The Chain Lakes Wildlife Habitat Management Area (WHMA) lies approximately 13 km [8 mi] south of the proposed Lost Creek project area. There are no designated wildlife viewing locations in the study area (LCI, 2008a), though the proposed project area does include Wyoming Game and Fishing Department hunting areas for antelope, deer, elk, and mountain lion (WGFD, 2005a).

By applying the BLM's VRM system, the proposed project area is not visually pristine or of special visual interest due to existing infrastructure and other mineral exploration (industrial) facilities in the area. The sole visually sensitive receptors within the visual resources study area are a small number of transient recreationists, hunters, and ranchers. BLM designated the proposed project area VRM Class III (LCI, 2008a).

3.11 Socioeconomics

This section of the SEIS describes current socioeconomic factors that have the potential to be directly or indirectly affected by the construction and operation of a new uranium recovery facility at the proposed Lost Creek ISR Project site. The proposed Lost Creek ISR Project is located in the Wyoming West Uranium Milling Region, which is described in GEIS Section 3.2.10 (NRC, 2009a). The proposed ISR facility and the people and communities that would support it can be described as a dynamic socioeconomic system. The communities provide the people, goods, and services required to construct and operate the facility. Construction and operations, in turn, create the demand for people, goods, and services and pays for them in the form of wages, salaries, and benefits, and payments for goods and services. Income from wages and salaries and payments for goods and services is then spent on other goods and services within the community, thus creating additional opportunities for employment and income.

The proposed Lost Creek ISR Project site is located in the rural northeast section of Sweetwater County, Wyoming. The site is located approximately 61 km [38 mi] northwest of Rawlins (population of approximately 8,500) and is approximately 24 km [15 mi] southwest of the town of Bairoil (population of approximately 100). There were approximately 40,000 residents in Sweetwater County in 2008. (USCB, 2010)

The primary population centers in Sweetwater County are Rock Springs (population of approximately 19,500) and Green River (population of approximately 12,300), which are located approximately 130 and 150 km [80 and 94 mi] southwest of the proposed project area. Large population centers such as Rawlings, Green River, Rock Springs, Casper (population of approximately 53,000), and Lander (population of approximately 7,000) are within commuting distance to the proposed project area (USCB, 2009).

The socioeconomics region of influence (ROI) is defined by the area where employees and their families would reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. Given that most employees would reside near the ISR facility, the most significant impacts of plant construction and operations are likely to occur in Sweetwater County. The focus of the analysis in this SEIS is, therefore, on the impacts of the proposed ISR facility in Sweetwater County.

The following subsections describe the demographics, income, housing, employment structure, local finance, and education and public services in the ROI surrounding the proposed ISR facility at the Lost Creek site.

3.11.1 Demographics

Sweetwater County is the fourth most populated county in the state, but has a relatively low population density of 8.5 people per km^2 [approximately 4 people per mi^2). The population of Sweetwater County is primarily concentrated near the cities of Rock Springs and Green River, in the western portion of the county, while the northeastern section of the county, where the

proposed Lost Creek ISR project site is located, has a relatively low population. According to the 2000 Census, the population of Sweetwater County is mostly White, with Hispanic or Latino, American Indian, Black or African American, and other races comprising approximately 13 percent of the population.

Table 3-11 shows population projections and growth rates from 1980 to 2050 in Sweetwater County. The population in Sweetwater County had a slight decline in population from 1980 to 2000. From 2000 to 2050, the county is projected to grow at an increasing rate until 2030.

The 2000 demographic profile of the population in Sweetwater County is presented in Table 3-12. Persons self-designated as minority individuals comprise about 13.1 percent of the total population in 2000. The minority population is composed largely of Hispanic or Latino residents.

According to the U.S. Census Bureau's 2007–2009 American Community Survey 3-year Estimates, minority populations were estimated to have increased by approximately 1,900 persons and comprised 17.1 percent of the county population (see Table 3-13). Most of this increase was due to an estimated influx of Hispanic or Latinos (approximately 1,400 persons), an increase in population of over 39 percent from 2000. The next largest increase in minority population was two or more races, an increase of approximately 760 persons from 2000.

3.11.2 Income

Estimated income information for the ROI is presented in Table 3-14. According to the U.S. Census Bureau's 2007–2009 American Community Survey 3-year Estimates, median household and per capita income in Sweetwater County were both above the Wyoming average. An estimated 7.6 percent of the population and 5.4 percent of families in Sweetwater County were living below the official poverty level (USCB, 2010).

According to American Community Survey 2007–2009 3-Year Census data estimates, the annual unemployment average for Sweetwater County was 4.5 percent, which was slightly higher than the annual unemployment average of 4.3 percent for Wyoming (USCB, 2011).

Table 3-11. Population and Percent Growth in Sweetwater County, Wyoming From 1980 to 2050

Year	Population	Percent Growth*
1980	41,723	—
1990	38,823	−7.0
2000	37,613	−3.1
2009	41,226	9.6
2010	41,700	10.9
2020	46,530	11.6
2030	48,130	3.4
2040	51,883	7.8
2050	55,098	6.2

*Percentage growth rate is calculated over the previous decade.
Sources: Population data for 1980 through 2000 (USCB, 2010); 2008 estimate (U.S. Census Bureau, 2010); projected population data for 2010 through 2030 (Wyoming Department of Administration and Information, Economic Analysis Division, July 2008); population projections for 2040 and 2050 (calculated).

Table 3-12. Demographic Profile of the Population in Sweetwater County, Wyoming in 2000

	Sweetwater County	Percent
Total Population	37,613	-
Race (Not Hispanic or Latino)		
White	32,675	86.9
Black or African American	270	0.7
American Indian and Alaska Native	290	0.8
Asian	235	0.6
Native Hawaiian and Other Pacific Islander	13	0.0
Some other race	28	0.1
Two or more races	557	1.5
Ethnicity		
Hispanic or Latino	3,545	9.4
Minority Population (including Hispanic or Latino ethnicity)		
Total minority population	4938	13.1
Source: USCB (2011),		

Table 3-13. Demographic Profile of the Population in Sweetwater County, Wyoming, 2007 to 2009 3-Year Estimate

	Sweetwater County	Percent
Total Population	40,163	-
Race (Not Hispanic or Latino)		
White	33,287	82.9
Black or African American	310	0.8
American Indian and Alaska Native	62	0.2
Asian	226	0.6
Native Hawaiian and Other Pacific Islander	10	0.0
Some other race	12	0.0
Two or more races	1,319	3.3
Ethnicity		
Hispanic or Latino	4,937	12.3
Minority Population (including Hispanic or Latino ethnicity)		
Total minority population	6,867	17.1
Source: U.S. Census Bureau (2011)		

3.11.3 Housing

Table 3-15 lists the total number of occupied housing units, vacancy rates, and median value in Sweetwater County. According to the 2000 Census, there were more than 15,900 housing units in the ROI, of which approximately 14,105 were occupied. The median value of owner-occupied units was $172,600.

According to American Community Survey 2007–2009 3-Year Census data estimates, the total number of housing units in Sweetwater County has grown by almost 1,300 units to 17,194, while the total number of occupied units grew by 1,586 units to 15,691. As a result, the

Table 3-14. Income Information for the ROI, 2007–2009 American Community Survey 3-Year Estimates

	Sweetwater County	Wyoming
Median household income (dollars)	70,273	52,951
Per capita income (dollars)	30,653	27,709
Percentage of families below the poverty level	5.4	6.1
Percentage of persons below the poverty level	7.6	9.7
Source: U.S. Census Bureau (2011), 2007–2009 American Community Survey 3-Year Estimates, Economic Characteristics for Sweetwater County and Wyoming (http://factfinder.census.gov) *In 2009 inflation-adjusted dollars		

Table 3-15. Housing in Sweetwater County, Wyoming

2000	
Total	15,921
Occupied housing units	14,105
Vacant units	1,816
Vacancy rate (percent)	11.4
Median value (dollars)	104,200
2007–2009; 3–year estimate	
Total	17,194
Occupied housing units	15,691
Vacant units	1,503
Vacancy rate (percent)	8.7
Median value (dollars)	196,400
Source: USCB (2011)	

number of available vacant housing units decreased by 313 units to 1,503, or 8.7 percent of all housing units.

3.11.4 Employment Structure

Between 2000 and 2009, the civilian labor force in Sweetwater County increased by approximately 13 percent to 22,563 (USCB, 2011). The mining industry is the largest employer in Sweetwater County. The local, State, and Federal governments are the next largest employers, followed by educational services, and health care and social assistance industry. (USCB, 2011)

3.11.5 Local Finance

Sweetwater County taxes commercial personal property. The county determines assessed valuation of commercial property at 11.5 percent of the market value and applies a mill levy of 63.088 (set by the County Commissioners) (Sweetwater County, 2009a).

Sweetwater County has a 6 percent sales and use tax (statewide base of 4 percent, plus 1 percent optional county tax, plus 1 percent capital facilities). The average property tax rate in Sweetwater County is 7.06 percent. Wyoming also imposes *ad valorem* taxes on mineral extraction properties. Taxes levied for uranium production were 10 percent in 2007 (comprised of 6.0 percent ad valorem and 4 percent severance) totaling $1.7 million. A small portion of this uranium tax revenue ($715.90) was generated in Sweetwater County in the Wyoming West Uranium Milling Region. (NRC, 2009a)

3.11.6 Education

The proposed Lost Creek ISR Project is located in the Sweetwater County School District 1. This district serves the communities of Rock Springs, Farson-Eden and Wamsutter. The nearest public school is Desert Elementary and Desert Middle School in Wamsutter. The annual enrollment for Sweetwater County School District 1 is 5,159 students. Both schools have very low student-teacher ratios (approximately 8 to 1 and 5 to 1, respectively). The Carbon County School District 1 has the next closest public schools, including Bairoil School and Bairoil Elementary School, as well as several elementary, middle, and high schools located in Rawlins. Rawlins is located approximately 58 km [38 mi] southeast of the proposed project area in Carbon County. The annual enrollment for Carbon County School District 1 is 1,787 students, with an average student-teacher ratio of 9.26 to 1 (based on 2006 data) (Wyoming Department of Education, 2009). Construction of a new elementary school was initiated in Rawlins, Wyoming in 2010 (Throgmorton, 2010).

3.11.7 Health and Social Services

The closest health care facility with emergency care to the proposed project area is the Carbon County Memorial Hospital, which is a 35-bed acute-care facility. It is located approximately 62 km [38 mi] southeast of the proposed project area in Rawlins. The main health care facility in Sweetwater County is the Memorial Hospital of Sweetwater, located approximately 130 km [80 mi] southwest of the proposed project area in Rock Springs. It is a nonprofit, 99-bed, rural acute-care facility. There are also a number of private and state-operated social services facilities in Sweetwater County and a variety of utility service providers in the area. (LCI, 2008a)

3.12 Public and Occupational Health and Safety

The purpose of this section is to summarize the natural background radiation levels in and around the proposed Lost Creek ISR Project area. Descriptions of these levels are known as “preoperational” or “baseline” radiological conditions, and they would be used for evaluating potential radiological impacts associated with ISR operations. Also included in this chapter are descriptions of applicable safety criteria and radiation dose limits that have been established for the protection of public and occupational health and safety.

Radiation dose is a measure of the amount of ionizing energy that is deposited in the body. Ionizing radiation is a natural component of the environment and ecosystem, and members of the public are exposed to natural radiation continuously. Radiation doses to the general public occur from radioactive materials found in the Earth’s soils, rocks, and minerals. Rn-222 is a radioactive gas that escapes into ambient air from the decay of uranium (and its progeny Ra-226) found in most soils and rocks. Naturally occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of radiation. In addition to natural sources of radiation, there are also artificial or human-made sources that contribute to the dose the general public receives. Medical

diagnostic procedures using radioisotopes and x-rays are a primary human-made radiation source. The National Council for Radiation Protection (NCRP) estimates the annual average dose to the public from all natural background radiation sources (terrestrial and cosmic) is 3.1 millisieverts (mSv) {310 millirem [mrem]}. The background dose rate for the Wyoming West Uranium Milling Region is 316 mrem/yr, as stated in the GEIS (NRC, 2009a). The annual average dose to the public from all sources (natural and manmade) is 6.2 mSv [620 mrem] (NCRP, 2009a)

3.12.1 Background Radiological Conditions

In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, a preoperational monitoring program was developed and implemented to establish baseline conditions at the proposed Lost Creek ISR site (Figure 3-16). Results of the baseline radiological environmental monitoring provide data on background levels that can be used for evaluating future impacts from routine facility operations or from accidental or unplanned releases. The scope of the baseline program conducted for the proposed Lost Creek ISR Project is generally consistent with the NRC Guidelines in Regulatory Guide 4.14 (NRC, 1980).

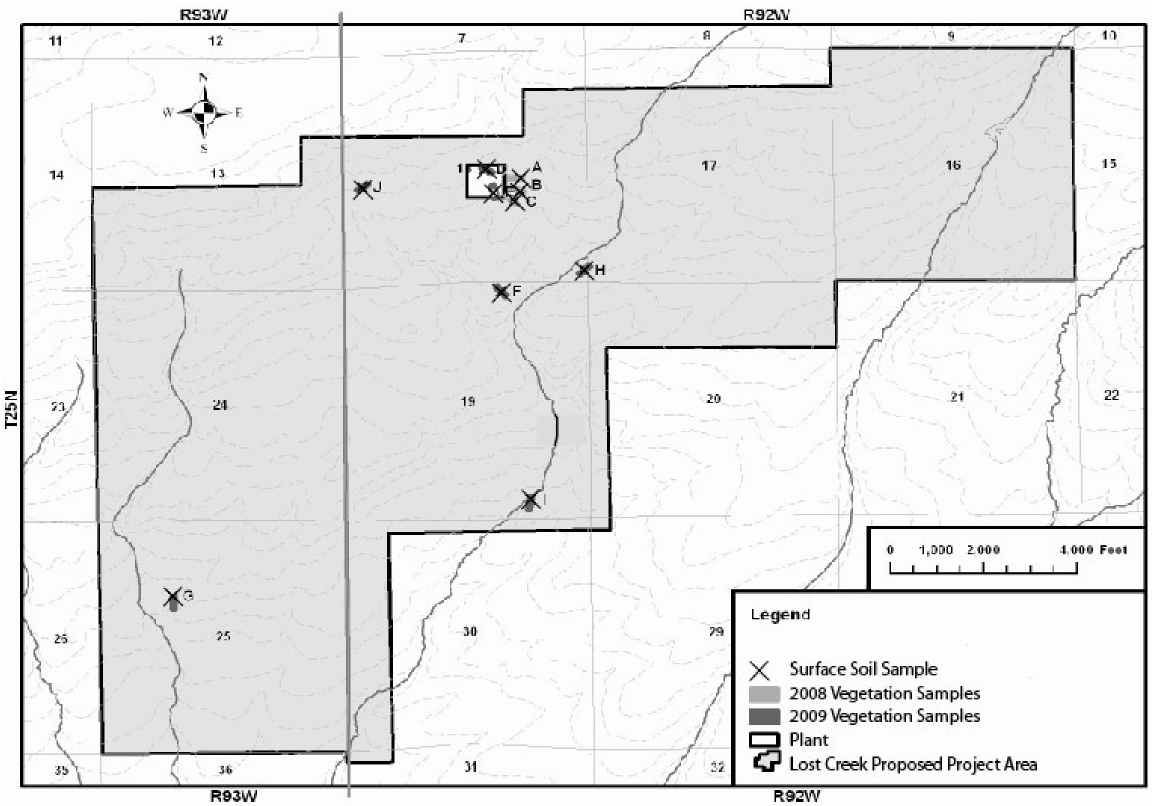

Figure 3-16. 2009 Soil and Vegetation
Source: Modified from LCI (2008a)

LCI (2008a, Section 3.12) describes methods and results of the baseline radiological survey initiated in November of 2006 and completed in 2008. The goal of the survey was to establish background radionuclide concentrations in the various environmental media of the Lost Creek site. In response to requests for additional information from the NRC staff and to resolve open issues following several public meetings in 2009 with the NRC staff, LCI conducted additional

sampling of environmental media through early 2010 and reported all results in LCI, (2010a). In addition to the data and revisions to the technical report, LCI (2010a) also included a description of additional air and passive gamma radiation sampling that would be collected through 2011 in the changes to the technical report.

LCI included the following sampling methods in its baseline radiological environmental monitoring program (LCI, 2008a; 2010a):

- An integrated overland gamma scan survey was performed using gamma sensitive sodium iodide (NaI) detectors with GPS positioning for mapping the ambient gamma radiation levels across the site,

- Ten surface soil samples from a depth of 15.4 cm [6 in] were taken from ten 100-m^2 [1,076 ft^2] sampling grids. Each group of 10 samples per grid was combined into 1 composite sample and analyzed for dissolved natural uranium, Ra-226, Th-230, and Pb-210.

- Subsurface soil was sampled at 6 locations in the fall and winter of 2008: at the center of the proposed plant, 152 m [500 ft] east of the proposed plant, and 750 m [2,500 ft] in each of the cardinal directions from the plant. Two to four samples were collected at each site to a minimum depth of 1 m [40 in] and analyzed for natural uranium, Ra-226, Th-230, and Pb-210.

- Vegetation samples were collected at three downwind locations at three different times during the summer of 2008.

- Surface soil and vegetation samples were collected in 2009 at seven locations determined by model predictions[1] to have the maximum radon progeny deposition from plant operations (see Figure 3-16).

- Groundwater and storm water samples were collected on a quarterly basis and analyzed for radium-226, dissolved natural uranium, Th-230, Po-210, and Pb-210.

- Sediment samples were collected in late 2008 at the upstream and downstream proposed licensed area boundaries, which coincided with seven of the surface water sampling locations. Composites of 10 to 20 subsamples were collected at each location and analyzed for natural uranium, Ra-226, Th-230, and Pb-210.

- Air particulates were collected using high velocity air samplers at four onsite and one offsite locations in the town of Bairoil for 1 year between 2007 and 2008. Composite samples were collected quarterly and analyzed for natural uranium, Ra-226, Th-230, and Pb-210.

[1]MILDOS and MILDOS-Area computer codes calculate the dose commitments received by individuals and the public from the airborne releases of radioactive materials from an operating uranium recovery facility(Argonne National Laboratory (ANL) Environmental Science Dvision (EDS), 2010), Dose is calculated from inhalation, ingestion (vegetables, milk, and meat), and external (cloud immersion and ground shine) exposure pathways. The computer codes can estimate air and ground concentrations of radionuclides. MILDOS was developed for mainframe computers in the early 1980s (Strenge and Bander, 1984) and later updated as MILDOS-AREA to be used on personal computers (Yuan et al, 1989). Other updates incorporated 10 CFR Part 20 revisions and application to ISR facilities (Faillace et al, 1997; Kamboi et al, 2008). Retrieved February 7, 2011, from http://web.evs.anl.gov/mildos/index.html.

- Passive air samples were collected to measure gamma and radon-222 at six locations within and outside the proposed operational project area between 2006 and 2008. Six additional locations were added in April 2010 so that radon would be sampled at 12 locations to provide full coverage of the site (Figure 6-1). Five radon samplers were colocated with air particulate samplers. Four samplers were at previously used locations; three were at predicted receptor sites or downwind. The intent of the overland gamma survey was to characterize and quantify natural background or preoperational radiation levels and radionuclide concentrations in soils throughout the proposed Lost Creek ISR Project area. As described in LCI (2008a, Section 3.12.1.3) and LCI (2008b, Section 2.9), results of the overland gamma survey and soil sampling show higher than expected variability of radioactive concentrations in surface soils. However, averaged results for measured gamma radiation and soil concentrations are within the range of concentrations typically measured in this region of Wyoming. The applicant identified elevated areas as likely attributable to different types of soil and rocks with elevated levels of natural background radioactivity. Similar variability in surface or near-surface measurements taken at other Wyoming sites has been attributed to natural radioactivity potentially influenced by weathering factors such as erosion and/or deposition (Whicker, et al., 2008).

- Soil samples were analyzed for uranium, Ra-226, Th-230, and Pb-210. As presented in LCI (2008a, Section 3.12), measured concentrations for the majority of the sampled radionuclides were higher than typical background ranges for the United States, though consistent with typical background ranges for this region of Wyoming. For comparison, background radium levels in soil in the U.S. typically average 0.04 Becquerel (Bq)/g [1 picocurie (pCi)/g] (NCRP, 2009). The range of background concentrations is 0.018 to 0.074 Bq/g [0.5 to 2 pCi/g] for the sampled radionuclides. The average radium-226 concentration for surface samples taken at the Lost Creek site was 0.22 Bq/g [6.0 pCi/g] with a maximum concentration of 0.33 Bq/g [8.8 pCi/g]. The uranium average was 0.16 Bq/g [4.4 pCi/g] with a maximum concentration of 0.48 Bq/g [12.9 pCi/g]. The thorium-230 average was 0.033 Bq/g [0.9 pCi/g] with a maximum concentration of 0.078 Bq/g [2.1 pCi/g]. The lead-210 average was 0.033 Bq/g [0.9 pCi/g] with a maximum concentration of 0.18 Bq/g [4.9 pCi/g].

- Soil samples were taken for six locations in the area of the proposed plant site. The samples were taken at various depths with some samples as deep as 60 inches. The samples were analyzed for lead-210, radium-226, thorium-230 and uranium. The average lead concentration was 3.2 pCi/g, the average radium-226 concentration was 1.6 pCi/g, the average thorium-230 concentration was 1.1 pCi/g and the average uranium concentration was 2.3 mg/kg. The results showed small variation in the concentrations of some radionuclides with depth, but there did not appear to be a consistent pattern. (LCI, 2008b)

- Sediment samples were taken at seven locations in the three watersheds in the area of the proposed ISR project. The samples were analyzed for lead-210, radium-226, thorium-230 and uranium. The lead was undetectable (less than 3.5 pCi/g). The average radium concentration was 0.8 pCi/g, the average thorium-230 concentration was 1 pCi/g and the average uranium concentration was 2.2 mg/kg. (LCI, 2008b)

- The concentrations of radionuclides in groundwater can be strongly correlated with the location of the uranium mineralization. The average concentration of uranium in all the samples collected during baseline monitoring was 0.306 mg/L [3.72×10^{-5} oz/gal], while

the EPA drinking water Maximum Contaminant Level (MCL) is 0.03 mg/L [3.6×10^{-6} oz/gal]. Radium concentrations were also high {e.g., the radium-226 concentration in HJ monitoring well LC19M is 15,558 Bq/m^3 [420.5 pCi/L]}. The MCL for Ra-226 is 5 pCi/L.

- Baseline surface water samples were collected and analyzed for natural uranium, radium-226, Ra-228, gross alpha, gross beta, lead-210, and thorium-230. Results are presented in ER Table 2.7-4 and are all below detection limits except for uranium and gross alpha. Uranium values were all less than 0.001 mg/L [1.2×10^{-7} oz/gal] and gross alpha samples were less than 185 Bq/m^3 [5 pCi/L]. These values are within levels measured at other background locations across the region (LCI, 2008a).

- Vegetation samples were collected at three downwind locations at three different times during the summer of 2008. The samples were analyzed for natural uranium, Ra-226, Pb-210, Po-210, and Th-230. The reported average uranium concentration values were 0.18 mg/kg [2.9×10^{-6} oz/lb] and 4.4×10^{-6} Bq/kg [0.00012 μCi/kg]. Reported average values for remaining radionuclides are Ra-226 {4.4×10^{-6} Bq/kg [1.2×10^{-4} μCi/kg]}; Th-230 {9.3×10^{-7} Bq/kg [2.5×10^{-5} μCi/kg]}; Po-210 {2.3×10^{-6} Bq/kg [6.2×10^{-5} μCi/kg]}, and Pb-210 {9.2×10^{-4} μCi/kg (LCI, 2008a).

- Six radon samples were collected downwind and upwind locations were used for baseline measurements. Sampling results for four quarters are presented in LCI (2008a,Table 3.7-11). Reported outdoor radon-222 results range between 832.5 and 13,712 Bq/m^3/day [22.5 and 370.6 pCi/L/day], which approximately equals an average daily concentration range for the quarterly sampling periods of 10 to 141 Bq/m^3 [0.27 to 3.8 pCi/L] in air. These values are consistent with background levels reported for that region of the country (NCRP, 2009).

- Air particulate samples were collected at five locations during four quarters starting in November 2007. Consistent with guidance in Regulatory Guide 4.14, air samplers were placed at the location of the nearest resident, an upwind (background) location, and selected downwind locations within the proposed project area. Quarterly composite samples for each location were analyzed for natural uranium, radium-226, thorium-230, and lead-210. Reported results are summarized as follows:

- <u>Uranium</u>: Sixteen of 20 samples for uranium were below the detection limit of 3.7×10^{-6} Bq/m^3 [1.0×10^{-16} μCi/mL], and the maximum was 2.1×10^{-5} Bq/m^3 [5.61×10^{16} μCi/mL], which is less than 1 percent of the effluent release limit of 3.3×10^{-3} Bq/m^3 [9.0×10^{-14} μCi/mL] specified in 10 CFR Part 20, Appendix B.

- <u>Thorium-230</u>: Sixteen of 20 samples for thorium-230 were below the detection limit of 3.7×10^{-6} Bq/m^3 [1.0×10^{-16} μCi/mL], and the maximum was 9.6×10^{-6} Bq/m^3 [2.59×10^{-16} μCi/mL], which is less than 1 percent of the effluent release limit of 1.1×10^{-3} Bq/m^3 [3.0×10^{-14} μCi/mL] specified in 10 CFR Part 20, Appendix B.

- <u>Radium-226</u>: Sixteen of 20 samples for radium-226 were below the detection limit of 3.7×10^{-6} Bq/m^3 [1.0×10^{-16} μCi/mL], and the maximum was 8.25×10^{-5} Bq/m^3 [2.23×10^{-15} μCi/mL], which is less than 1 percent of the effluent release limit of 3.3×10^{-2} Bq/m^3 [9.0×10^{13} μCi/mL] specified in 10 CFR Part 20, Appendix B.

- Lead-210: All 20 samples for lead-210 were measured above the detection limit, with concentrations ranging from 1.12×10^{-4} to 8.81×10^{-4} Bq/m^3 [3.02×10^{-15} to 2.38×10^{-14} µCi/mL]. The maximum value was 4 percent of the effluent release limit of 2.2×10^{-2} Bq/m^3 [6.0×10^{-13} µCi/mL] specified in 10 CFR Part 20, Appendix B.

- At the request of the NRC technical staff review, two livestock were sampled to verify baseline conditions. The results are pending. NRC staff does not anticipate that livestock have a significant amount of contamination because of the relatively low levels of contamination in the vegetation and because grazing times are limited through the implementation of BLM Guidelines and Standards for management of public grazing areas

- The applicant stated that radon would be sampled at 12 locations to provide full coverage of the site (Figure 3-17). Five radon samplers would be colocated with air particulate samplers. Four samplers will be at previously used locations; three would be at receptor sites or downwind. NRC staff finds the placement of the radon monitors and air particulate samplers to be consistent with Regulatory Guide 4.14.

The NRC staff concluded that the information provided to date establishes a reasonable baseline for radiological conditions can be established for the proposed Lost Creek ISR Project area. The NRC staff concluded that the information provided for the proposed Lost Creek ISR Project area does not present any new information that is contrary to or varies with the information and conclusions presented in the GEIS.

3.12.2 Public Health and Safety

NRC has the statutory responsibility, under the *Atomic Energy Act* (AEA), to protect public health and safety. NRC regulations in 10 CFR Part 20 specify annual dose limits to members of the public of 1 mSv [100 mrem] TEDE and 0.02 mSv [2 mrem] per hour from any external radiation sources. This public dose limit from NRC-licensed activities is a fraction of the background radiation dose as described previously in Section 3.12.1.

The boundary of the Kennecott uranium mine property is located approximately 3 km [2 mi] south of the proposed Lost Creek ISR Project area boundary. There are several inactive and decommissioned conventional uranium mills within an 80-km [50-mi] radius. Because of their distances from Lost Creek and since the conventional mills are cross-wind and not up-wind of the proposed Lost Creek ISR Project, none of these mills are considered to represent a source of radiation exposure in and around the proposed project area. Therefore, the natural background represents the only radiation exposure to individuals in the area surrounding the proposed Lost Creek ISR Project area.

Other than slightly elevated background readings in a limited number of boundary locations at the proposed site, the information provided for the proposed Lost Creek ISR Project area does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS. The limited number of locations with elevated readings is most likely due to natural conditions and variability in the background conditions or past exploration activities. The baseline gamma surveys presented in the LCI (2008a) and LCI (2008b) provide adequate documentation of preoperational conditions for the proposed Lost Creek ISR Project area and would be used as part of the overall baseline data package during operational and decommissioning activities.

3.12.3 Occupational Health and Safety

NRC regulates occupational health and safety risks to workers as a result of exposure to radiation mainly through the Radiation Protection Standards contained in 10 CFR Part 20. In addition to annual radiation dose limits, these regulations incorporate the principal of maintaining doses "as low as reasonably achievable" (ALARA), taking into consideration the purpose of the licensed activity and its benefits, technology for reducing doses, and the associated health and safety benefits. To comply with these standards, radiation safety measures are implemented for protecting workers at ISR facilities, ensuring radiation exposures and resulting doses are less than the occupational limits as well as ALARA.

Also of concern with respect to occupational health and safety are industrial hazards and exposure to nonradioactive pollutants, which for an ISR operation can include normal industrial airborne pollutants associated with service equipment (e.g., vehicles), fugitive dust from access roads and wellfield activities, and various chemicals used in the ISR process. Industrial safety aspects associated with the use of hazardous chemicals at the proposed Lost Creek ISR Project would be regulated under the State of Wyoming regulations and the Wyoming Occupational Safety and Health Administration Program. The type of chemicals and impacts are discussed in SEIS Section 4.13.

3.13 Waste Management

SEIS Chapter 2 describes the types and volumes of liquid and solid wastes that would be generated by the operation of the proposed Lost Creek ISR Project. The disposal options being considered include the use of a sanitary landfill for disposal of nonradioactive solid wastes and septic system solids, a licensed waste disposal site (or mill tailings facility) for byproduct material, deep disposal (UIC) wells for liquid effluents, and onsite septic systems (with leach fields) for sanitary wastewater. No mixed waste would be generated from implementing the alternatives. Based on information from LCI about the types of wastes that would be generated, NRC staff concludes that the proposed Lost Creek ISR Project would be classified as a Conditionally Exempt Small Quantity Generator (CESQG) of hazardous waste under the *Resource Conservation and Recovery Act* (RCRA). However, WDEQ will make the formal determination. SEIS Section 2.1.1.1.6 discusses the expected annual waste volumes that would be generated. This section describes the disposition of wastes the proposed Lost Creek ISR Project would generate.

3.13.1 Liquid Waste Disposal

Liquid wastes generated from operation of the proposed Lost Creek ISR Project would include sanitary wastewater, wastewater generated from well development and testing, and liquid effluent generated by the ISR process (liquid byproduct material). Sanitary wastes would be disposed of in two to three septic systems with leach fields and permitted by Sweetwater County. (LCI, 2009a)

A small volume of liquid hazardous wastes (used petroleum products and waste chemicals) is anticipated for the Lost Creek site. As a CESQG, the applicant could send any hazardous wastes generated at the proposed Lost Creek site to the Sweetwater County District #1 Landfill in Rock Springs. LCI has stated in its application that it would use a commercial contractor for used petroleum product recycling or energy recovery purposes, and would use a licensed disposal facility for chemical waste recycling or disposal. All liquid hazardous wastes would be

handled and disposed of in accordance with federal and state regulations governing hazardous waste (LCI, 2008a).

Except for well development and well test waters (which would be uncontaminated and could be discharged to the surface), remaining liquid effluent would be plant washdown water and production “bleed” wastes. These wastes would be disposed of in deep underground wells permitted under the Underground Injection Control (UIC) program WDEQ-WQD administers (LCI, 2010).

3.13.2 Solid Waste Disposal

Solid byproduct material (including radioactively contaminated soils or other media) that does not meet NRC unrestricted release criteria must be disposed of at a facility permitted to receive byproduct material. As described in Section 2.1.1.1.6.3, the proposed action would annually generate as much as 77 m^3 [100 yd^3] of solid byproduct material (that does not meet NRC criteria for unrestricted release) (LCI, 2010). The only existing facility in Wyoming that is licensed by NRC to accept byproduct material for disposal is the Pathfinder Mines-Shirley Basin uranium mill tailings impoundment in Shirley, Wyoming. Two other sites licensed to accept byproduct material for disposal are the EnergySolutions site in Clive, Utah, and the White Mesa uranium mill site in Blanding, Utah. The EnergySolutions facility, the largest licensed commercial low-level radioactive waste disposal facility, is in a remote area, located approximately 129 km [80 mi] west of Salt Lake City, Utah. The facility is permitted to receive byproduct material and mixed waste (combined radioactive and hazardous wastes). It is also permitted to receive soil, sludges, resins, dry active waste, and other radioactively contaminated debris. The facility is accessible by both rail and highway (EnergySolutions, 2009). Prior to operation, the applicant would be required by license condition to submit the solid byproduct material disposal agreement to NRC. This would ensure that there is sufficient capacity at the site for byproduct material disposal. LCI has not yet identified a preferred disposal site.

Solid wastes generated in Sweetwater County are managed by the Sweetwater County Solid Waste Disposal District (SWCSWD) #1, located in Rock Springs. SWCSWD #1 operates the largest landfill in the county. Under its current program, SWCSWD #1 handles municipal solid wastes (MSW), construction and demolition (C&D) wastes, and ISR wellfields wastes (nonradioactive waste, auto engines, electronic wastes, landscape wastes, and small amounts of household hazardous wastes). In addition, the landfill in Rock Springs has (i) a composting facility, (ii) a used materials warehouse (e.g., building materials), (iii) bulk disposal dropoff, (iv) used oil and batteries disposal, and (v) commercial tire disposal (Sweetwater County, 2010).

The Rock Springs Landfill (SWCSWD #1) has a capacity of 13.8 million m^3 [18 million yd^3] and accepts, on an average day, about 136 t [150 T] of waste {approximately 364 m^3/day [400 yd^3/day], at a compaction rate of about 260 kg/m^3 [750 lb/yd^3], without daily cover included}. The majority of the waste accepted is MSW (about 65 percent). The remaining waste (35 percent) is made up mostly of C&D wastes, with minor amounts of other wastes described previously (Sweetwater County, 2009b). This facility is in the process of permitting an additional 20.2 ha [50 ac] at the Rock Springs Landfill site. This additional capacity is anticipated to expand the life of the landfill 27 to 30 years (Sweetwater County, 2010).

LCI has stated, however, that it would most likely use the Carbon County Landfill in Rawlins (LCI, 2009a), less than half the distance from the Lost Creek site to the SWCSWD #1 Landfill. The landfill currently accepts 123 t [135 T] of MSW per week, and 136 t [150 T] per week of C&D waste. The Rawlins Landfill is 56 ha [140 ac] in size and has a useful life expectancy of 50

years, based on its current rates of waste disposal. The landfill does not accept liquid, industrial, or hazardous wastes. All wastes received at the landfill are disposed there, and no wastes are transferred to other facilities.

3.14 References

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4 ENVIRONMENTAL IMPACTS AND MITIGATIVE ACTIONS

4.1 Introduction

The Generic Environmental Impact Statement (GEIS) for *In-Situ* Leach Uranium Milling Facilities (NUREG–1910, NRC, 2009a) evaluated the potential environmental impact of implementing *in-situ* recovery (ISR) operations in four distinct geographic regions, including the Wyoming West Uranium Milling Region, where the proposed Lost Creek ISR Project is located. This chapter evaluates the environmental impacts from implementing the proposed action, including alternative wastewater disposal options, the No-Action alternative, and an alternative to ship dry yellowcake. Other alternatives considered for the proposed Lost Creek ISR Project, but eliminated from detailed analysis, included alternative site locations, alternate lixiviants, conventional uranium mining and milling, and conventional mining with heap leach processing as described in Section 2.2 of this SEIS.

This chapter analyzes the four lifecycle phases of ISR uranium extraction (construction, operations, aquifer restoration, and decommissioning/reclamation) at the proposed Lost Creek ISR Project consistent with the analytical approach used in the GEIS (NRC, 2009a). The results of the GEIS impact analyses for the Wyoming West Uranium Milling Region, as summarized in Table 1-1 of this supplemental environmental impact statement (SEIS), were used to focus the site-specific environmental review at the proposed Lost Creek ISR Project. If the GEIS concluded that there could be a wide range of impacts on a particular resource area (e.g., the impacts could range from SMALL to LARGE) then that resource area was evaluated in greater detail within this site-specific SEIS. The impact analysis is organized by resource area by ISR phase (i.e., construction, operation, aquifer restoration, and decommissioning). The primary source document supporting the impact analysis was LCI's (referred to herein as the applicant) license application (LCI, 2008 a,b).

NRC established a standard of significance for assessing environmental impacts in the conduct of environmental reviews, as described in the NRC guidance NUREG–1748 (NRC, 2003a), and summarized as follows:

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

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

Table 4-1 summarizes mitigative measures and best management practices (BMPs) the applicant has proposed to implement as part of the proposed action. These mitigative measures and BMPs are referred to in the discussion of each resource area throughout Chapter 4.

Table 4.1. Applicant-Identified Mitigation Measures

Resource Area	Mitigation Measure
TRANSPORTATION	Delivery truck drivers will possess appropriate licenses/certificates & submit to mandatory drug testing Delivery trucks transporting project materials will carry certificates of relevant safety inspections Implement driver safety & accident avoidance program Plow, maintain, and improve on-site & local roads as appropriate File internal near-miss or accident report; brief drivers on avoidance of such accidents Confine traffic to roadways wherever possible to mitigate soil compaction
SOIL	Reduce erosion by timely reclamation, installation of drainage controls, reseeding, and installing water bars across reclaimed areas Loosen soils to reseed and to mitigate soil compaction Stockpile and stabilize cleared topsoil prior to construction Implement Spill, Prevention, Control, & Countermeasure (SPCC) plan to minimize impacts from potential spills Regularly inspect erosion control installments, topsoil stockpiles, and reclaimed/revegetated areas to ensure success
WATER	Surface Water (SW) Limit soil compaction Conduct operations in accordance with standard operating procedures & SPCC plans Ensure that runoff from disturbed areas meets WYPDES permit guidelines for SW management & to reduce sediment volume Minimize erosion by implementing the following measures: contouring & revegetation to stabilize soils; placement of hay bales; engineered sedimentation breaks and traps; and water contour bars Prevent excessive erosion and control runoff through the use of diversion ditches, engineered culverts, & energy dissipaters Design features to mitigate SW impacts: silt fences, earthen dikes, drainage swales, sediment traps, check dams, straw bales, water contour bars, rip rap, grading & contouring, sediment basins, temporary/ permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, & preservations of mature vegetation Install culverts to maintain site surface drainage conditions Groundwater (GW) Install leak detection system Design and build two storage ponds to NRC standards to mitigate the likelihood of pond failure Lower pump level in affected BLM stock wells (if possible); deepen wells (if possible); and drill affected new wells to deeper sands that are not impacted by ISR operations

Table 4.1. Applicant-Identified Mitigation Measures (continued)

Resource Area	Mitigation Measure	
ECOLOGY	Reseed disturbed areas with approved seed mixtures Install temporary fencing to restrict access to reseeded areas until vegetation is reestablished Impose speed limits to reduce the risk of vehicular collision Implement best management practices (BMP) to minimize & mitigate impacts to wildlife (Refer to Appendix F for detailed BMPs)	
AIR QUALITY	Control fugitive dust emissions through: water spray, gravel application, or applying organic/chemical suppressants (also associated with transportation) Impose on-site speed limits to reduce dust Maintain engines and pollution-prevention equipment Encourage employee busing/car pooling (Potentially establish housing/man camp for workers) Revegetate disturbed areas to minimize soil loss and fugitive dust emissions	
HISTORICAL & CULTURAL	Conduct site evaluations in areas containing archaeological resources prior to development Prepare formal treatment plans to guide data recovery excavations Halt work immediately if unmarked or unrecorded artifacts are discovered over the life of the ISR project	
VISUAL & SCENIC	Use building materials and paint to blend with the natural environment Use low-profile structures to minimize number of vantage points Maintain a clean site	
WASTE MANAGEMENT	Reduce effluents by minimizing disturbance and reusing/recycling materials when possible Train employees to safely handle, store, decontaminate, and dispose of waste Implement Spill Prevention & Response Plans to help reduce the occurrence of accidental release and to provide appropriate action in the event of release Decontaminate radiological materials/equipment to NRC unrestricted release standards or remove for disposal at an NRC-licensed facility	Reduce generation of wastes and ensure proper storage, handling, and disposal Revegetate disturbed areas LIQUID WASTES Recover native GW during well development, sample collection, & pump testing Implement procedural & engineering controls such that storm water runoff will not pose potential pollution problem Dispose of waste petroleum products at an off-site permitted facility

Table 4.1. Applicant-Identified Mitigation Measures (continued)

Resource Area	Mitigation Measure	
	GASEOUS EMISSIONS & AIRBORNE PARTICULATES Maintain vehicles, standard operating procedures (SOP), and personal protective equipment (PPE) to reduce nonradioactive gaseous emissions Control fumes from the limited use of liquid chemicals with the use of lab hoods Restrict vehicular access and impose speed limits to minimize road dust from emissions; apply water spray, gravel, or organic/chemical dust suppressants	Treat and dispose of byproduct materials via UIC Class I wells Build concrete curb (berm) around processing plant to contain contents of largest tank in the event of a rupture (also mitigates soil impacts) Design and build storage ponds with impermeable synthetic liners and a leak detection system (also mitigates soil impacts) to provide temporary storage capacity for liquid byproduct material.
Source: LCI (2008a, b)		

4.2 Land Use Impacts

Environmental impacts on land use at the Lost Creek site could occur during all phases of the ISR facility's lifecycle. Impacts result from land disturbance during construction and decommissioning, from grazing and access restrictions, and from competing access for mineral rights. As described in the GEIS, much of the land in the Wyoming West Uranium Milling Region is unpopulated rangeland, Federally-owned and administered by the U.S. Bureau of Land Management (BLM). Most of the remainder of the land is publicly owned (by the State of Wyoming), with some land privately held. Land is used primarily for recreation, wildlife management, and mineral extraction (NRC, 2009a).

A detailed description of the environmental impact on land use from construction, operation, aquifer restoration, and decommissioning is provided in the following sections for the alternatives considered at the Lost Creek site.

4.2.1 Proposed Action (Alternative 1)

Lost Creek ISR, LLC (LCI, referred to herein as the applicant) is applying for a source material license to produce a wet yellowcake slurry from the ore body underlying the proposed project area. The project footprint, including the access roads to the project site, the processing plant, the six wellfields, and two storage ponds, would directly affect an estimated 115 ha [285 ac] of land within the proposed 1,705 ha [4,220 ac] Lost Creek ISR Project license area. The life of the proposed project would be approximately 12 years (see Figure 2-1). Lands within the proposed project area are owned and administered by the Federal (BLM) and State government.

4.2.1.1 Construction Impacts

GEIS Section 4.2.1.1 states that land use impacts during construction may occur from land disturbances (including alterations of ecological, cultural, or historic resources) and from access restrictions (including limitations on other mineral extraction, grazing, or recreational activities) (NRC, 2009a). The GEIS noted that land disturbances during construction would be temporary

and limited to small areas within permitted boundaries and further noted that changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the small size of restricted areas, the temporary nature of restrictions, and the availability of other land for these activities. In GEIS Section 4.2.2 (transportation), the NRC also concluded that, depending on site-specific conditions, 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). Of these potential transportation impacts, the loss of forage palatability from road dust an increase in livestock kills could affect local land use (i.e., grazing) activities. As summarized in SEIS Table 1-1, the GEIS concluded that most of the construction impacts on land use in the Wyoming West Uranium Milling Region would be SMALL and principally related to potential conflicts with other uses. Exceptions include those impacts to portions of land containing localized ecological, historical; and cultural resources which could range from SMALL to LARGE, and dust impacts on local grazing which could range from SMALL to MODERATE, depending on local conditions. (NRC, 2009a)

The GEIS conclusions that contributed to greater than SMALL impacts findings considered potential alterations to ecological, historic, and cultural resources. The impacts to these resources would be mitigated by careful planning and surveying to help identify resources and to avoid or mitigate impacts. For this SEIS the impacts on ecological and historic and cultural resources are discussed in Sections 4.6 and 4.9, respectively. SEIS Section 4.4 evaluates impacts on soil from surface disturbances. The following discussion assesses land use impacts at the proposed Lost Creek Project considering the proposed land disturbances associated access restrictions and transportation activities that could limit other mineral extraction, grazing, or recreational activities.

The construction phase of the proposed Lost Creek ISR Project would disturb approximately 115 ha [285 ac] over a 6–8 month period for construction of the processing plant and for 18–24 months for construction of each wellfield as shown in Figure 2-1 resulting in the removal of 23.5 ha [58 ac] of topsoil. Topsoil that was removed would be stockpiled in a designated area until reclamation activities commenced.

Construction of the processing plant would disturb a 4.0 ha [10 ac] area. A 14.8 km [9.2 mi], 6 m [20 ft] wide gravel access road would be constructed to link the proposed project area to the Wamsutter–Crooks Gap Road at the western edge of the proposed project area. The construction of the 6 planned production (wellfield, also referred to as a mine) units, which are estimated to encompass 99 ha [244 ac] of the disturbed area, would be phased as illustrated in Figure 2-1 of the SEIS. These areas (processing plant and wellfields) would be fenced off to grazing activities over the proposed project life.

The closest coal bed methane (CBM) exploration is located about 66 km [40 mi] southeast of the proposed Lost Creek site, while oil and gas exploration is located about 85 km [51 mi] to the east. Therefore, construction of the proposed ISR facility would have no impact on either CBM or oil and gas production, because these activities do not occur within the proposed project area. Recreational activities, such as hunting and off-road vehicle (ORV) exploration, would be restricted from wellfield and processing plant construction areas. Three BLM grazing allotments encompass all of the proposed project area {i.e., 1800 ha [4200 ac]}. Therefore, less than 1 percent of the area in the grazing allotments would be restricted from use during the ISR construction phase. Wild horses, prevalent in the Lost Creek area, would likely avoid both areas that were fenced and those where construction activity was occurring.

Dust generated by the proposed action could deposit on vegetation located outside construction areas and adjacent to untreated unpaved roads thereby potentially affecting grazing in certain areas. Potential impacts on grazing from road dust adjacent to access roads near the plant site would be limited by dust control measures required by the WDEQ construction permit (WDEQ, 2010a). More road dust would be generated from travel on untreated, unpaved roads located outside the range of the applicant's dust control measures (e.g., Wamsutter Road, County Road 22) (SEIS Section 4.7.1.1) and, therefore, these areas would be more likely to experience road dust accumulation potentially affecting grazing. To evaluate the possible extent of proposed road dust emissions (described and evaluated for air impacts in Sections 2.1.1.1.6.1 and 4.7 of this SEIS), the staff considered the analysis and findings of an expert panel convened to evaluate road dust in western states that concluded that typically only a fraction of resuspended particles are regionally transportable due to near source settling and impaction (Countess et al., 2001). Therefore, the NRC staff concludes the potential impacts on grazing from road dust deposition would be limited to small tracts of land in close proximity to the areas downwind of the unpaved and untreated portions of primary access roads. Overall, the NRC staff concludes that because the type of land use activities proposed at the Lost Creek ISR Project are similar to those evaluated in the GEIS and the area to be disturbed is at the low end of the range evaluated in the GEIS {50 to 750 ha [120 to 1,860 ac]}, grazing activities and recreational activities would be minimally affected at the site ,the NRC staff concludes the impact on land use during the construction phase would be SMALL.

4.2.1.2 Operations Impacts

As described in GEIS Section 4.2.1.2, land use impacts from operational activities would be similar to the impacts from the construction phase with respect to access restrictions because the infrastructure would be in place. No additional land disturbances would occur from conducting operational activities. Because the impact from either access restriction or land disturbances during operations would either be similar to or less than the SMALL impacts that would occur during construction, the GEIS concluded that overall potential impacts on land use from operational activities would be SMALL (NRC, 2009a). As noted previously, one potential exception during construction identified in the GEIS could be SMALL to LARGE impacts associated with the alteration, destruction, restriction, or access limitations to localized ecological, historical, and cultural resources. As concluded in the GEIS, however, other than the sequential development wellfields, which are addressed as a construction activity, ISR operations would not be expected to result in additional land disturbance or access restrictions (NRC, 2009a). Ecological impacts during operations at the proposed Lost Creek ISR Project are addressed in SEIS Section 4.6, and potential impacts to historical and cultural resources are addressed in SEIS Section 4.9. In GEIS Section 4.2.2 (transportation), the NRC also concluded that, depending on site-specific conditions, 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). Of these potential transportation impacts, the loss of forage palatability from road dust and increase in livestock kills could affect local land use (i.e., grazing) activities.

The primary difference between the ISR operation and construction phases at the proposed Lost Creek ISR Project would be the timing and magnitude of each phase. The applicant has estimated that operations at the proposed facility would last for approximately 8 years, versus the relatively short construction phase of 6 to 8 months to construct the processing plant and the 18 to 24 months to develop a wellfield. During the operations phase, the current land use would be limited within the fenced portions of the proposed project area such as the processing plant, storage ponds, and wellfields. However, because 3 grazing allotments cover 1,680 ha [4,200 ac] as described in SEIS Section 3.2.1 and the proposed action would result in fencing

99 ha [244 ac], less than 1 percent of the proposed project area would be restricted from grazing. Wild horses would tend to avoid areas of human disturbance. Public access for recreational activities, such as off-road exploration and hunting that occur within the proposed project area, would be limited during the operation of the ISR facilities. By the operations phase, the buildings would have been constructed and the storage areas would in use. Although additional well drilling and new two-track roads would be constructed, the disturbed area would be less than during the ISR construction phase. Because projected daily traffic would be similar to the construction phase (Sections 4.3.1.1 and 4.3.1.2), fugitive road dust emissions during the operations phase would be comparable to the emissions evaluated for the construction phase in Section 4.2.1.1 of this SEIS, and therefore the NRC staff conclude the potential impacts to grazing from dust deposition to land areas would be the same as described for the construction phase (SMALL).

The NRC staff concludes that the impact from ISR operations at the proposed Lost Creek ISR Project would be SMALL because the primary infrastructure would be in place, a small area (less than 1 percent of grazing allotments) would be restricted from grazing and recreational activities, road dust emissions and associated deposition to land areas would be similar to the construction phase, and other land use activities are similar to those considered in the GEIS. Furthermore, the land disturbance area at the proposed Lost Creek ISR site is at the low end evaluated in the GEIS.

4.2.1.3 Aquifer Restoration Impacts

GEIS Section 4.2.1.3 describes aquifer restoration impacts on land use. Because the same infrastructure would be used as during operations, land use impacts from aquifer restoration would be similar to, or less than, those from operations. The GEIS stated that as aquifer restoration proceeds and wellfields were closed, some operational activities would diminish. Therefore, the GEIS concluded aquifer restoration impacts on land use would be SMALL (NRC, 2009a). In GEIS Section 4.2.2 (transportation), the NRC also concluded that, depending on site-specific conditions, 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). Of these potential transportation impacts, the loss of forage palatability from road dust and increase in livestock kills could affect local land use (i.e., grazing) activities.

The applicant has estimated that aquifer restoration of each wellfield would occur over approximately a 3 year period as shown in Figure 2-1, covering a period of 9 years inclusive of all the wellfields. During aquifer restoration grazing and recreational activity would continue to be restricted from fenced areas as described in Section SEIS 4.2.1.2. The number of commuting workers required for aquifer restoration is reduced relative to the construction and operations phases and therefore potential road dust impacts on grazing from aquifer restoration activities would be reduced.

The NRC staff concludes the impact on land use from aquifer restoration at the proposed Lost Creek ISR Project would be SMALL because a small area (less than one percent of grazing allotments) would be restricted from grazing and recreational activities, road dust emissions and associated deposition to land areas would be reduced relative to the construction and operations phases, and the land use activities occurring around the proposed Lost Creek site are similar to those considered in the GEIS. Furthermore, the projected land area to be disturbed at the proposed Lost Creek ISR Project is at the low end evaluated in the GEIS.

4.2.1.4 Decommissioning Impacts

Decommissioning impacts on land use are described in GEIS Section 4.2.1.4. Land use impacts from decommissioning 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. Access restrictions could remain throughout the project area until decommissioning and reclamation are completed, although it is possible that a licensee could decommission and reclaim the site in stages so less land would have restrictions at one time. Reclamation of land to preexisting conditions and uses would mitigate long-term impacts. The GEIS concluded that impacts on land use during decommissioning would range from SMALL to MODERATE and would be SMALL when decommissioning and reclamation are completed (NRC, 2009a). In GEIS Section 4.2.2 (transportation), the NRC also concluded that, depending on site-specific conditions, 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). Of these potential transportation impacts, the loss of forage palatability from road dust and increase in livestock kills could affect local land use (i.e., grazing) activities.

At the proposed Lost Creek Project, the impact from dismantling and decontaminating the processing plant, roads, and support facilities would be consistent with the conclusions reached in the GEIS. The 115 ha [285 ac] of land potentially disturbed as part of the proposed action would be returned to its preextraction condition and available for other uses such as livestock grazing and wildlife habitat. The dismantling of the proposed project area would have impacts similar in scale to the construction phase. However, as decommissioning and reclamation progressed, the disturbed and fenced land area would decrease.

During decommissioning, the applicant would perform surface reclamation to return disturbed land to preextraction use and decommissioning equipment, materials, and structures (including piping) would be decontaminated, if necessary. Equipment decontaminated to levels consistent with NRC requirements would be released for unrestricted use. Equipment that could not be decontaminated would either be used onsite or sent to a licensed facility for disposal (LCI, 2008b). All production, injection, and monitoring wells and drillholes would be abandoned in accordance with applicable WDEQ-LQD rules and regulations (LCI, 2008b). Topsoil removed and stored as part of the proposed action would be replaced and areas reseeded, in particular where the header houses and roads had been removed and in the processing plant area. Disturbed surfaces would be graded to approximate preoperational contours and drainage patterns (LCI, 2008b). Permanent vegetation would be established on disturbed areas. The number of commuting workers required for decommissioning is reduced relative to the construction, operation, and aquifer restoration phases and therefore the NRC staff conclude the potential road dust impacts to grazing from decommissioning activities would be less than the dust impacts described in Sections 4.2.1.1, 4.2.1.2, and 4.2.1.3 of this SEIS.

NRC staff concludes that the land use impacts from decommissioning activities would be MODERATE until the reestablishment of vegetation in seeded areas. Once vegetation was reestablished in reclaimed areas, the land would be returned to a condition that would support a variety of land uses, such as wildlife habitat and livestock grazing. Therefore the NRC staff concludes the land use impacts from decommissioning would be SMALL.

4.2.2 No-Action (Alternative 2)

Under the No-Action alternative, the proposed Lost Creek Project would not be licensed. The current land uses, including grazing lands, and recreational activities, would continue. There would be no impacts on any of the current land uses from ISR development at Lost Creek. No construction, operation, aquifer restoration, or decommissioning activities would occur. Therefore, the 115 ha [285 ac] of land surface potentially disturbed by the proposed action would not be disrupted. No access restrictions would be in place to either limit grazing or wildlife usage. No wells would be drilled, no pipeline would be laid, and no access roads would be constructed. The land could be impacted by other activities occurring in the area. For example, the two herd management areas (HMAs), Lost Creek and Stewart Creek, currently have 45 and 28 active mining claims, respectively, that could be developed according to BLM (2009). The No-Action alternative would have no impact on land use from development of the ISR project at Lost Creek.

4.2.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, NRC would issue the applicant a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing resulting in dry yellowcake as the final product. This alternative differs from the proposed action by the addition of dryer equipment for the processing of dry yellowcake from a wet slurry. Because the dryer equipment would be installed in the processing plant (which would be constructed under the proposed action with a space allocated for drying equipment) at the Lost Creek site, the footprint of the processing plant would not differ from that of the proposed action. The dry yellowcake would be transported offsite from the Lost Creek site directly to Metropolis, Illinois, for ultimate processing into commercial fuel for nuclear reactors. While fewer dry yellowcake shipments would be made under Alternative 3 relative to the yellowcake slurry shipments under the proposed action (based on truck capacity), the overall number of vehicle miles traveled on the unpaved access roads and therefore the amount of estimated fugitive road dust generated would not be significantly different because the number of commuting workers for the two alternatives (the majority of daily traffic proposed) would be similar. The impact on land use from implementing Alternative 3 would be the same as for the proposed action (Alternative 1); therefore, the NRC staff concludes the impact would be SMALL.

4.3 Transportation Impacts

Potential environmental impacts from transportation to and from the proposed Lost Creek ISR Project could occur during all phases of the facility lifecycle. Impacts would result from workers commuting to and from the site and from the shipment of materials and chemicals on and off the site. Impacts could also occur from fugitive dust emissions, noise, incidental wildlife or livestock kills, increased traffic on local roads, and from accidents. Fugitive dust emissions are evaluated as land use (grazing) impacts in SEIS Section 4.2, ecological impacts in SEIS Section 4.6, and air quality impacts in SEIS Section 4.7, noise impacts are evaluated in SEIS Section 4.8, and the impact from livestock kills is considered in SEIS Section 4.6.1.1.2. Secondary impacts from fugitive dust emissions on grazing activities and wildlife that can include decreases in forage productivity and palatability and possible health impacts to livestock and wildlife considered in SEIS Sections 4.2 and 4.6.

A detailed description of the estimated environmental impacts from transportation to and from the proposed Lost Creek ISR Project during construction, operation, aquifer restoration, and decommissioning is provided in the following sections.

4.3.1 Proposed Action (Alternative 1)

4.3.1.1 Construction Impacts

The GEIS Section 4.2.2.1 concluded that low levels of traffic generated by ISR construction activities (relative to local traffic counts) would not significantly increase traffic or accidents on many of the roads in the region. Roads that currently experience low traffic counts could be moderately impacted by the additional worker commuter traffic during periods of peak employment. For these reasons, the GEIS concluded that transportation impacts during the construction phase could range from SMALL to MODERATE. (NRC, 2009a)

For the proposed Lost Creek ISR Project, the NRC staff considered the transportation network described in SEIS Section 3.3, and information provided in the license application (LCI, 2008a) and determined that most construction workers would travel to the proposed project area from Casper and Rawlins, the two largest cities in the region. This travel would involve driving on US 287 to Lamont, then west to Bairoil approximately 10 km [6 mi] on WY 73, then about 20 km [12 mi] west on CR 22 to Sooner Road (BLM #3215) to the proposed project area access road (SEIS Figures 4-1 and 4-2). The nearest residence to CR 22 is 275 m [300 yards]. The most direct route from the site to the nearest interstate highway (I-80) would follow the proposed west access road to Wamsutter Crooks Gap Road south to I-80.

As described in SEIS Section 2.1.1.1.7, during construction, the applicant estimated 30 to 35 light-duty trucks and 2 to 5 heavy-duty trucks would travel to and from the site each day. The NRC staff considered that if no carpooling was used the number of commuting workers could be as high as the projected construction workforce of 94 workers (SEIS Section 2.1.1.1.7). Because of the remote location of the site annual average daily traffic (AADT) counts are not available for those unpaved roads in proximity to the proposed project area. As described in SEIS Section 3.3 the nearest road with available data is SR 73, which enters Bairoil from US 287 at Lamont. This highway averages 230 vehicles per day. Assuming conservatively that all traffic approached the site using this road segment, a maximum number of 94 vehicles per day carrying out two-way trips would generate 188 one way trips. That level of traffic would constitute approximately an 82 percent increase in daily traffic along Bairoil Road. Based on the low levels of existing traffic the NRC staff concludes the increase would not overtax the capacity of the road; however, the increased traffic would increase wear and tear on the road surface and would generate fugitive road dust (SEIS Sections 4.2.1.1, 4.6.1.1, and 4.7.1.1). Project-related increases in traffic along larger roadways such as US 287 and I-80 (maximum AADT counts of 1,870 and 13,840, respectively) would be small and negligible.

Crash data for the proposed project area roadways was analyzed by the applicant (LCI, 2008a) and described in SEIS Section 3.2. According to documented crashes that occurred between 2002 and 2006, truck crashes rarely occur. For SR 73 (from Lamont to Bairoil), no truck crashes occurred during the study period. Based on the current crash rates and the estimated minimal increase in traffic volumes due to site development, no measurable increase in crashes on the area roadways would be expected.

Six wellfields are proposed for uranium extraction at the proposed Lost Creek ISR Project. The construction of the associated wellfields would be phased over time as shown in Figure 2-1 rather than simultaneously meaning that construction-related traffic would persist at the site for about 8 years. Road construction represents a long-term impact on land use in the proposed

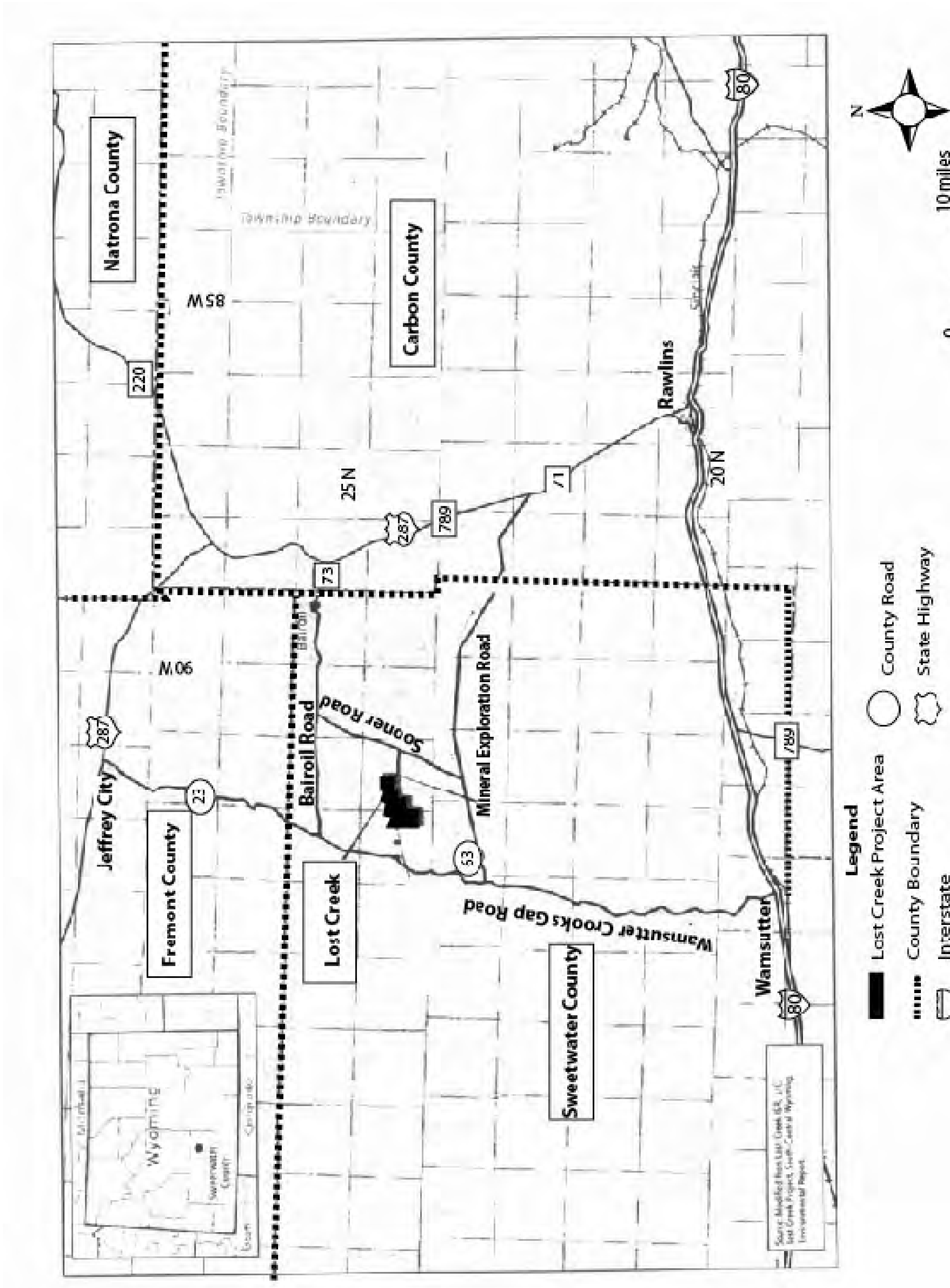

Figure 4-1. Area Roads
Source: Modified from LCI (2008a)

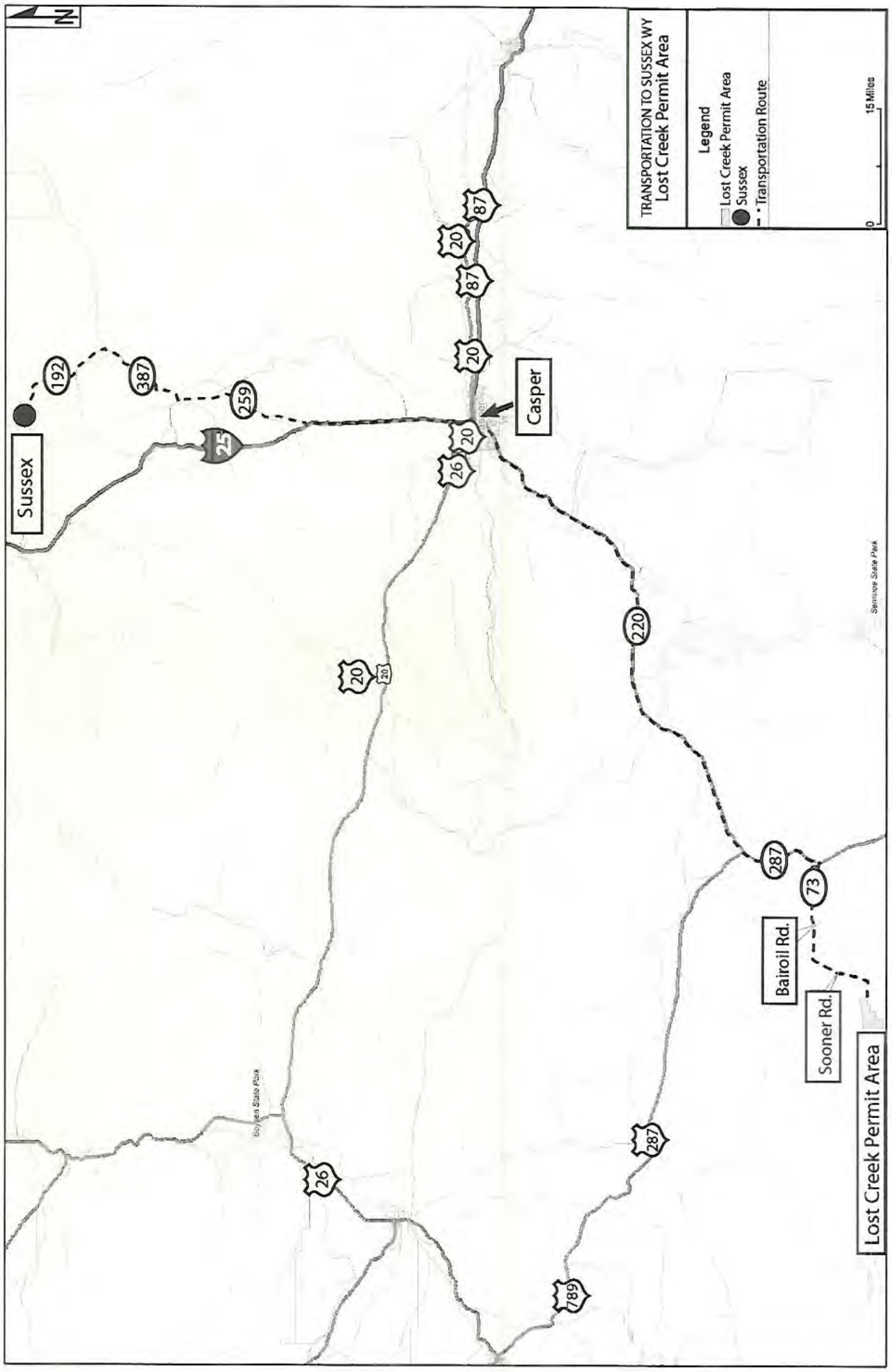

Figure 4-2. Regional Transportation Showing Drainages
Source: Modified From LCI (2008a)

project area, with approximately 7.8 ha [19.3 ac] being converted from rangeland to road surface. However, most of these impacts are temporary, as ISR operations are sequential and because of ongoing reclamation. All roads, except for those roads the BLM or the State of Wyoming specifically requested remain, would be reclaimed (see SEIS Section 4.3.2.4).

Based on the foregoing analysis, the NRC staff concludes that site-specific conditions are consistent with the assumptions stated in GEIS Section 4.2.1.2.

Potential impacts on wildlife and grazing from road dust adjacent to access roads near the plant site would be limited by dust control measures required by the WDEQ construction permit (WDEQ, 2010a). More road dust would be generated from travel on untreated, unpaved roads located outside the range of the applicant's dust control measures (e.g., Wamsutter Road, County Road 22) (SEIS Section 4.7.1.1) and, therefore, these areas would be more likely to experience road dust accumulation potentially affecting grazing and wildlife. The NRC staff concludes the transportation impacts during the construction phase of the proposed Lost Creek ISR Project would be SMALL.

4.3.1.2 Operation Impacts

As described in GEIS Section 4.2.2.2, during the operations phase, the low levels of facility-related traffic would not noticeably increase traffic or accidents except that local, less-traveled roads could be moderately impacted during periods of peak employment. The GEIS also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. The GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The probability of such accidents occurring was determined to be low because of the small number of shipments, comprehensive regulatory controls, and an applicant's use of best management practices (BMPs). For radioactive material shipments (yellowcake product, ion-exchange resins, waste materials), compliance with transportation regulations is expected to limit the radiological risk for normal operations. The GEIS concluded there would be a low radiological risk in the unlikely event of an accident. The use of emergency response protocols would also help to mitigate the consequences of severe accidents involving the release of uranium. The GEIS concluded the potential impacts from transportation during operations could range from SMALL to MODERATE. (NRC, 2009a)

For the proposed Lost Creek ISR facility, the operational transportation activities described in SEIS Sections 2.1.1.1.3.2.3, and 2.1.1.1.7 would occur over a planned 8 year period (Figure 2-1) and include the same activities evaluated in the GEIS, including employee commuting and truck shipments of: yellowcake product, chemicals and other supplies, and waste materials. These transportation activities could result in potential environmental impacts associated with traffic and additional risks from routine and potential accident conditions.

The potential impacts from the proposed operational activities on local and regional traffic would be low and bounded by the operational traffic evaluated in the GEIS (NRC, 2009a). The GEIS had assumed a workforce of 20 to 200 employees and operational trucking activity of approximately 2 trucks per day (NRC, 2009a). During the operations phase at the proposed Lost Creek ISR Project, the applicant's trip frequency to the proposed project area involves a workforce of employees commuting in 20 vehicles per day and heavy trucking activity ranging from 2 to 5 trucks per day (SEIS Section 2.1.1.1.7). If the NRC staff assume no carpooling is used by commuting workers, the number of commuting employees would be the same as the number of operations workers reported by the applicant; 89 individuals (SEIS Section 2.1.1.1.7).

The approximate trip frequency and resulting approximate increase in AADT counts on local highways from proposed operations transportation activities would therefore be less than the proposed transportation described in SEIS Section 4.3.1.1 for the construction phase. Because of the lower traffic volume relative to that evaluated for the construction phase, the NRC staff concludes the estimated traffic impacts during the operations phase of the proposed Lost Creek ISR Project would also be SMALL. Road dust and fugitive dust emissions generated by travel through the Town of Bairoil are described in SEIS Section 4.7 and impacts on land use and wildlife are addressed in SEIS Sections 4.2 and 4.6.1.1.1.2.

The potential radiological accident risk associated with yellowcake product shipments was previously evaluated in GEIS Section 4.2.2.2 which assumed there would be 34 to 145 yellowcake shipments per year at an ISR facility resulting in an accident risk of 0.04 and 0.003 latent cancer fatalities for the larger number of shipments, taking into account the accident probabilities and consequences (NRC, 2009a). Considering the maximum annual production rate of yellowcake slurry at the proposed Lost Creek ISR Project of 1 million pounds and an approximate capacity of 15,000 pounds for each yellowcake slurry shipment) (LCI, 2008a), the applicant estimates a maximum of approximately 70 shipments per year for the proposed action (or approximately one shipment every 5 days). The NRC staff considered the annual accident risk for the proposed shipments of yellowcake slurry would be less than that evaluated in the GEIS because: (i) the proposed wet yellowcake slurry would be less concentrated and less dispersible in air than the dry yellowcake evaluated in the GEIS; (ii) the shipment distance evaluated in the GEIS is considered bounding for potential yellowcake drying locations; and (iii) the number of proposed shipments at the Lost Creek site would be less than that evaluated in the GEIS. Therefore, the radiological accident risk associated with shipment of yellowcake slurry at the proposed Lost Creek ISR Project would be bounded by the GEIS analysis.

The NRC staff's review also considered that the risk of an accident involving a yellowcake slurry spill would be limited by the applicant's use of exclusive-use-only vehicles, properly licensed and trained drivers, and adherence to existing NRC transportation regulations in 10 CFR Part 71 and Department of Transportation regulations 49 CFR 171–189. The applicant staff would be the primary responders that would be responsible for cleaning up any spilled material at an accident site (LCI, 2008b). The applicant proposes to develop an emergency response manual that would include actions to limit and monitor the exposure to employees and members of the public in the event of an unplanned release (External Radiation Exposure Monitoring Program, LCI, 2008b). Employees would also be trained in how to respond to emergencies. All drivers transporting bulk quantities of licensed material would be familiar with the shipment and how to properly respond to accidents involving the material. Should a spill occur, yellowcake slurry would pour onto the ground surface and infiltrate into soil, but would not become airborne until the slurry dried thereby allowing time for emergency responders to assess and control the spread of spilled material. The viscosity of yellowcake slurry would reduce the chance of spill migration, and thereby reduce the potential for slurry to enter a waterway prior to containment. Based on the low calculated accident risks and the applicants proposed and required safety measures, the NRC staff concludes the environmental impact from transportation of yellowcake slurry during the operations phase of the proposed Lost Creek ISR Project would be SMALL.

The potential impacts from transportation of process chemical supplies were also evaluated in GEIS Section 4.2.2.2. The potential safety hazards associated with process chemicals the applicant intends to use for the proposed action (described in SEIS Section 4.13.1.2.3) were previously evaluated in the GEIS impact assessment in Section 4.2.11.2.4 (NRC, 2009a). These process chemicals include sodium carbonate (soda ash), sodium chloride (salt),

gasoline, diesel fuel, propane, oxygen, carbon dioxide, sulfuric acid, hydrogen peroxide, and hydrochloric acid.

Transportation risks associated with chemical shipments involve potential in-transit accidents. The process chemicals described in the applicant's proposal are commonly used in industrial applications, and their transport would be made in accordance with the applicable USDOT hazardous materials shipping regulations. If an accident occurred, spill response would be handled by emergency response procedures, although a spill of nonradiological materials would be reportable to the appropriate State agency, the U.S. Environmental Protection Agency, and the USDOT (NRC, 2009a). Spill material would be recovered or removed and the affected areas reclaimed resulting in no significant long-term environmental impact (public health impacts of chemical releases are discussed in SEIS Section 4.13). Therefore, the NRC staff concludes the environmental impact from transportation of process chemical supplies during the operations phase of the proposed Lost Creek ISR Project would be SMALL.

The potential radiological accident risk associated with byproduct material shipments would be SMALL based on the low number of annual shipments and the risks relative to concentrated yellowcake product shipments described previously and in the GEIS (NRC, 2009a). The applicant has estimated an annual production rate up to 77 m^3 [100 yd^3] during operations. Based on the use of roll-off containers with a nominal capacity of 15 m^3 [20 yd^3], the NRC staff estimate there would be five shipments annually to a licensed disposal facility.

Based on the small projected decrease in traffic during the operations phase, the low radiological risks from transportation accidents, and the applicants proposed safety practices as previously discussed, the NRC staff concludes that the overall impacts from transportation during the operation phase of the proposed Lost Creek ISR Project would SMALL.

4.3.1.3 Aquifer Restoration Impacts

GEIS Section 4.2.2.3 concluded that the magnitude of transportation activities during aquifer restoration would be lower than for the ISR construction and operations phases at an ISR facility. Aquifer restoration-related transportation activities would primarily be limited to supply shipments, waste shipments, onsite transportation, and employee commuting. The GEIS concluded that transportation impacts from the aquifer restoration phase would range from SMALL to MODERATE for the same reasons described previously for the operation phase. (NRC, 2009a)

The aquifer restoration activities at the proposed Lost Creek ISR Project would be the same as those described and evaluated in the GEIS. The rate of uranium recovery would gradually decrease throughout the aquifer restoration phase, and incoming supply shipments of process chemicals and the number of outgoing shipments of yellowcake slurry to offsite drying facilities would be reduced. Based on the applicant's description of proposed activities summarized in SEIS Section 2.1.1.1.7, the number of commuting employees would be less than during the operations phase (17 workers) and therefore the potential transportation impacts from commuting workers would be less than the impacts described for the operations phase in SEIS Section 4.3.1.2. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS, and the NRC staff concludes the impact from aquifer restoration phase of the proposed Lost Creek ISR Project would be SMALL.

4.3.1.4 Decommissioning Impacts

GEIS Section 4.2.2.4 concluded transportation activities and potential impacts during decommissioning would be similar to those described for the construction and operations phases of an ISR facility, except the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning would be lower than during the operations phase. The GEIS concluded the potential accident radiological risks from transportation during decommissioning would be bounded by the estimates of yellowcake transportation risk during operations based on the concentrated nature of the shipped yellowcake, the farther distance yellowcake is shipped compared to the waste destined for a licensed disposal facility, and the number of yellowcake shipments relative to byproduct material. The GEIS concluded the potential transportation impacts during decommissioning would be SMALL because of the reduced levels of transportation activities. (NRC, 2009a)

Transportation activities during decommissioning (SEIS Section 2.1.1.1.5) of the proposed Lost Creek ISR Project would be the same as those evaluated in the GEIS. These activities would include transporting construction equipment, workers, and waste material shipments to offsite disposal facilities. The volume of onsite traffic at the proposed Lost Creek ISR Project would be related to the need for radiological surveys, infrastructure inspection and decontamination, extraction of buried pipelines, well abandonment, reclamation of disturbed areas, removal of contaminated materials, and monitoring of the restored site. The state required road dust mitigation procedure to spray the facility access roads with water or chemical dust suppressants would limit the generation of fugitive dust from transportation activities, and dust impacts generated from transportation in the vicinity of the site would, therefore, be SMALL.

Waste materials generated during decommissioning would be segregated by type and transported offsite to approved disposal facilities. Nonhazardous solid waste would be shipped to the local landfill (Section 3.13.2) and solid byproduct material would be shipped to those facilities authorized to dispose of byproduct material. Based on the decommissioning waste volume estimates provided in the applicant's surety calculation (LCI, 2011) described in SEIS Section 2.1.1.1.6.3, approximately 26 percent of the total decommissioning solid waste would be suitable for disposal in a local landfill as nonhazardous solid waste while the remaining 74 percent would be considered byproduct material that would be transported and disposed of at a licensed facility such as the Pathfinder-Shirley Basin uranium mill site in Mills, Wyoming {171 km [106 mi] from the proposed site}; Energy Solutions low-level radioactive waste disposal site in Clive, Utah (678 km [421 mi] from the proposed site); or White Mesa uranium mill site in Blanding, Utah (826 km [513 mi] from the proposed site). Because the trip distance to these authorized facilities is less than that of transporting yellowcake to the conversion facility in Metropolis, Illinois {2,190 km [1360 mi]}, and the transported yellowcake is more concentrated, the inherent risks of an accident involving a uranium release would be lower than those discussed in SEIS Section 4.3.1.2.

The applicant proposes reclaiming all roads unless approval is granted for post-mine use (LCI, 2010b). The BLM would determine the eventual fate of the access roads built to connect Sooner Road and Wamsutter–Crooks Gap Road with the plant facility and the wellfields. Unless requested or approved by BLM to do otherwise, the applicant would reclaim these access roads including removal of culverts, removal of road surfacing materials, recontouring as necessary, preparation of the seedbed, and reseeding. The state would be involved in decisions regarding reclamation of roads that may exist on state managed lands.

Unimproved roads may require scarification, ripping, or disking to reduce compaction before seed application.

As described in SEIS Section 2.1.1.1.7, the volume of heavy truck traffic during the decommissioning phase of the proposed Lost Creek ISR Project is expected to be dominated by shipments of materials for offsite disposal. The annual volume of these shipments estimated by the NRC staff based on the applicants surety information (LCI, 2011) is slightly higher but comparable to the volume evaluated in the GEIS (175 annual shipments for the proposed action compared to 144 in the GEIS or approximately one shipment every 2 days assuming a 5 day week). The applicant's proposed number of commuting workers during the decommissioning phase described in SEIS Section 2.1.1.1.7 (11 workers) would be less than the number of commuting workers during the construction phase (90 workers total); however, the average daily traffic generated during the decommissioning phase would still be predominantly from commuting workers. The resulting 22 one-way commuting trips per day would be a small proportion of traffic on all roads considered in the analysis, therefore, the potential traffic impacts during the decommissioning phase would be SMALL.

Another potential transportation impact from the proposed decommissioning activities is the radiological risk from the transportation of byproduct material for offsite disposal. The NRC staff considers the potential radiological accident risk associated with byproduct material shipments would be low based on the calculated risks from concentrated yellowcake product shipments discussed previously in Section 4.3.1.2 and in GEIS Section 4.2.2.2. Analysis of the staff's annual waste volume estimate calculated from the applicant's surety (SEIS Section 2.1.1.1.6.3) shows that the majority (approximately 88 percent by volume) of this material would be facility demolition materials and infrastructure equipment such as wellfield piping. Relative to powdered yellowcake, this material would be less concentrated and in a form that would be less dispersible (i.e., less likely to cause public exposure if released from a transportation vehicle) and easier to clean up if an accident involving release were to occur. The applicant proposes to implement additional BMPs to reduce the risk of accidents as summarized in Table 4-1 including (i) safe driving and emergency response training for personnel and truck drivers, (ii) mandatory drug testing program, and iii) safety inspections. The applicant also proposes to plow and maintain, and improve, as appropriate, on-site and local roads (LCI, 2008a). All shipments would be required to comply with applicable U.S. Department of Transportation regulations governing the transportation of radioactive material (including quantity limits, packaging requirements, and conveyance dose rate limits).

Because of the low estimated traffic from the decommissioning phase of the proposed Lost Creek ISR Project relative to existing road traffic volume in the region surrounding the site, the NRC staff concludes the potential traffic related transportation impacts would be SMALL. The low radiological risk from potential transportation accidents in comparison to the accident risks evaluated for the operation phase (i.e., no interstate transport of yellowcake product) supports the staff's conclusion that the radiological risks from transportation of decommissioning byproduct material for offsite disposal would also be SMALL.

4.3.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in existing traffic flows, routings, service levels, or the integrity of the road surfaces and profiles associated with the proposed project. There would be no transportation of materials to and from the site to support licensed activities. There would be no transportation of either radioactive or solid waste attributable to the proposed action because the facility would neither be licensed nor constructed and

operated. Traffic volumes associated with current land use activities such as cattle ranching and recreational activities would continue into the future. This alternative would have no additional impact on transportation.

4.3.2.1 Construction Impacts

Construction activities under Alternative 3 would be similar to construction activities for the proposed action. The physical components of the ISR facility would be the same as described in the proposed action, with the exception of the addition of a yellowcake dryer in the processing plant. Because the processing plant would be designed to house a yellowcake dryer under the proposed action (Alternative 1), the addition of the dryer equipment would not change the footprint of the ISR facility. Additional tractor trailer traffic, however, would be required to supply parts for the yellowcake dryer, but traffic counts for heavy trucks would remain within the range of two to five per week. For the purpose of evaluating potential impacts, the proposed local and regional routes for incoming and outgoing traffic, the number of commuting workers, traffic counts, and vehicle types would be the same as for the proposed action. Therefore, construction phase transportation impacts under this alternative would be similar to those described previously in SEIS Section 4.3.1.1 for the proposed action and SMALL.

4.3.2.2 Operation Impacts

The operational transportation activities and the environmental impacts under Alternative 3 would be the same as described for the Proposed Action (SEIS Section 4.3.1.2), however, the addition of a yellowcake dryer in the processing plant would result in shipments of dried yellowcake rather than yellowcake slurry. This would result in a net reduction in yellowcake transportation as more dried yellowcake can be loaded on a truck compared to yellowcake slurry and dry yellowcake shipments would go directly from the proposed Lost Creek ISR Project to the finished product destination (e.g., conversion facility) compared to the proposed action which would ship slurry to a drying facility and then to the finished product destination. Considering a maximum annual production rate of yellowcake at the proposed Lost Creek ISR Project of 1 million pounds (LCI, 2008a), and an approximate capacity of 40,000 pounds for each yellowcake shipment (NRC, 2009a), the NRC staff estimated a maximum of 25 shipments per year for the proposed action (or approximately one shipment every 15 days) compared to the 70 annual shipments of slurry estimated for the proposed action (SEIS Section 4.3.1.2). As described in SEIS Section 4.3.1.2 for the proposed action, yellowcake transportation risk was evaluated in the GEIS Section 4.2.2.2 assuming shipment volumes ranging from 34 to 145 yellowcake shipments per year, and concluded the accident risk ranged from 0.04 and 0.003 latent cancer fatalities for the larger number of shipments (NRC, 2009a). The NRC staff concludes the GEIS analysis bounds the annual accident risk for the proposed shipments of yellowcake and therefore, the radiological accident risk for the proposed yellowcake transportation under Alternative 3 would be SMALL.

The safety precautions and security measures described for the proposed action in SEIS Section 4.3.1.2 also apply to transportation of dried yellowcake drums under Alternative 3. These include: (i) using exclusive-use shipments and properly licensed and briefed drivers; (ii) compliance with existing NRC transportation regulations; (iii) strict adherence to the applicant's Security Plan; (iv) employee training regarding contamination and spill control and security and emergency procedures; (v) implementation of an emergency response plan (ERP) (as required); and (vi) routine road maintenance.

Because transportation activities under Alternative 3 would be similar to or bounded by the impacts from the proposed action, the NRC staff concluded the impact would be SMALL. Based on the small increase in estimated traffic during the operations phase, the low and manageable risks associated with yellowcake, chemical, and waste transportation, and the applicants proposed mitigation measures as summarized in SEIS Table 4-1, the impacts from the operation phase under Alternative 3 would be SMALL.

4.3.2.3 Aquifer Restoration Impacts

Potential transportation impacts during the aquifer restoration phase under Alternative 3 would be the same as described for the proposed action (SEIS Section 4.3.1.3) with the addition and continuation of dried yellowcake transportation (evaluated for the operations phase in SEIS Section 4.3.3.2). The amount of dried yellowcake transportation would diminish as aquifer restoration progressed and the amount of uranium removed from circulated groundwater decreased. Therefore, transportation impacts from the aquifer restoration phase of the proposed Lost Creek ISR Project would be SMALL.

4.3.2.4 Decommissioning Impacts

Potential transportation impacts during the decommissioning phase under Alternative 3 would be the same as described for the proposed action (SEIS Section 4.3.1.4). A small increase in trucking associated with removal of drying equipment and related building materials would occur, but would not significantly change the magnitude of annual trucking activity. Based on the foregoing analysis, the NRC staff concludes the site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, transportation impacts from the decommissioning phase of the proposed Lost Creek ISR Project would be SMALL.

4.4 Geology and Soils Impacts

Environmental impacts on geology and soils can occur during all phases of the proposed Lost Creek ISR Project lifecycle. However, the impact on soils would occur largely during the construction phase of the proposed project when most of the earthmoving and well drilling would occur.

4.4.1 Proposed Action (Alternative 1)

4.4.1.1 Construction Impacts

As presented in GEIS Section 4.2.3, during construction of ISR facilities, the principal impacts on geology and soils would result from earthmoving activities. Earthmoving activities that could impact soils include the clearing of ground or topsoil and preparing surfaces for the processing plant, satellite facilities, pumping and distribution houses, access roads, drilling sites, and associated structures. Similarly, excavating and backfilling trenches for pipelines and cables could impact soils at an ISR facility. (NRC, 2009a)

The GEIS further stated that the impact on geology and soils from construction activities depends on local topography, surface bedrock geology, and soil characteristics and concluded that the impact on soils would be SMALL if less than 15 percent of the permitted site area would be affected. Furthermore, the GEIS stated that ISR facility operators typically adopt best management practices to prevent or substantially reduce soil impacts. (NRC, 2009a)

Finally, the GEIS stated that ISR milling activities would neither remove rock matrix nor structure. Therefore, no subsidence from the collapse of overlying rock strata into the extraction zone would occur, which could happen in conventional underground mining operations. (NRC, 2009a)

Within the proposed project area, 115 ha [285 ac] or less than one percent of the proposed license area would be disturbed by the proposed action during construction of the processing plant facilities, wellfields, and access roads. Potential impacts to soils include soil loss, sedimentation, compaction, increased salinity, loss of soil productivity, and soil contamination. Soils in the proposed project area would be affected by clearing vegetation, excavating, leveling, stockpiling, compacting, and redistributing soils during construction and, later, during reclamation. Some of these disturbances are short term (temporary, minor) (e.g., construction of mud pits, pipelines, and two-track roads; installation of power lines and fences) and long-term disturbances to the soil would result from construction of primary and secondary roads, header houses, and lay-down areas. Although of short duration, the installation of mud pits would result in a short-term impact. The applicant considered using either portable tanks or tubs to contain drilling mud and other fluids instead of mud pits, but determined that this alternative would be uneconomical and impractical due to the anticipated volume of mud (LCI, 2008a). The longer term disturbances would be of short duration (over the life of the project) because most of the affected site would be restored and reclaimed after the site had been decommissioned (LCI, 2008a). The applicant proposes reclaiming all roads unless approval is granted for post-extraction use (LCI, 2008b). The applicant's proposal includes 4.48 ha [11.1 acres] of road (LCI, 2008a) which is approximately 4 percent of the proposed 115 ha [285 acres] of surface disturbance (LCI, 2008a). Wind erosion could occur in the proposed project area because most of the soils in the proposed project area have a high percentage of silt, which can generate dust emissions from travel on unpaved roads. The applicant has proposed to remove vegetation only where it is necessary and to mitigate wind erosion by using such techniques as surfacing roads with gravel, limiting traffic speeds, watering unpaved roads, spreading soil binding agents, and implementing timely reclamation (LCI, 2008b).

The applicant stated in the license application that water erosion would not be likely in the proposed project area because of very low (flat) surface slopes, the limited amount of precipitation, and the lack of perennial and intermittent streams (LCI, 2008a). Soil loss from increased erosion after vegetation removal would be reduced by performing timely reclamation, installing drainage controls and reseeding, and installing water bars across reclaimed areas as summarized in Table 4-1of the SEIS. The NRC staff reviewed the information provided by the applicant and agrees that due to the flat surface and the limited precipitation soil loss would be minimal.

Construction activities could also compact soils due to heavy trucks driving over bare soils. However, because the topsoil is sandy at the proposed project site, this would help to minimize compaction. Compaction of soils could decrease infiltration, promoting and increasing runoff. The applicant proposed to disk and reseed soils compacted during construction activities as soon as possible following use (LCI, 2008a).

Based on the limited construction that would affect less than 1 percent of the proposed project area, the applicant's proposal to remove and stockpile soils, the applicant's plan to minimize vegetation removal, and the implementation of the BMPs discussed previously and summarized in Table 4-1 of the SEIS, the NRC staff concludes the impact from construction activities on geology and soils at the proposed Lost Creek ISR Project would be SMALL.

4.4.1.2 Operation Impacts

As described in GEIS Section 4.2.3.2, during ISR operations, a nonuranium-bearing (barren) solution, or lixiviant, is injected through wells into the mineralized zone. The lixiviant moves through the pores in the host rock, dissolving uranium and other metals. Production wells withdraw the resulting "pregnant" lixiviant, which now contains uranium and other dissolved metals, and pump it to a processing plant or to a satellite processing facility for further uranium recovery and purification. (NRC, 2009a)

The removal of uranium from the target sandstones during ISR operations would result in a permanent change to the chemical composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones, deep below the ground surface, does not remove rock matrix or structure, and therefore no significant matrix compression or ground subsidence is expected. Therefore, the GEIS concluded impacts on geology from ground subsidence at ISR projects would be SMALL. (NRC, 2009a)

GEIS Section 4.2.3.2 further notes that soils could be affected by ISR operations from the transfer of barren and pregnant uranium-bearing lixiviant to and from the processing facility in aboveground and underground pipelines. If a pipe ruptures or fails, lixiviant could be released and: (i) pond on the surface; (ii) run off into surface water bodies; (iii) infiltrate and adsorb in overlying soil and rock; or (iv) infiltrate and percolate to groundwater (NRC, 2009a). In the case of spills from pipeline leaks and ruptures, licensees would be required to establish immediate spill response actions through onsite standard operation procedures. As part of the monitoring requirements at ISR facilities, licensees must report certain spills to NRC within 24 hours. Licensees in the State of Wyoming must also comply with applicable Wyoming Department of Environmental Quality (WDEQ) requirements for spill response and reporting.

Additionally, depending on the method of disposal for process-related liquid effluents, failure of a storage pond liner or embankment system could impact soils. Licensees would construct and monitor storage pond liners and embankments in accordance with NRC-approved plans, and licensees would obtain the appropriate permits from state regulatory agencies to conduct regular soil monitoring. Such actions would mitigate the impacts on soils from these storage or disposal methods. (NRC, 2009a)

Based on these considerations, GEIS Section 4.2.3.2 concluded that the impact on soils from spills during operations could range from SMALL to LARGE, depending on the chemical composition of the liquid spilled and the volume of soil affected by the spill. Because of the requirement for immediate response at ISR facilities, spill recovery actions, and routine monitoring programs, the GEIS concluded the impacts from spills would be temporary, and the overall long-term impact on soils would be SMALL. (NRC, 2009a)

Potential tank, pipeline, and pond failures are described in the application (LCI, 2008b, Sections 7.4.1, 7.4.2, and 7.4.3). Because the tanks would be contained within the processing plant at the proposed Lost Creek ISR Project, this design would prevent releases to soil from tank failure. The design and monitoring of the storage ponds and pipelines should similarly limit a potential release to soil from these structures. During operations, the applicant would have in place a program to monitor wellfield and pipeline flow and pressure as described in SEIS Section 6.3.2. This program is designed to ensure the timely detection of releases from pipeline breaks or ruptures and to minimize the volume of a potential release. However, if a pipeline release occurred that represented an environmental concern, the applicant would survey the affected area and remove and dispose of contaminated soils according to NRC and/or state

regulations. The applicant would also bury pipelines 1.5 to 1.8 m [5 to 6 ft] below ground surface (bgs), below the frost line, and use pipelines constructed of a corrosion-free HDPE material. Consequently, the probability of such a failure, after the pipelines have been tested and placed into service, would be low. The storage ponds would be constructed with a liner and leak detection systems, and these systems would be monitored daily. In the event a leak was detected, the fluid in the compromised unit would be transferred to the second pond, and the liner would be repaired as need. The pond area would be surveyed and reclaimed as part of the final reclamation, eliminating any long-term impact (LCI, 2008a).

No significant matrix compression or ground subsidence would be expected during operations, and it is unlikely that the pressure induced by the proposed ISR operations would reactivate the fault. There are documented cases where fluid withdrawal or injection has affected fault transmissivity resulting in small earthquakes when the change of reservoir pressure was on the order of 450 to 2,275 kg [1,000 to 5,000 lb] per square inch (psi) or higher. However, operations at the proposed Lost Creek ISR Project would induce only small pressure changes {e.g., approximately 23 to 68 ksi [50 to 150 psi]}. The NRC safety evaluation also considered the influence of the fault on groundwater flow during operations and, based on modeling results, determined that the fault will act as an adequate hydrogeologic barrier (see SEIS Section 4.5.2).

Based on these considerations, the estimated environmental impacts on soils from spills during operation at the Lost Creek ISR Project could range from SMALL to LARGE, depending on the chemical composition of the liquid spilled and the volume of soil affected by the spill. However, because the area of soil disturbance or ground subsidence would be minimal and no significant matrix compression or ground subsidence would be expected from the small pressure changes during operation, and the applicant’s implementation of a spill recovery and response plan as summarized in Table 4-1, and implementation of the applicant’s routine monitoring programs described in SEIS Chapter 6, the NRC staff concludes the impacts from spills would be temporary and the long-term impact on soils would be SMALL.

4.4.1.3 Aquifer Restoration Impacts

GEIS Section 4.2.3.3 described aquifer restoration, which typically uses a combination of: (i) groundwater transfer; (ii) groundwater sweep; (iii) reverse osmosis, permeate injection, and recirculation; (iv) stabilization; and (v) water treatment and surface conveyance. The groundwater sweep and recirculation processes do not remove rock matrix or structure, and therefore no significant matrix compression or ground subsidence would be expected. The water pressure in the aquifer is decreased during restoration. A negative water balance is maintained in the wellfield being restored to ensure water flows into the wellfield from its edges, thus reducing the potential spread of contamination. However, the change in pressure is limited by recirculation of treated groundwater, and therefore it is unlikely that ISR operations would reactivate any local faults and extremely unlikely that any earthquakes would be generated Therefore, the GEIS concluded the estimated impacts on geology and soils in the Wyoming West Uranium Milling Region, where the Lost Creek ISR site is located, from aquifer restoration would be SMALL. (NRC, 2009a)

GEIS Section 4.2.3.3 concluded that impacts to soils from spills during aquifer restoration could range from SMALL to LARGE, similar to the ISR operations phase, depending on the chemical composition of the liquid spilled and the volume of affected soil. Because of the requirement for immediate response at ISR facilities, spill recovery actions, and routine monitoring programs, the GEIS concluded the impacts from spills would be temporary, and the overall long-term impact to soils would likely be SMALL. (NRC, 2009a)

The same spill and leak-detection program used during operations would be used during restoration. Similarly, an applicant would be required to conduct the same spill response and cleanup program during restoration as required during operations (GEIS Section 4.2.2.2). Consequently, the impact on soils from spills and pipeline leaks during aquifer restoration would be similar to that described for the operations phase of an ISR project. (NRC, 2009a)

ISR milling activities during aquifer restoration at Lost Creek would not remove rock matrix or structure. No significant matrix compression or ground subsidence would be expected because the net withdrawal of lixiviant (bleed) would be typically 1 percent or less. No subsidence would result at the site from the collapse of overlying rock strata into the extraction zone during the restoration phase because the target extraction zone occurs within approximately 213 m [700 ft] below the ground surface. Similarly, the fault would not be affected during aquifer restoration as described in SEIS Section 4.4.1.2. Therefore, the NRC staff concludes the impact on the subsurface geology would be SMALL.

Because of the applicant's implementation of instrumentation and monitoring to prevent and correct spills, and the applicant's development of a spill response plan for wellfield spills to address procedures for notification, spill containment and recovery, post-spill sampling and cleanup and reporting as summarized in Table 4-1 and implementation of the routine monitoring programs described in SEIS Chapter 6, the NRC staff concludes the impacts from spills would be temporary, and the overall long-term potential impact on soils during the ISR aquifer restoration phase at the proposed Lost Creek ISR Project would be SMALL.

4.4.1.4 Decommissioning Impacts

GEIS Section 4.2.3.4 described the decommissioning phase of ISR facilities as including: (i) dismantling process facilities and associated structures; (ii) removing buried piping; and (iii) plugging and abandoning wells using accepted BMPs. The main impacts on geology and soils at an ISR facility during decommissioning would be from activities associated with land reclamation and cleanup of contaminated soils. (NRC, 2009a)

As further noted in the GEIS, before decommissioning and reclamation activities began, a licensee would be required to submit a decommissioning plan to NRC for review and approval. Any areas potentially impacted by operations would be included in surveys to ensure all areas of elevated soil concentrations are identified and properly cleaned up to comply with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6(6). Additionally, a goal of reclamation is to return a site to preproduction conditions through the return of topsoil and reestablishment of vegetative communities. (NRC, 2009a)

The GEIS concluded that most of the impacts on geology and soils associated with decommissioning would be detectable but SMALL. Disruption and/or displacement of existing soils would be relatively slight. Changes in the area and locations of impervious surfaces would be measurable but not be large enough to noticeably alter existing natural conditions. Mitigation could be needed to offset adverse impacts but would be relatively simple to implement and would likely be successful. (NRC, 2009a)

The proposed surface reclamation and decommissioning activities planned for the proposed Lost Creek ISR Project would restore lands disturbed by the milling project to their preextraction land use of livestock grazing and wildlife habitat. The applicant has stated that tanks, filters, ion exchange columns, pipes, pumps, processing buildings, administrative buildings, shipping areas, deep disposal wells, buried pipes, culverts, and roads would be reclaimed and

decommissioned. The applicant proposes reclaiming all roads unless approval is granted for post-extraction use (LCI, 2008b). The applicant's proposal includes 4.48 ha [11.1 acres] of road (LCI, 2008a) which is approximately 4 percent of the proposed 115 ha [285 acres] of surface disturbance (LCI, 2008a). Buildings and structures would be decontaminated to regulatory standards and either demolished and trucked to a disposal facility or turned over to the landowner (e.g., BLM), if desired. Baseline or prereclamation soils and vegetation radiological data would be used to guide final reclamation activities, which would consist of well abandonment, excavation of buried pipe, topsoil replacement, and the reestablishment of vegetation. The final decommissioning plan would be sent to NRC for review and approval approximately 12 months prior to initiation of decommissioning. The NRC safety evaluation describes in more detail reclamation and decommissioning actions.

While there could be short-term impacts as reclamation progressed, the outcome of these activities would be to return the proposed project area to its preextraction land use. Should selected roads be approved for continued use beyond the duration of the Lost Creek ISR Project, these roads would represent a small fraction of the land area disturbed by the proposed project and the NRC conclude would constitute a small incremental addition to the existing road network in the region. Based on the foregoing analysis, the NRC staff concludes the impact on soils and geology from decommissioning would be SMALL.

4.4.2 No-Action (Alternative 2)

Under the No-Action alternative, there would neither be change s to existing soil and/or topographic and geologic conditions at the proposed project area nor in the region from the proposed action because no license would be issued. No buildings would be constructed; no wells would be drilled; none of the six wellfields would be developed, including the laying of pipeline to connect the wellfields to the processing plant; therefore, no soils would be disturbed by earthmoving activities. No fluids would be injected into the subsurface.

Grazing and other land use activities (mineral exploration, recreation, and hunting) ongoing in the area could impact the soils, but there would be no impact from the proposed action.

4.4.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the applicant would be issued a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling, but the recovered uranium would be processed into a dry powder instead of yellowcake slurry. Because this process would occur in the same processing plant designed for the proposed action covering the same footprint, the environmental impact on geology and soils would be the same as described for Alternative 1 (the proposed action). Consequently, the NRC staff concludes the environmental impact on geology and soils from implementing Alternative 3 would be SMALL.

4.5 Water Resources Impacts

4.5.1 Surface Waters and Wetlands Impacts

Potential environmental impacts on surface water at the Lost Creek site may occur during all phases of the ISR facility lifecycle. Impacts can result from road construction and crossings, erosion runoff, spills or leaks of fuel and lubricants, discharges of storm water and process-related fluids, and discharge of wellfield fluids as a result of pipeline or well head leaks.

This section focuses on the potential impacts to surface waters. No wetlands occur in or around the proposed Lost Creek ISR Project area that could be impacted by the proposed action or any alternatives. Detailed discussion of the estimated environmental impacts on surface water from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.5.1.1 Proposed Action (Alternative 1)

4.5.1.1.1 Construction Impacts on Surface Waters and Wetlands

As described in the GEIS Section 4.2.4.1.1, potential impacts to surface waters from construction involve road crossings, filling, erosion, runoff, and spills or leaks of fuels and lubricants from construction equipment. These impacts, should they occur, would be mitigated through proper planning, design, construction methods, and BMPs. These occurrences would be mitigated through proper planning and design, the use of proper construction methods, and the implementation of BMPs. Spills of petroleum products or hazardous chemicals into surface waters or related habitats must be reported to WDEQ. The GEIS considered changes to stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase is complete. Additionally, while impacts from incidental spills of drilling fluids into local streams could occur, they would also be expected to be temporary due to the implementation of monitoring equipment. The GEIS concluded that potential impacts to surface water from construction of an ISR facility are expected to be SMALL. Should an ISR facility require a permit from the USACE, then the facility could have MODERATE impacts (NRC, 2009a).

On August 10, 2010, the USACE provided its determination that the ephemeral channels in the area of the proposed Lost Creek site are not considered “Waters of the U.S.” Therefore, the surface waters are not jurisdictional, and the USACE does not require any permits or approvals (USACE, 2010). The NRC staff determined that impacts on surface water and wetlands from storm water runoff from roads, parking areas, and buildings would be SMALL based on the absence of jurisdictional wetlands, surface water, and the applicant’s proposed use of BMPs.

Primary disturbances to the ground surface occurring during the construction phase include wellfield drilling, road and facility construction, and pipeline installations. Construction-related disturbances would occur within small areas relative to the overall proposed project area, and over a relatively short duration. Table 4-1 summarizes applicant-proposed mitigation measures for soils and surface water described below. Most construction work would occur during the summer and fall months when the ephemeral channels are dry.

<u>Roads</u>: The applicant’s proposal includes 4.48 ha [11.1 acres] of road (LCI, 2008a) which is approximately 4 percent of the proposed 115 ha [285 acres] of surface disturbance (LCI, 2008a). An existing and relatively well-traveled two-track road (Lost Creek Road) traverses the proposed project area from Wamsutter–Crooks Gap Road to Sooner Road and would be improved for heavy truck usage. The applicant proposes reclaiming all roads unless approval is granted for post-extraction use (LCI, 2008b). Additional details regarding Lost Creek Road are provided in SEIS Section 2.1.1.2.3. Other, temporary access roads would also be constructed to provide access to the wellfields for the drill rigs. The proposed road network would cross ephemeral channels at a minimum of seven locations (SEIS Figure 4-2). Two existing crossings would be improved and five new crossings would be constructed. The crossing design would be the minimum width necessary (using BLM standards) for safe vehicular traffic. Crossings (without culvert use), where feasible, would occur at the natural streambed elevation,

perpendicular to flow, and without the use of fill material. Steeply incised channel banks may be graded to create gently sloping approaches to these channel crossings. Proper sedimentation and erosion control, such as silt fences and hay bales, would be installed to minimize sedimentation into the channels, and disturbed soil would be reseeded.

Temporary disturbances to the soil from vehicular passes may cause some sediment transport during periods of surface flow (storm water runoff). However, the amount of sediment transport would likely have a negligible effect on the stability of the channel and water quality. Accidental spills of petrochemicals such as oil and gas would be mitigated by routine vehicle maintenance and inspection. In addition to applying for a general Wyoming Pollutant Discharge Elimination System (WYPDES) permit, the applicant would prepare a Storm Water Pollution Prevention Plan (SWPPP).

Impacts associated with road construction and vehicular traffic would thus be SMALL. The scope of the impact would range from typically site-specific to potentially regional but only in the rare instance when a sediment plume or accidental petrochemical discharge is conveyed outside the study area by flowing water.

Electric Lines: Electric lines would cross six ephemeral channels above ground. The placement of the utility poles would be outside the ephemeral channels; therefore, they would have no effect on flow within a channel and the impact would be SMALL.

Wells: The uranium ore body at Lost Creek has a narrow, elongated configuration approximately 60 ha [150 ac] in size that trends perpendicular to surface drainage features (see SEIS Figure 2-6). Therefore, if well placement in an ephemeral channel could not be avoided, the wells would be installed during the dry season, and the erosion and sedimentation-control features described previously and summarized in Table 4-1 would be used to minimize the impact.

As described in the GEIS, drilling fluid used for well installation would be contained in proximity to the drill rig within a temporary pit. In ephemeral channel or wash locations, the drilling fluid and residual cuttings in the pit would be emptied and cleaned after the well was drilled, with the waste materials being trucked offsite for proper disposal. Pits for wells installed in uplands may be removed in the same manner or may be backfilled and graded flush with the surrounding terrain. (NRC, 2009a)

Wellheads installed within stream channels would be designed to withstand storm water flows using exterior protection measures. The applicant proposes to install surface casing around wellheads as an added level of protection. Water-tight wellheads will also be used to prevent water from flowing into the wellhead (LCI, 2008b). For wells located in ephemeral channels, pumped water would be released directly into ephemeral channels where the water would quickly absorb into soil or evaporate. After each well was drilled, mitigation measures such as reseeding and mulching using standard erosion-control techniques as summarized in Table 4-1 would be used to stabilize loose soil.

Surface water impacts from wellfield installation would be temporary until wells were removed and the area reclaimed. The scope, nature, and extent of surface water impacts from well installation would be SMALL.

Pipelines: The injection and production wells would be interconnected via pipeline and connected to the processing plant via flexible, PVC pipeline buried at a depth to prevent

freezing. Pipelines could also cross ephemeral channels at numerous locations. Excavation work for the laying of pipeline would be performed when the channels were dry using small-scale excavation equipment. The excavated soil would be returned to the trench at the preexisting grade after the pipeline had been installed. Bare soil would be reseeded and mulched for stability (LCI, 2008a). Therefore, the impact on the ephemeral channels and water quality would be SMALL.

Processing Plant: The processing plant would have no direct impact on the ephemeral channels or on the Crooked Well Reservoir, located to the northeast because it would be located in an upland area. If a heavy rainfall were to occur during construction, runoff would be diverted to ditches and/or energy dissipaters. Therefore, the impact on the ephemeral channels and the Crooked Well Reservoir (water quality) would be SMALL.

Because of the limited areal extent of construction, the ephemeral nature of surface water, the absence of wetlands at the proposed Lost Creek ISR Project, and the applicant's commitment to implement BMPs summarized in Table 4-1, the NRC staff concludes the potential impact to surface waters from construction (including road construction, installation of electric lines, well construction, pipeline routing, building construction, and related vehicular traffic) would be SMALL.

4.5.1.1.2 Operation Impacts on Surface Waters

The GEIS Section 4.2.4.1.2 states that through permitting processes, Federal and State agencies regulate both the discharge of storm water runoff and process-related water. Impacts from these discharges would be controlled because licensees would operate within the conditions of their permits. The potential impact of spills on surface waters would depend on the size of the spill, the chemical composition of the spilled liquid, the success of remediation, the surface water use, and the proximity of the spill to surface water. For these reasons, the GEIS concluded the potential impacts on surface waters during operation could range from SMALL to MODERATE. (NRC, 2009a)

Upon completion of the necessary infrastructure and initiation of the uranium-recovery process at Lost Creek, the processing plant would be constructed on a concrete slab with a protective berm erected around the perimeter to prohibit spills from escaping the area. A storm water management plan as summarized in Table 4-1 would be implemented in accordance with WDEQ requirements to retain or treat runoff from the processing plant. Runoff would be diverted away from the facility, where would absorb into the soil. No wastewater would be discharged to surface water. (LCI, 2008a)

The applicant would be required to check and maintain the injection, production, and monitoring wells during the uranium-recovery process, to identify leaks or spills and to remediate them quickly. During these activities, vehicles would cross ephemeral channels to access wellfields resulting in temporary soil disturbance and limited downstream sediment transport if water was flowing. Because surface water at the proposed Lost Creek site is ephemeral and the site would be required to discharge stormwater in accordance with their WDEQ stormwater discharge permit and the applicant's commitment to implement a Spill, Prevention, Control, & Countermeasures (SPCC) Plan, the NRC staff concludes the estimated impact on surface water from the ISR operation phase would be SMALL and further reduced by the applicant's proposed mitigation measures described in Section 4.5.1.1.1.

4.5.1.1.3 Aquifer Restoration Impacts on Surface Waters

The GEIS Section 4.2.4.1.3 states that through permitting processes, Federal and State agencies regulate the discharge of storm water runoff and process-related water. Impacts from these discharges would be controlled because licensees would operate within the conditions of their permits. The potential impact of spills on surface waters would depend on the size of the spill, the success of remediation, the use of the surface water, and the proximity of the spill to surface water. For these reasons, the GEIS concluded that impacts on surface waters during operation would be SMALL. (NRC, 2009a)

Aquifer restoration at the proposed Lost Creek ISR Project as described in SEIS Section 2.1.1.1.6 would generate wastewater. However, no surface water discharge of liquid effluent would occur under the proposed action. Impacts from stormwater runoff or accidental spills would be managed as described for ISR operations in SEIS Section 4.5.1.1.2. Because of the applicant's implementation of mitigation measures as summarized in Table 4-1 and its compliance with both the NRC license and WDEQ permit requirements, the NRC staff concludes the impact on surface water from stormwater runoff and potential spills during the ISR aquifer restoration phase at the proposed Lost Creek ISR Project would be SMALL.

4.5.1.1.4 Decommissioning Impacts on Surface Waters

As described in the GEIS Section 4.2.4.1.4, impacts from decommissioning are expected to be similar to, but less than, impacts from construction. Activities to clean up, and recontour and reclaim the land surface during decommissioning would mitigate potentially long-term impacts on surface waters. Nevertheless, potential impacts on surface water from decommissioning would be SMALL. The GEIS concluded that impacts to surface water from decommissioning and reclamation activities would be SMALL. (NRC, 2009a)

Section 2.1.1.5 of this SEIS and Section 6.4 of the applicant's TR (LCI, 2008b) provides details on the decommissioning process for the proposed project. In summary, all buildings and pipelines would be removed, and wells would be plugged and abandoned. The estimated impact on surface water from the removal of property improvements would be similar to that described for the ISR construction phase (see SEIS Section 4.5.1.1.1).

As buildings and associated structures are decontaminated and removed, temporary soil disturbances would occur. The applicant would implement mitigation measures as summarized in Table 4-1 of the SEIS to reduce the impact on ephemeral channels during site decommissioning. Because of the short-term, temporary nature of these activities and the applicant's commitment to implement mitigation measures, the NRC staff concludes the impact on surface water from decommissioning would be SMALL.

4.5.1.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no impact on surface water from the proposed action. The existing land uses of livestock ranching and recreational activities within the proposed project area would continue.

The proposed project area currently maintains a network of two-track ranch roads for vehicular access. The roads consist of unimproved and unmaintained dirt paths that intersect natural drainage channels and washes at various locations. These "trail" roads would continue to be

used and dust emissions generated by the passage of vehicular traffic could deposit in the ephemeral channels and be carried in surface water during periods of flow.

Under the No-Action alternative, livestock would continue to have access to channels/washes and Crooked Well Reservoir to graze vegetation resulting in soil disturbances, and soil compaction. Cattle entering stream channels and washes could create instabilities along banks, resulting in higher-than-normal soil erosion during periods of storm water runoff. In combination, these actions could result in SMALL impacts on surface water quality.

4.5.1.3 Dry Yellowcake (Alternative 3)

Alternative 3 consists of the same construction, operation, aquifer restoration, and decommissioning phases as the proposed action, but with a slight modification to process a dry yellowcake product. The yellowcake slurry (final product in the proposed action) would be dried on-site within the processing plant. No changes to the development footprint, wells, road network, electric lines, pipelines, or ponds that could affect ephemeral channels would occur nor would be there be an increase in the waste stream volumes under this alternative compared to the proposed action. Therefore, the estimated impact on surface water would be SMALL, the same as described for the proposed action.

4.5.2 Groundwater Impacts

The staff's analysis determined that potential environmental impacts on groundwater resources in the Lost Creek ISR Project can occur during each phase of the ISR facility lifecycle. ISR activities could potentially impact aquifers above and below the uranium-bearing production zone, as well as in the uranium-bearing aquifer itself, outside the proposed project area. Surface or near-surface activities that can introduce contaminants into soils are more likely to impact shallow (near-surface) aquifers, while ISR operations and aquifer restoration are more likely to impact the deeper uranium-bearing aquifer and aquifers located above, below and surrounding aquifers.

As discussed in the GEIS Section 4.2.3.2, ISR facility impacts on groundwater resources can occur from surface spills and leaks, releases from shallow surface piping, consumptive water use, horizontal and vertical excursions of extraction solutions from production aquifers, degradation of water quality from changes in the production aquifer chemistry, and waste management practices involving deep well injection (NRC, 2009a). Detailed description of the estimated impacts on groundwater resources from construction, operations, aquifer restoration, and decommissioning are provided in the following sections.

4.5.2.1 Proposed Action (Alternative 1)

4.5.2.1.1 Construction Impacts on Groundwater

As stated in the GEIS Section 4.2.4.2.1, potential impacts to groundwater during construction are primarily from consumptive use of groundwater, injection of drilling fluids and muds during well drilling, and spills of fuels and lubricants from construction equipment. The GEIS further noted that groundwater use during the construction phase would be limited and that groundwater would be protected by implementing BMPs such as spill prevention and cleanup. A limited volume of drilling fluids and muds would be introduced into the environment during well installation. Because of the limited nature of construction activities and the implementation of

BMPs to protect shallow groundwater, the GEIS concluded that construction impacts on groundwater would be SMALL. (NRC, 2009a)

During the construction of the wellfields and facility at Lost Creek, potential impacts to groundwater could occur from the consumptive use of groundwater, introduction of drilling fluids and muds into the environment during well installation, discharge of pumped water to the surface during hydrologic testing, and surface spills of fuels and lubricants.

The consumptive water use during construction at the Lost Creek site would generally be limited to dust control, drilling support, and cement mixing. Most water used for construction at the proposed Lost Creek ISR Project would be extracted from a well completed in the FG horizon described in SEIS Section 3.5. The sands in this aquifer unit occur at depths from 55 to 107 m [180 to 350 ft] bgs, and are hydrologically separated from the HJ production (ore-bearing) sand and the DE surficial aquifer (see Figure 3-8 of the SEIS). The volume of water consumed during construction would be small and temporary relative to the water supply available in the FG Sands.

The volume of drilling fluids and muds used during well installation would be limited and BMPs would be used to prevent, identify, and correct impacts on soils and the uppermost DE aquifer at Lost Creek. Drilling fluids and muds would be placed into mud pits to control the spread of the fluids, to minimize soil contamination in the area and to enhance evaporation. According to the site potentiometric data, the depth to the water table in the uppermost DE aquifer at Lost Creek ranges from 24 to 46 m [80 to 150 ft] bgs and a low permability horizon (i.e., the BC horizon) overlies it. Therefore, small amounts of leakage from the pits or spills during drilling activities would result in a small amount of infiltration with a minimal effect on the DE surficial aquifer water quality. A minor amount of drilling fluids could be introduced into the DE, FG, and HJ aquifers during the installation of production and monitoring wells because drilling muds are designed to seal the borehole to set the casing. For the two storage ponds, a leak-detection system would be located between two synthetic liners, and the two synthetic liners would rest on compacted soil to significantly slow fluid migration.

After wells are installed, some water may be pumped from aquifers for hydrologic testing. This water would be discharged to the surface in accordance with the applicant’s approved permits from the State of Wyoming. These surface discharge permits protect near-surface aquifers by limiting the discharge volume and prescribing concentration limits to discharged waters.

During construction and wellfield installation at the proposed Lost Creek ISR Project, the groundwater quality of near-surface aquifers would further be protected when the BMPs summarized in Table 4-1 were followed during facility construction and wellfield installation. A small volume of fuels and lubricants would be stored in the proposed project area during construction; therefore, no leaks or spills contaminating groundwater would be likely. If such a spill were to occur it would primarily be surficial in nature with a SMALL impact on surface soils and vegetation since such an occurrence would result in an immediate cleanup response. Further, the applicant would be required by license condition to maintain documentation of spills of source or byproduct materials (including process solutions) and process chemicals, to maintain procedures to evaluate the consequence of a spill, and to implement reporting requirements.

The NRC staff concludes the impact on groundwater resources during wellfield and facility construction would be SMALL based on the limited nature of construction activities and implementation of BMPs to protect shallow groundwater.

4.5.2.1.2 Operation Impacts on Groundwater

As stated in Section 4.2.4.2.2 of the GEIS, during ISR operations, potential environmental impacts on shallow (near-surface) aquifers are related to leaks of lixiviant from pipelines, wells, or header houses, and to waste management practices. Potential environmental impacts to groundwater resources in the production and surrounding aquifers also include consumptive water use and changes to water quality. Water quality changes would result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations could also potentially impact groundwater resources. (NRC, 2009a)

4.5.2.1.2.1 Operation Impacts on Shallow (Near-Surface) Aquifers

The GEIS Section 4.2.4.2.2.1 discusses the potential impacts on shallow aquifers during ISR operations. A network of buried pipelines is used during ISR operations for transporting lixiviant between the pump house and the satellite or main processing facility and also to connect injection and extraction wells to manifolds inside the pumping header houses. The failure of pipeline fittings or valves or failures of well mechanical integrity in shallow aquifers could result in leaks and spills of lixiviant, which could impact water quality in shallow aquifers. The potential environmental impact of such pipeline, valve, well integrity failure, or pond leakage depends on a number of factors, including the depth to shallow groundwater, the use of shallow groundwater, and the degree of hydraulic connection between shallow aquifers and regionally important aquifers. As reported in the GEIS, potential environmental impacts could be MODERATE to LARGE, if: (i) groundwater in the shallow aquifers is close to the ground surface; (ii) shallow aquifers are important sources for local domestic or agricultural water supplies; or (iii) shallow aquifers are hydraulically connected to other locally or regionally important aquifers or if shallow aquifers either have poor water quality or yields not economically suitable for production. (NRC, 2009a)

As previously described in Sections 3.4 and 3.5.3 of this SEIS, the top 213 m [700 ft] of the Battle Spring Formation in the study area has been divided into at least five horizons identified from top to bottom as the BC, DE, FG, HJ, and KM horizons (Figure 3-8). These horizons are sandstone layers separated from one another by various thicknesses of shale, mudstone, and siltstone. The first saturated horizon is the DE Horizon. The overlying BC Horizon is unsaturated and separated from the underlying DE Horizon by a shale sequence. The DE Horizon is comprised of alternating very fine to coarse-grained sandstone, mudstone, and siltstone. The top of the DE Horizon is encountered at depths ranging from 30 to 61 m [100 to 200 ft] bgs. Water level data indicate that a water table generally exists within the DE Horizon, although locally it may be confined. The shallow water table in this area is typically 24 to 46 m [80 to 150 ft] bgs. The FG Horizon directly underlies the DE Horizon, which contains the aquifer overlying the production zone (HJ Horizon).

The applicant’s survey of groundwater wells in the area (see Section 3.5.3 of this SEIS) shows that shallow groundwater is an important source of water within a 3.2-km [2-mi] radius of the proposed project area. However, the depth to the water table and its separation from the land surface by the BC Horizon and the intervening impermeable shale overlying the DE Horizon supports the position that there would be minimal potential for infiltrating fluids released at the surface to reach the uppermost aquifer. Potential releases would likely be either slowed or attenuated by low-permeability beds within the BC Horizon or by the underlying shale unit (SEIS Figure 3-8). Thus, the estimated impact on the shallow aquifer during operations from surface releases would be localized and SMALL. Therefore, the site-specific conditions are

consistent with the assumptions stated in the GEIS and the NRC staff concludes the impact would be SMALL.

As stated in the GEIS, the impact from releases at or near the ground surface on shallow groundwater can be greatly reduced by the NRC-required leak-detection programs. The applicant plans a leak-detection and spill-cleanup program as outlined in Section 5.7.8.3 (Storage Pond Leak Detection) and Section 4.0 (Effluent Control Systems) of the TR (LCI, 2008b). In addition, preventative measures such as well mechanical integrity testing would limit the likelihood of well integrity failure during operations.

Moreover, the potential leakage from the planned storage ponds would be minimized by the design and operation of these ponds. The applicant has stated that these ponds would be built with impermeable double liners with leak detection systems between the liners. If a leak were detected beneath the primary liner, that storage pond would be closed and the liner repaired before the integrity of the second liner was compromised. During operations, leak-detection standpipes would be checked for evidence of leakage. Visual inspection of the pond embankments, fences, and liners and the measurement of pond freeboard would also be performed during normal operations. A Pond Inspection Program would be developed for the proposed project following NRC Regulatory Guide 3.11 and applicant commitments in Section 5.3.2 of the TR (LCI, 2008b). Further, the NRC will require by license condition that the applicant install two monitoring wells in the downgradient direction from the storage ponds to include in the storage pond monitoring program.

NRC staff concludes the impact on the shallow aquifer system at the proposed Lost Creek ISR Project would SMALL. This conclusion is based upon implementation of a leak-detection system and groundwater monitoring program at the proposed storage ponds, monitoring, reporting, and corrective actions for near-surface spills or releases, and the mechanical testing program, all of which are designed to mitigate the impact (i.e., early detection and cleanup) and result in SMALL operational impacts on shallow (near-surface) aquifers.

4.5.2.1.2.2 Operation Impacts on Production and Surrounding Aquifers

The potential environmental impacts on groundwater supplies in the production and other surrounding aquifers are related to consumptive water use and groundwater quality.

Water Consumptive Use: As described in the GEIS Section 4.2.4.2.2.2, groundwater is withdrawn and reinjected into the production zone during ISR operations. Most of the water withdrawn from the aquifer is returned to the aquifer. The portion that is not returned to the aquifer is referred to as consumptive use. The consumptive use is primarily from production bleed (about 1 to 1.5% of groundwater withdrawal) and incidental losses. The production bleed is the net withdrawal maintained to ensure groundwater gradients toward the center of the production network. This net withdrawal ensures there is an inflow of groundwater into the wellfield to minimize excursions of lixiviant and its associated constituents out of the wellfield. (NRC, 2009a)

As described in the GEIS Section 4.2.4.2.2.2, consumptive water use during ISR operations could potentially impact local water users who use water from the production aquifer outside the exempted zone. This potential impact would result from lowering the water levels in nearby wells, thereby reducing the yield of these wells. In addition, if the production zone is hydraulically connected to other aquifers above and/or below the water zone, consumptive use

may potentially impact the water levels in these overlying and underlying aquifers and reduce the yield in any nearby wells withdrawing water from these aquifers. (NRC, 2009a)

Assuming an average withdrawal rate of 656 Lpm [175 gpm] over the life of the proposed Lost Creek ISR Project, the applicant predicted the drawdown (reduction in hydraulic head) at the end of production/restoration operations (LCI, 2008b). The applicant estimated the average withdrawal based on withdrawals from the HJ Horizon during both the ISR production and aquifer restoration phases. These predictions assumed that the HJ Horizon is laterally extensive, confined both above and below, and that the fault acts as a flow barrier. Consequently, all flow comes from one side of the fault. The applicant predicted drawdown at the end of the production/restoration operations would be 53 m [177 ft] at 3.2 km [2 mi] from the centroid of production, 50 m [164 ft] at 4.8 km [3 mi], and 45 m [148 ft] at 8 km [5 mi]. The actual drawdown during operations would depend on the behavior of the fault barrier under production conditions and vertical flow from overlying and underlying FG and UKM aquifers. Leakage through these barriers would have the effect of reducing the drawdown relative to those predicted. Excessive drawdown could also be mitigated by drilling wells to a deeper level. The applicant has committed to a program of monitoring water levels in nearby wells and to provide additional pumping capacity, as necessary (LCI, 2008a).

As described in SEIS Section 3.5.3.1,15 wells have been identified within 8 km [5 mi] of the proposed project area that could be impacted by drawdown (Figure 3-10 of the SEIS). Water levels in those wells open to the HJ Horizon (i.e., the production zone) could be significantly impacted. Although many of these wells are not installed at the same depth as the production wells, the estimated 3-degree dip (west) of the Battle Spring formation may allow potential drawdown to affect several shallower wells to the east and northeast. If the assumption that the HJ Horizon is laterally extensive and confined both above and below is not accurate, then some groundwater may be drawn from both overlying and underlying aquifer units during production resulting in a reduction in water levels in wells penetrating these sands and drawdown of the water level in nearby stock wells. Based on the applicant-supplied information, three of the wells located within an 8-km [5-mi] radius of the facility (particularly to the east and northeast) could be significantly impacted by consumptive use of groundwater during operation and aquifer restoration at the proposed facility. After operation and aquifer restoration were complete and groundwater withdrawals ceased at the proposed Lost Creek ISR Project, the water levels would recover. However, because recharge in this area is limited the recovery may be slow. Rebound to preoperation water levels could take many years.

A reduction in water levels in nearby wells could increase the pumping requirements for these wells, with complete dewatering possible in two wells: P5112W/4775 and P8444P (SEIS Table 3-3). One of the nearby BLM wells, P10696P, taps a confined aquifer with sufficient hydraulic head for groundwater to flow to the surface by artesian pressure, negating the need for a pump. Reduction in hydraulic head at this well could stop it from naturally flowing to the surface and the installation of a pump could be required to bring water to the surface. Under the applicant's conservative drawdown scenario, 3 of 15 stock wells would be adversely affected by ISR operations, hence the short-term impact from consumptive groundwater use during ISR operation and restoration would be MODERATE. The applicant's methods to mitigate excessive drawdown during operation and aquifer restoration as described earlier, would reduce this impact to SMALL. Although the water levels would slowly recover to preoperational depths after aquifer restoration was complete, the available hydraulic head is great enough that the long-term environmental impact from consumptive groundwater use during the operational phase at Lost Creek would to be SMALL. Based on the foregoing analysis, site-specific conditions are consistent with the GEIS assumptions for a MODERATE

impact determination because local water users near a wellfield could be affected if their wells were completed in the same aquifer as the extraction zone.

Excursions and Groundwater Quality: As described in the GEIS, groundwater quality in the production zone is degraded as part of ISR operations. The production portion of the aquifer would be recommended for exemption as an underground source of drinking water (USDW) by WDEQ to EPA. After production operations are completed, a licensee would be required to return water-quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in 10 CFR Part 40, Appendix A, Criterion 5B(5), “at the point of compliance, the concentration of a hazardous constituent must not exceed- (a) the Commission approved background concentration of that constituent in the groundwater; (b) the respective value given in the table if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (c) an alternate concentration limit (ACL) established by the Commission.” Only after demonstrating that it cannot restore a particular hazardous constituent to the background concentration or maximum contaminant level (MCL), can a licensee request an amendment for an ACL for a particular hazardous constituent. Appendix C explains the process for granting an ACL. For proposed ACLs to be approved, they must be shown to protect public health at the site. For these reasons, the GEIS concluded that the potential impacts to the water quality of the uranium-bearing production zone aquifer as a result of ISR operations would be SMALL. To prevent horizontal excursions, a licensee would maintain inward hydraulic gradients in the production aquifer during ISR operations through net groundwater withdrawals (production bleed may be as high as 1.5 percent but would typically be less than 1 percent) maintained by pumping during ISR operations. The direction of groundwater flow would thus be toward the wellfield. This inward groundwater flow toward the extraction wells prevents horizontal excursions of extraction solutions away from the wellfield. (NRC, 2009a)

In addition, as required by NRC license condition, a licensee is required to take preventive measures to reduce the likelihood and consequences of potential excursions. An applicant must design and install a monitoring network capable of detecting both horizontal and vertical excursions from the production zone to demonstrate that restoration is feasible. A ring of monitoring wells within, and encircling, the production zone is required for early detection of horizontal excursions as described in Section 6.3.1.2. If excursions are detected outside the exempted area of the production aquifer, corrective actions are required. (NRC, 2009a)

Vertical excursions into aquifers overlying or underlying the production-zone aquifer may also occur. As described in the GEIS, the potential for migration of extraction solutions into an overlying or underlying aquifer is small if the aquitard (confining layer) thickness separating the production zone from the overlying and underlying aquifer is sufficient, and the aquitard has low permeability. The hydraulic gradient between the production zone and overlying or underlying aquifers also influences the potential for vertical excursions. Vertical excursions can also occur due to improperly sealed boreholes, poorly completed wells, or from a loss of mechanical integrity in ISR injection and extraction wells. To ensure the detection of vertical excursions, NRC also requires monitoring in the overlying and underlying aquifers. A program of mechanical integrity testing of all ISR wells is also required (10 CFR 146.8). The conduct of mechanical integrity testing reduces the likelihood of poor well integrity and potential excursions. Corrective action would be required if vertical excursions were detected. (NRC, 2009a)

Section 2.11.4 of the GEIS documented excursions which have occurred at operating ISR facilities. Separately, NRC staff analyzed the environmental impacts from both horizontal and vertical excursions which occurred at three NRC-licensed ISR facilities. In that analysis, which

considered 60 events at three facilities, NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short-lived, although a few continued for several years. In all cases, however, no impacts occurred to non-exempted portions of the aquifer (NRC, 2009b).

Many of the hydrogeologic conditions at the proposed Lost Creek ISR Project are similar to those which occur at other ISR facilities. Groundwater in the HJ production aquifer is confined locally and the aquifer displays sufficient hydraulic conductivity to minimize excursions during ISR activities. The drawdown from pumping in the production zone would facilitate containment of the lixiviant in the extraction zone and permit the recovery of either horizontal or vertical excursions. However, the Lost Creek site has several distinctive hydrogeological features that could contribute to the potential occurrence of either vertical or horizontal excursions as described below.

First, and most conspicuous, among these distinctive hydrogeologic features is the Lost Creek Fault, which extends across the proposed project area as described in SEIS Section 3.4. The fault offsets the various geologic units vertically so that the production zone aquifer, the confining units, and the overlying and underlying aquifers are not laterally continuous across the fault plane in some locations. Migration of production-zone fluids from one layer to another, either vertically along the fault plane or horizontally across it, could potentially result in the migration of production fluids to other groundwater aquifers. However, the applicant has conducted several long-term pumping tests in the vicinity of the fault and observed little hydrologic communication (flow) across the fault (LCI, 2008b, Section 2.7.2.2). As part of its safety review, NRC staff conducted independent numerical modeling to evaluate the potential influence of the fault on groundwater flow during site operations and concluded that under typical operating conditions (i.e., where balanced hydrologic pressures are maintained), the fault would act as an adequate barrier to fluid migration in production units adjacent to the fault. However, the modeling also showed that should imbalanced hydrologic pressures (conditions encountered in an excursion) develop during ISR operations, this condition could result in fluids potentially migrating across the fault at that location.

Each proposed wellfield would be subject to further hydrological testing during the wellfield test that NRC would require by license condition before the applicant could initiate ISR production in a wellfield. This additional testing would employ monitoring wells located on both sides of the fault to observe conditions in the production-zone aquifer and in the overlying aquifer. The potential effect of the fault on groundwater aquifers could also be mitigated by installing a set of closely spaced monitoring wells on the opposite side of the fault along the length where the production unit abuts the fault.

The second distinctive hydrogeologic feature, relates to the effectiveness of the overlying Lost Creek Shale and the underlying Sage Brush Shale in providing vertical confinement of the proposed production zone (HJ horizon) at some locations (Sections 3.4 and 3.5.2.3.2 of this SEIS). Although both shales are regionally extensive, the applicant provided isopach (thickness) maps showing that in some locations, the Lost Creek Shale has a maximum thickness of 1.5 m [5 ft] thick, and the Sage Brush Shale is less than 3.4 m [10 ft] thick at many locations. The applicant reported that minor hydraulic responses in the overlying and underlying aquifers were observed during the 2007 pumping tests for the HJ horizon. The applicant identified several potential causes for the observed responses, including leakage across the confining shales, off-site pumping, leakage through abandoned boreholes, or hydrologic communication across the fault. The NRC staff conducted independent numerical modeling of the predicted flows, as described in the NRC safety evaluation, and concluded that even the thin

shale layers would provide adequate vertical confinement during production operations except if a horizontal excursion occurred in a production unit near the fault. If a horizontal excursion occurred near the fault, the simulations predict that the additional overpressure would result in some vertical breakthrough in the confining layers. However, for such a horizontal excursion to occur it would be large enough to be detected by routine monitoring and subject to remediation before loss of vertical confinement occurred.

The third distinctive hydrogeologic feature, is the occurrence of historic drillholes(boring or wells) within the proposed project area the applicant has listed 809 existing (historic) borings that have been completed within 3.2 km [2 mi] of the proposed project area, including 161 known abandoned or cancelled wells (LCI, 2008b, Attachment 2.6-2). From applicant-prepared maps the NRC staff estimates that approximately 40 abandoned drillholes are present in each of the proposed wellfields. If any of these drillholes have been improperly abandoned, they could provide pathways for the vertical movement of fluids, thus potentially impacting groundwater aquifers. The applicant has provided historic information about the measures that were undertaken to properly plug undocumented wells, but the NRC staff has noted in their safety review that many historic plugging procedures in the Battle Spring Formation are inconsistent with the applicant's designation of individual aquifers (e.g., the HJ aquifer) for ISR operations. Therefore, the uncertainty about the impact of historic abandoned boreholes serving as potential flow paths for vertical excursions could be mitigated by ensuring that abandoned drillholes in the vicinity of a production unit has been properly plugged before the commencement of ISR operations. Therefore, the NRC would require by license condition that the applicant attempt to locate and abandon all historic drillholes located within the perimeter monitoring well ring such that the drillhole will not provide a conduit for the migration of production fluids.

The fourth distinctive hydrogeologic feature at the Lost Creek site, is the occurrence of heterogeneous lithologies in the HJ production aquifer. Fine-grained silt and clay lenses locally separate the upper HJ Horizon from the middle HJ Horizon, and the middle from the lower HJ Horizon. The occurrence of these lenses could impede the timely detection of a horizontal excursion within a particular horizon of the HJ aquifer. This effect could be mitigated by ensuring that the wellfield perimeter monitoring wells are screened in the same horizon as the production wells.

Although the structural and hydrogeological features add complexity to the assessment of environmental impacts from ISR operations at the Lost Creek area, the NRC staff notes that the aquifers bounding the proposed HJ production zone, as well as the HJ aquifer itself, contain naturally-occurring high levels of radionuclides that exceed the WDEQ Class I, II, and III and EPA primary drinking water standards for gross alpha, uranium, and combined Radium-226 and Radium-228. Therefore, the NRC staff concludes the impact on water quality from excursions, either horizontally in the production zone or vertically into the overlying and underlying aquifer units, during ISR operations would be SMALL. Although site-specific conditions at the proposed Lost Creek ISR Project (faulting) deviate from the site conditions assessed in the GEIS, the applicant proposes and will be required by license condition to properly install and maintain an enhanced monitoring well network for the early detection of an excursion consistent with the assumptions in the GEIS and in accordance with 10 CFR Part 40.

4.5.2.1.2.3 Operation Impacts on Deep Aquifers Below the Production Aquifers

Potential environmental impacts to confined deep aquifers below the production aquifers could occur from deep well injection of liquid effluent into deep aquifers. Under different

environmental laws such as the Clean Water Act, the *Safety Drinking Water Act* (SDWA), and the *Clean Air Act*, the EPA has statutory authority to regulate activities that may affect the environment. Underground injection of fluid requires a permit from the EPA or from an authorized state UIC program. The WDEQ has been authorized to administer the underground injection control (UIC) program in Wyoming and is responsible for issuing permits for deep well disposal at the proposed Lost Creek ISR Project site.

Section 4.2.4.2.2.3 of the GEIS states that the potential environmental impact from disposal of liquid effluent into deep aquifers below ore-bearing aquifers would be SMALL, if water production from deep aquifers is not economically feasible, the groundwater quality from these aquifers is not suitable for domestic or agricultural uses (e.g., high salinity), and they are confined above by sufficiently thick and continuous low-permeability layers. (NRC, 2009a)

The applicant plans to dispose of waste fluids using deep well injection and has received a permit for five Class I injection wells from the WDEQ. The specified injection zone for all five wells is within the Fort Union Formation, which is the thick sedimentary unit directly beneath the Battle Spring and Wasatch Formations (SEIS Figure 3-4). The Class I injection well permit issued by the WDEQ identified the overlying confining unit above the injection zone as consisting of approximately 90 m (300 ft) of shale at the base of the Wasatch Formation. The top of the discharge zone occurs about 1,870 m (6,139 ft) bgs, or deeper, for each permitted disposal well, and the total thickness of the injection zone in the wells ranges from 640 m (2,100 ft) to 1,052 m (3,451 ft). In issuing the permit, the WDEQ determined that at the depth and location of the injection zones specified by the permit, the use of groundwater in the Fort Union Formation aquifer system is economically and technologically impractical (WDEQ, 2010b).

After evaluating the suitability of the proposed deep disposal wells, the WDEQ concluded that the liquid effluent could be suitably isolated in a deep aquifer and would not affect any overlying underground sources of drinking water. Consequently the NRC concludes that the impact to deep aquifers from proposed ISR operations would be SMALL. This is based upon the applicant receiving a WDEQ-issued UIC permit and because these deep aquifers are isolated from the overlying aquifers which may be used for water supplies.

4.5.2.1.3 Aquifer Restoration Impacts on Groundwater

As stated in the GEIS Section 4.2.4.2.3, the potential environmental impact on groundwater resources during aquifer restoration are related to groundwater consumptive use and waste management practices, including discharge to waste storage ponds and potential deep disposal of brine resulting from reverse osmosis. In addition, aquifer restoration directly affects groundwater quality in the vicinity of the wellfield being restored. (NRC, 2009a)

The purpose of aquifer restoration is to return the groundwater quality in the production zone to groundwater protection standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards state the concentration of a hazardous constituent must no exceed (i) the Commission-approved background concentration of that constituent in groundwater, (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed, or (iii) an alternate concentration limit the Commission establishes. Potential environmental impacts are affected by the restoration techniques chosen, the severity and extent of the contamination, and the current and future use of the production and surrounding aquifers in the vicinity of an ISR facility. Consequently, the GEIS concluded that the potential environmental impacts of groundwater

consumption during restoration could range from SMALL to MODERATE depending on site-specific conditions.

Lost Creek is planning three phases of restoration: groundwater sweep, groundwater treatment, and recirculation. A reductant may be added anytime to the fluids circulated during restoration to lower the oxidation potential of the production zone to render uranium less mobile. During groundwater sweep, water is pumped from the wellfield, without reinjection, resulting in an influx of baseline quality water from the perimeter of the wellfield. This baseline quality water effectively sweeps (cleanses) the affected portion of the aquifer. Following the sweep phase, water would be pumped from the wellfield to treatment equipment and then reinjected into the wellfield. Ion exchange and reverse osmosis circuits would be used during this phase to treat the groundwater. At the completion of the groundwater treatment phase in a wellfield, recirculation would be initiated. Recirculation consists of pumping from the wellfield and reinjecting the recovered solution to recirculate solutions and homogenize the groundwater conditions.

Regardless of the process, hydraulic control of the former production zone must be maintained during restoration. This is accomplished by maintaining an inward hydraulic gradient through a production bleed (see Section 4.5.2.1.2.2 of this SEIS). As described in the GEIS, the impacts of consumptive use during aquifer restoration are generally greater than during ISR operations. This is particularly true during the sweep phase when a greater amount of groundwater is generally withdrawn from the production aquifer. During the sweep phase, groundwater is not reinjected into the production aquifer and all withdrawals are considered consumptive.

As described in Section 4.5.2.1.2.2 of this SEIS, the applicant predicted drawdown based on an average consumptive use of 656 Lpm [175 gpm] during the proposed project period. The applicant plans to concurrently restore individual wellfields while initiating ISR operations at another wellfield. Thus, the NRC staff anticipates that a limited portion of the proposed wellfields would be in the ISR aquifer restoration phase at any particular time. This mix of wellfields in production and restoration was considered to estimate the average consumptive use discussed previously. Significant drawdown in the hydraulic head was calculated in the HJ Horizon (the production zone): the drawdown at the end of production/restoration operations was predicted to be 53 m [177 ft] at 3.2 km [2 mi] from the centroid of production, 50 m [164 ft] at 4.8 km [3 mi], and 45 m [148 ft] at 8 km [5 mi]. As discussed previously, this prediction assumes that the HJ Horizon is fully confined above and below. However, drawdown in units overlying and underlying the HJ Horizon could also occur impacting the water levels and groundwater usage in a number of nearby stock wells. Consequently, the short-term impact from consumptive groundwater use during aquifer restoration would be MODERATE. This impact could span many years; however, water levels would eventually recover after aquifer restoration is complete.

The impact from the presence of the fault during ISR restoration would be two-fold. First, similar to the ISR operations phase, the fault would act as a barrier to flow. However, because the volume of process flows during aquifer restoration would be less than during ISR operations, the potential for an excursion during aquifer restoration would be less. Second, the area potentially affected by drawdown during ISR operations and aquifer restoration could be greater because the fault acts like a hydraulic barrier. However, the predicted drawdowns discussed above consider the influence of the fault.

A network of buried pipelines is used during ISR restoration for transporting restoration fluids between the pump house and the satellite or processing facility and also to connect injection

and extraction wells to manifolds inside the pumping header houses (this is the same network that would be used during the operation phase). Although the liquids carried in these pipes during restoration are less hazardous than during the operation phase, the failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers could result in leaks or spills of these fluids, which could impact water quality in shallow aquifers. Similarly, the waste storage ponds would continue to operate and if they leaked they would impact shallow groundwater. Estimated impacts to shallow groundwater during the operation phase were previously evaluated in SEIS Section 4.5.2.1.2.2. The monitoring and mitigation activities for groundwater aquifers during operations described in SEIS Section 4.5.2.1.2.2 would also limit the estimated impacts on groundwater aquifers during aquifer restoration. Therefore, the impact on shallow, production, and surrounding aquifers during aquifer restoration would be SMALL.

The disposal of liquid effluent via deep well disposal would occur during aquifer restoration as described for ISR operation. As discussed in SEIS Section 4.5.2.1.2.2, the estimated environmental impact on deep aquifers below the production aquifers from deep well disposal would be SMALL.

4.5.2.1.4 Decommissioning Impacts on Groundwater

The environmental impacts on groundwater during dismantling and decommissioning ISR facilities are primarily associated with: (i) consumptive use of groundwater; (ii) potential spills of fuels and lubricants; and (iii) well abandonment. Consumptive groundwater use would include water used for dust suppression, revegetation, and reclaiming disturbed areas. The potential environmental impacts during the decommissioning phase would be similar to the impacts from the ISR construction phase. Groundwater consumptive use during the decommissioning activities would be less than groundwater consumptive use during ISR operation and groundwater restoration activities. Spills of fuels and lubricants during decommissioning activities could, however, impact the water qualify of shallow aquifers (NRC, 2009a). The applicant’s implementation of BMPs, such as those identified in Table 4-1, during decommissioning would reduce the likelihood and magnitude of such spills and facilitate cleanup. Based on the applicant’s proposed BMPs to minimize water use and spills, the estimated environmental impacts on the groundwater resources in shallow aquifers at the Lost Creek site from decommissioning would be SMALL. (NRC, 2009a)

After ISR operations were complete, improperly abandoned wells (from previous exploration activities not associated with the applicant) could impact aquifers above the production aquifer by providing hydrologic connections between aquifers. As part of the restoration and reclamation activities, all monitoring, injection, and production wells would be plugged and abandoned in accordance with the Wyoming UIC program requirements. The wells would be filled with cement and/or clay and then cut off below plow depth to ensure groundwater does not flow through the abandoned wells (Stout and Stover, 1997). If this process is properly implemented and the abandoned wells are properly isolated from the flow domain, the estimated environmental impact would be SMALL.

4.5.2.2 No-Action (Alternative 2)

The No-Action alternative would result in no construction or operational activities on site that would impact groundwater. Neither injection, production nor disposal wells would be drilled. No consumptive water use would occur as a result of the proposed action. The existing BLM stock wells in the proposed project area would be unaffected by the proposed action.

4.5.2.3 Dry Yellowcake (Alternative 3)

Under Alternative 3 the applicant could be issued a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling to include processing the recovered uranium into a dry powder instead of a yellowcake slurry. The potential environmental impacts on groundwater for this alternative would not differ from those described for the proposed action since this alternative would not involve additional groundwater production or the installation of additional injection, production, or disposal wells. Consequently, the estimated environmental impacts on groundwater for Alternative 3 would be comparable to that described for the proposed action.

4.6 Ecological Resources Impacts

Potential environmental impacts to ecological resources at the Lost Creek site, for both flora and fauna, may occur during all phases of the proposed ISR facility lifecycle. Impacts may include: (i) the removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities as a result of site activities; (iii) the loss of sensitive plants and habitats; and (iv) the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve (i) loss, alteration, and/or incremental fragmentation of habitat; (ii) displacement of and stresses on wildlife; and (iii) direct and/or indirect mortalities.

The estimated environmental impacts on ecological resources from construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek ISR Project are detailed in the following sections.

4.6.1 Proposed Action (Alternative 1)

4.6.1.1 Construction Impacts

As described in GEIS Section 4.2.5.1, during construction, terrestrial vegetation may be affected through: (i) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities; (iii) the loss of sensitive plants and habitats as a result of clearing and grading; and (iv) the potential spread of invasive species and noxious weed populations. (NRC, 2009a)

As described in the GEIS, the ISR construction phase would remove vegetation to clear the land for facilities (e.g., individual well sites and associated piping, header houses, the processing plant, access roads, parking, lay-down areas, fences, and storage ponds), which would destroy habitats and could result in the relocation of mobile wildlife. Facility construction could be completed in phases, with restoration following each stage to minimize impacts on vegetation and wildlife. (NRC, 2009a)

At the proposed Lost Creek ISR Project, the offsite impacts from construction would affect core area habitat for the sage-grouse (E.O. 2010–4). Construction activities would also result in an increase in vehicular traffic and the potential for animal collisions with vehicles. There would also be a temporary increase in dust from construction, some of which would deposit on vegetation, both on- and offsite, affecting the forageability for obligate species. However, vegetation in this naturally dusty, arid region would likely have adapted to moderate, temporary increases of dust coverage. Potential impacts on wildlife from road dust adjacent to access

roads near the plant site would also be limited by dust control measures required by the WDEQ construction permit (WDEQ, 2010a). More road dust would be generated from travel on untreated, unpaved roads located outside the range of the applicant's dust control measures (e.g., Wamsutter Road, County Road 22) (SEIS Section 4.7.1.1) and, therefore, these areas would be more likely to experience road dust accumulation potentially affecting wildlife.

The applicant prepared a Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2008b, Attachment OP-6) developed in accordance with recommendations and USFWS, BLM, WGFD, and WDEQ-LQD requirements. While NRC does not have regulatory authority to enforce the applicant Wildlife Protection Plan and Wildlife Mitigation Plan or the stipulations in E.O. 2010–4, NRC can enforce the applicant commitments in the NRC license application to minimize and mitigate potential impacts on wildlife (LCI, 2008a, b), which are consistent with regional land and wildlife management agency recommendations (BLM, 2008; WGFD, 2008; WGFD, 2010). The applicant's implementation of the road and right-of-way, fencing and screening, and restoration/reclamation measures as summarized in Table 4-1, as well as those measures intended to reduce human disturbance and incidental wildlife mortalities, and to manage mudpits summarized in Appendix F would minimize impacts on wildlife. The standard construction mitigation measures including erosion controls and other BMPs described elsewhere in the SEIS would also minimize ecological impacts. Details of applicant-planned mitigation measures at the proposed Lost Creek ISR Project are described in Appendix F.

BLM and WGFD have determined wildlife timing stipulations for certain species to protect their populations and habitats (BLM, 2008; WGFD, 2005). The applicant plans to initiate construction activities outside the stipulated time restriction periods; however, activities would continue year round within the area of approved disturbance (e.g., wellfield patterns, roads, plant area). Exploration activities outside the preapproved disturbance area would not be performed during the stipulated time period (LCI, 2008b, Attachment OP-6 Section 1.2). The details of BLM and WGFD wildlife timing stipulations planned for implementation at the proposed Lost Creek ISR Project are included in Appendix F.

4.6.1.1.1 Construction Impacts on Terrestrial Ecology

The terrestrial ecology at the proposed Lost Creek ISR Project is discussed in the following sections. Potential impacts on vegetation and wildlife are described in SEIS Sections 4.6.1.1.1.1 and 4.6.1.1.1.2, respectively.

4.6.1.1.1.1 Construction Impacts on Vegetation

As stated in GEIS Section 4.2.5.1, the percentage of vegetation removed and land disturbed by construction activities at an ISR facility (from less than 1 percent to up to 20 percent of the permit area) would cause a SMALL impact in comparison to the total permit area and surrounding plant communities. Additionally, the GEIS concluded that clearing of herbaceous vegetation in an open grassland or shrub steppe community was expected to have a short-term, SMALL impact, given the rapid colonization by annual and perennial species in the disturbed areas and restoration of the vegetative cover. The clearing of the more woody areas may have a long-term impact, given the pace of natural succession, and such impacts could range from SMALL to MODERATE, depending on the amount of surrounding woody areas. Noxious weeds would be controlled with appropriate spraying techniques, and therefore impacts would be SMALL. (NRC, 2009a)

ISR uranium recovery facility construction primarily affects terrestrial vegetation through: (i) removal of vegetation from the facility site during construction; (ii) modification of existing vegetative communities as a result of maintenance; (iii) loss of sensitive plants and habitats as a result of construction clearing and grading; and (iv) potential spread of invasive species and noxious weed populations as a result of construction. (NRC, 2009a)

SEIS Figure 4-3 shows the types and location of vegetation and wildlife habitat at the proposed Lost Creek location. During the life of the proposed Lost Creek ISR Project, a total of 115 ha [285 ac] of land would be disturbed by construction of the processing plant, main access roads, and wellfields as shown in SEIS Figure 4-3. Of the 115 ha [285 ac] of land disturbed, 23.5 ha [58 ac] would be stripped of vegetation. The remaining 91.5 ha [227 ac] of land would include wellfields, inclusive of the monitoring wells around the wellfield perimeter. This disturbance has been projected to occur over the estimated 12-year life of the project (LCI, 2008a, b). However, the applicant's planned operations would develop, produce, and reclaim the six wellfields sequentially; therefore, only small portions of the proposed project area would be disturbed at a given time (LCI, 2008a, Section 4.6.1). Details on the areas of various habitat types that would be stripped and disturbed by the proposed action are provided in SEIS Appendix F, Table F–2.

The construction of the processing plant, main access roads, storage ponds, and wellfields would remove vegetation and soil within the big sagebrush community type. As described in SEIS Section 2.1.1.1.2.1, the applicant would remove topsoil and temporarily stockpile it in accordance with WDEQ guidelines until reclamation activities commence. The applicant estimates that about 263,300 m^3 [34,400 yd^3] of topsoil, as well as subsoil, salvaged during construction activities would be stored in designated onsite topsoil stockpiles located just northeast of the proposed plant site (LCI, 2008b). Vegetation underlying the stockpiles would be destroyed and equipment used to manage the stockpiles would crush the vegetation and compact the soils. The processing plant, roads, and storage ponds would exist over the life of the project, while the wellfield areas would exist for approximately 2 years (see SEIS Figure 2-1). In areas where vegetation was removed, the applicant has committed to reestablish vegetation using native seed mixes at the next appropriate season in accordance with a BLM and WDEQ-Land Quality Division (LQD)-approved reclamation plan (LCI, 2008b, Attachment OP-6). Because the soils could be compacted by site activities, the applicant plans to loosen soil for reseeding during reclamation to increase the success rate of vegetation growth (LCI, 2008a). Because only 23.5 ha [58 ac] of land would be stripped of topsoil and vegetation, and 115 ha [285 ac] would be disturbed by construction activities, compared to the overall proposed project area of 1,722 ha [4,254 ac], the areal impact on vegetation would be relatively small. However, the impact on vegetation from facility construction would be long term since vegetation reclamation can take as many as 10 years to achieve full site recovery (WGFD, 2007). New vegetative growth could also be affected by grazing, droughts, or intense winters, thus reducing the rate of plant productivity and delaying full recovery (WGFD, 2007).

Surface disturbance of the land within the proposed project area also increases its susceptibility to invasive and noxious weeds, including Canada thistle (*Cirsium arvense*), Russian knapweed (*Centaurea maculosa*), perennial pepperweed (*Lepidium latifolium*), halogeton (*Halogeton glomeratus),* and quackgrass (*Elytrigia repens*) (BLM, 2011). These species are perennial and may quickly invade large areas depending on the season of the year. Some weeds, like halogeton, are lethal to livestock. As such, the applicant has committed to confine traffic to roads to minimize surface disturbance as summarized in Table 4-1 (LCI, 2008a). In addition to re-seeding, the applicant has also committed to conducting annual vegetative surveys over the

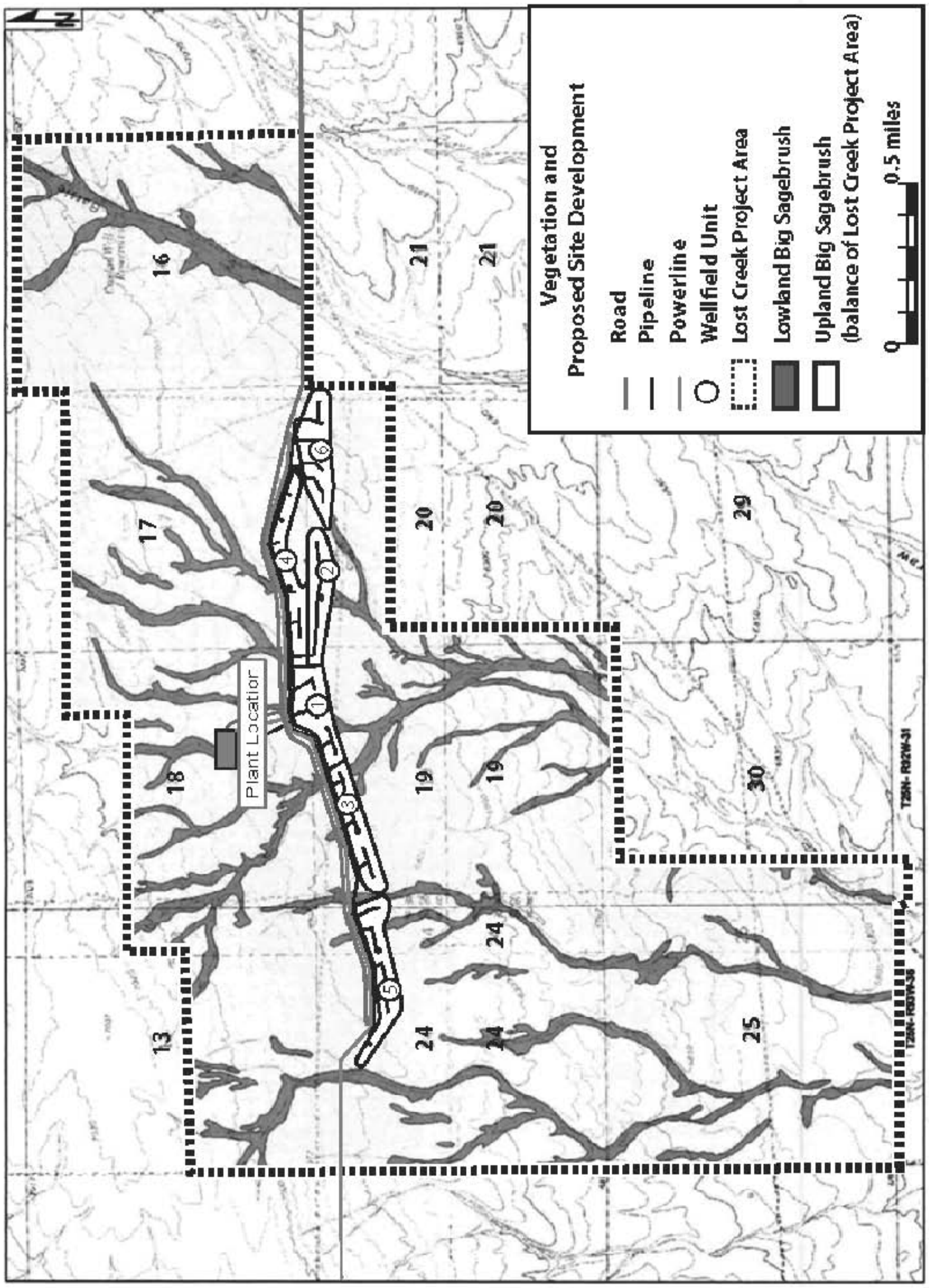

Figure 4-3. Vegetation and Proposed Site Development
Source: Modified from LCI (2008b)

proposed project area and access roads to locate and eradicate invasive plant species, such as cheat grass and conifers (LCI, 2008b, Attachment OP-6).

No Federally-listed threatened or endangered plant species are known to occur within the proposed project area (FWS, 2008). Therefore, the NRC staff concludes the impact on listed plant species during the construction phase would be SMALL.

Based on the foregoing analysis, the NRC staff concludes the overall impact on vegetation from construction would be MODERATE because of habitat destruction and the slow reestablishment of the sagebrush shrubland vegetation type.

4.6.1.1.1.2 Construction Impacts on Wildlife

GEIS Section 4.2.5.1 states that, in general, wildlife species would disperse from an area undergoing construction, although smaller, less-mobile species may die during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities are possible, and thus the GEIS concluded construction impacts on wildlife could range from SMALL to MODERATE (NRC, 2009a). These types of impacts could be mitigated at the Lost Creek site if standard management practices issued by the Wyoming Game and Fish Department (WGFD) were followed. Impacts on Greater sage-grouse *(Centrocercus urophasianus)* and big game species at the Lost Creek site could also be mitigated if BLM and WGFD guidelines were followed. Impacts on raptor species from power distribution lines could be mitigated by following the Avian Power Line Interaction Committee (APLIC) guidance and avoiding disturbing areas near active nests and prior to the fledgling of young (APLIC, 2006).

Direct wildlife habitat loss from planned construction activity at the proposed Lost Creek ISR Project is estimated to affect approximately 7 percent of the proposed project area (LCI, 2008a). As shown in SEIS Appendix F, Table F–2, the two major vegetation/habitat types that would be disturbed by construction include lowland and upland big sagebrush shrubland. Project construction would result in the long-term loss of about 1.6 ha [4 ac] of lowland big sagebrush shrubland habitat and 10 ha [24 ac] of upland big sagebrush shrubland habitat (SEIS Appendix F, Table F–2). In addition, approximately 14 ha [35 ac] of lowland big sagebrush shrubland habitat and 90 ha [222 ac] of upland big sagebrush shrubland habitat would be disturbed surficially, but not completely uprooted or stripped from the surface soil (SEIS Appendix F, Table F–2). Surface disturbance would be from dust deposition on vegetation, being crushed by a vehicle, or covered by stockpiled soil.

Big Game

As described in SEIS Section 3.6.1.2.2, the proposed project area provides winter/yearlong range to pronghorn antelope (*Antilocapra americana*) and is not considered mule deer (*Odocoileus hemionus*) range, but is considered transitional range for elk (*Cervus elaphus)*. Mule deer are abundant and elk herds are present within the region. There would be no direct impact on big game crucial habitat, critical or key winter or summer ranges, or migration corridors (University of Wyoming, 2008; NRC, 2009a). Direct impacts on mule deer and elk could include direct loss and modification of habitat, increased mortality from increased traffic collisions on local and regional roads, increased competition for and reduction of available forage, increased conflicts due to changes in movement and increased disturbances due to human presence. Mule deer and elk could be indirectly affected during construction by displacing portions of these populations from the project area into offsite suitable regional habitat. Because the site provides nonessential habitat for mule deer and elk, impacts to these species would be SMALL.

About 115 ha [285 ac] of pronghorn antelope habitat (lowland and upland big sagebrush shrubland) would be disturbed by project construction. The direct impacts on pronghorn antelope could be the same as those described previously for mule deer and elk. The applicant committed to implement mitigation measures, such as reduced speed limits to reduce the risk of vehicular collision, the use of fencing around wellfields, and wildlife timing restrictions on construction activities during wildlife breeding and nesting as summarized in SEIS Appendix F (LCI, 2008a). Winter/yearlong range carrying capacity for big pronghorn antelope could be reduced during the life of the proposed Lost Creek ISR Project and for several years thereafter until vegetative growth in restored areas becomes productive enough to support the portion of the Red Desert Pronghorn Herd population that uses the site. Since the average population of the Red Desert Pronghorn Herd is 13,800 (WGFD, 2009) and the predicted herd population exceeds the 2010 (WGFD, 2009) population objective, direct impacts on pronghorn antelope would be SMALL because the continued existence of the species' population in the proposed project area would not be threatened.

Indirect impacts on pronghorn antelope during ISR construction could include displacement from increased human activity, noise, lighting, and increased poaching and/or harvest from improved access via new roads. In addition, the increased human presence from construction could affect pronghorn antelope use of areas adjacent to the proposed project. Pronghorn antelope have been shown to become habituated to increased traffic volumes and heavy equipment if the traffic and equipment move in a predictable way (Reeve, 1984). However, initial well drilling activities and unpredictable traffic flows may cause pronghorn to disperse from the area. Some long-term disturbance (over the life of the milling operation) of pronghorn antelope habitat could occur with project construction. Pronghorn antelope displacement of up to 1.0 km [0.6 mi] has been observed from construction activities (Easterly et al., 1991). Because adequate pronghorn antelope habitat exists in the surrounding area, and antelope could return to the proposed project area after the conclusion of construction activities, and vegetative forage losses from construction would be mitigated by the applicant's plan for staged reclamation of disturbed areas, the NRC staff conclude the indirect impacts on pronghorn antelope would be SMALL because these species are highly mobile and there would be no long-term effect on the total pronghorn antelope population.

Upland Game Birds

Greater sage-grouse and mourning dove (*Zenaida macroura*) are the most likely upland game bird species to potentially be impacted by construction of the proposed Lost Creek ISR Project. Sage-grouse is a Federal candidate species, a State of Wyoming species of concern, and a BLM-designated sensitive species and is discussed in more detail in SEIS Section 4.6.1.1.4. Direct impacts to upland birds from proposed project activities would include habitat loss and fragmentation from wellfield, access road, storage pond, pipeline, and power line construction; alteration of plant and animal communities; increased human activity or noise (including generator noise) that could cause the birds to avoid a specific area or reduce breeding efficiency; increased motorized access to the public, which could lead to harvesting of individuals (legal and illegal); greater risk of mortality from vehicular collisions; and an increase in mortality from raptors if power poles or tall buildings are placed in occupied habitat.

The lowland big sagebrush shrubland habitat at the proposed Lost Creek ISR Project had the highest diversity and density of nesting birds (LCI, 2008b). Long-term loss of 1.6 ha [4 ac] of lowland big sagebrush shrubland habitat would occur with the proposed project area during the construction phase. Depending on the seasonal timing of construction and whether activities occur during mating, nesting, or rearing of young, direct mortality of individuals or loss of nests

could occur. Some individuals would be displaced and temporary habitat loss would occur over the life of the proposed project as development progressed. The applicant would restrict public access and hunting within the proposed license area to the extent allowable by BLM (LCI, 2008b, Attachment OP-6 Section 1.4.4). The applicant would minimize the removal and disturbance of vegetation, where possible, through the use of existing ranch roads for travel and for the placement of pipelines (LCI, 2008a). The land disturbed by the proposed project would be seeded as soon as practicable (LCI, 2008a). The applicant would submit a reclamation plan to the appropriate agencies for approval to ensure the reestablishment of habitat (LCI, 2008a). The applicant's commitment to implement mitigative measures as described in SEIS Appendix F, especially near sage-grouse leks (discussed in detail in SEIS Section 4.6.1.1.4), would also benefit mourning doves and other upland bird species and nests within the vicinity of the leks. Therefore, the potential impact on upland game birds, except for sage-grouse, during the ISR construction phase would be SMALL.

Raptors

No active raptor nests occur within the proposed project area; however, BLM documented 12 historic (abandoned) ferruginous hawk nests within the site vicinity, one being within a 1.6-km [1.0 mi] radius of the proposed project, but no nests were documented during the 2006 and 2007 applicant surveys (LCI, 2008b). As described in SEIS Section 3.6.1.2.4, several other raptor species were recorded within the study area, but nesting has not been documented.

Raptors are particularly sensitive to noise and the presence of human activity, which would be heightened during the construction period. Potential impacts on raptors include loss of nesting and foraging habitat, collisions with structures and vehicles, nest abandonment and reproductive failure due to increased human activities, reduction in prey populations, and displacement of birds into adjacent areas. Ferruginous hawks are sensitive to human disturbance, especially during periods of courtship, nest building, incubation, and brood rearing (Collins and Reynolds, 2005). Nest abandonment and loss of eggs or fledglings could occur in nests proximate to the site if human disturbance occurred during the early nesting period.

Mortality from encounters with power lines would be minimized by the applicant's proposed use of raptor deterrent products and the burial of transmission lines from the transformer to the header houses, and the header houses to the wells (LCI, 2008a, Section 4.6.1.3). WGFD and BLM established stipulations for certain raptor species with respect to restricting human proximity a designated distance from a raptor nest (WGFD, 2010; BLM, 2009). The applicant's implementation of the guidelines described in SEIS Appendix F near the Greater sage-grouse leks (discussed in detail in SEIS Section 4.6.1.1.4), would also benefit raptor species and nests located within the vicinity of the leks. A few individuals could be impacted, but the continued existence of the species in the proposed project area would not be threatened. Based on the fact that there are no active raptor nests in the proposed project area and the applicant's commitment to implement mitigative measures as summarized in Table 4-1, the NRC staff concludes the estimated impact on raptor species during the construction phase would be SMALL.

Waterfowl and Shorebirds

Only limited, seasonal habitat for waterfowl and shorebirds can be found since the site contains ephemeral channels and washes; therefore, construction would not likely disrupt breeding or nesting habitat for these species. Most construction work would occur during the summer and

fall months when the ephemeral channels are dry. Therefore, the NRC staff concludes the impact on waterfowl and shorebirds during the construction phase would be SMALL.

Migratory and Nongame Birds

Direct impacts on migratory and nongame birds could include: (i) mortality from motor vehicle collisions with the additional traffic volume during construction; and (ii) increased human activity or noise that could cause the birds to either avoid a specific area or to reduce their breeding efficiency. Direct loss of ground nests, eggs, and birds from construction activities could occur. Other temporary impacts on migratory birds in the proposed project area would depend on the season and duration of construction, well drilling and completion activities, and human disturbance. If these activities occurred in the late fall and winter, this would have the least impact on most migratory species because they would have migrated south (BLM, 2008). However, these impacts would affect only a few individuals, and are not expected to have any long-term impacts on the general population of the individual species.

Indirect impacts on migratory and nongame birds would include the displacement of shrub-dependent species while construction activities are ongoing and would result in habitat loss, fragmentation, and alteration of plant and animal communities. Planned activities may displace populations of bird species that disperse from the project area into a larger, offsite suitable habitat. For example, drilling and construction noise has been shown to interfere with the male songbirds' ability to attract mates and defend territory and the ability to recognize calls from other birds that could pose a threat (BLM, 2003). Other indirect impacts during construction activities could reduce prey species habitat from the clearing of vegetation. Some birds may avoid suitable habitat to avoid predation by raptors perched on power lines, construction equipment, or facilities. Migratory and nongame birds would benefit from the applicant's implementation of mitigation measures described in SEIS Appendix F because these measures would limit noise, vehicular traffic, and other human disturbances near these areas. The vegetation communities surrounding the site include portions of the sage-grouse core area (WGFD, 2010b), which provide crucial habitat for sage-grouse nesting and brood-rearing and are necessary to maintain sage-grouse populations (WGFD, 2010). The goal within core areas is to conserve sagebrush habitats and maintain habitat connectivity (BLM, 2009), which would also benefit species that disperse offsite from the proposed project area. Although there would be the potential loss of 115 ha [285 ac] of nesting bird habitat within the 1,722 ha [4,254 ac] proposed project area, the impact on migratory and nongame birds would be SMALL in comparison to the total proposed project area and coverage of quality of sagebrush vegetative communities surrounding the proposed site. Therefore, the potential impact on nongame and migratory birds during the construction phase would be SMALL.

Other Mammals, Reptiles, and Amphibians

The proposed project area also provides range to the Stewart Creek and Lost Creek wild horse herds (BLM, 2005). During the construction phase, the impacts on wild horses and mitigation measures would be similar to those previously discussed for big game species. Because the impacts on and mitigation measures for wild horses are similar to big game, only a few individuals would be affected and the continued existence of the species' population in the proposed project area would not be affected. Therefore, the NRC staff concludes the impacts on wild horses would be SMALL. Additionally, BLM is responsible for protection, management, and control of wild horses and continually monitors herds to determine how many horses an area can accommodate. Because wild horses are capable of dominating the winter range and have few natural predators or diseases to control populations, BLM periodically captures excess

horses and offers them to the public to maintain ecological balance between other livestock or big game in the area (BLM, 2010).

During the construction phase of the proposed project, small mammals, reptiles, and amphibians would be impacted by habitat loss and mortality from contact with construction equipment and vehicles. Small mammals, burrowing animals, reptiles, and amphibians would be affected because of their relatively small home ranges and inability to avoid construction equipment (BLM, 2008). Several small-mammal species of greatest conservation need that warrant increased management attention and funding, as well as consideration in conservation, land use, and development planning in Wyoming could occur on the proposed site and in the vicinity (WGFD, 2005). The Wyoming species of greatest conservation need designated in 2005 included 26 reptiles, 12 amphibians, and 54 mammals including the pygmy rabbit, olive-backed pocket mouse, and prairie vole (WGFD, 2005), which was recorded as part of the wildlife inventories conducted in accordance with the applicant work plan developed in consultation with the WGFD, WDEQ, and BLM (LCI, 2008a). Although the applicant did not conduct reptile and amphibian surveys, three reptile species were observed during the Lost Creek wildlife surveys, none of these species are considered either rare or sensitive. Because of the small amount of land {i.e., 115.5 ha [285.4 ac]} that would be disturbed during the life of the proposed project and there is not sufficient water to sustain wildlife species like amphibians that depend upon aquatic ecosystems; therefore, the NRC staff concludes the impact from construction on small mammals, reptiles, and amphibians would be SMALL.

4.6.1.1.2 Wildlife Enhancements

The applicant has stated they will work with BLM and WGFD to complete wildlife and livestock enhancements in the proposed project and nearby areas that could be disturbed; these enhancements could include placement of new raptor nest platforms, creation of new water sources, habitat modifications/improvements to improve specific habitat conditions for sage-grouse or other high-interest species, or rangeland improvements for livestock (LCI, 2008b). The applicant describes development of a resource selection function (RSF) to identify where sage-grouse are being displaced and to map the seasonal habitats in its Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2008b, Attachment OP-6). The results from the RSF analysis will be used by the applicant to determine the appropriate wildlife enhancement. For example, if mating habitat was determined to be most affected by the proposed ISR activities and the RSF results confirmed that mating habitat is decreasing, moving, or being avoided, the applicant could use this information to focus the enhancement efforts on those most important to mating habitats.

4.6.1.1.3 Construction Impacts on Aquatic Ecology

GEIS Section 4.2.5.1 discussed impacts on aquatic species that could be temporarily disturbed by in-stream channel activities from ISR construction activities and concluded the potential impact would be SMALL. Sediment loads in streams would likely taper off quickly both in time and distance, and the long-term (greater than or equal to the project life) impact would be SMALL (NRC, 2009a).

Applicant-conducted baseline surveys for the proposed Lost Creek ISR Project show that aquatic life and wetlands do not exist within and around the boundaries of the proposed project area (LCI, 2008a). Surface water may be present for a short period of time (ephemeral) mainly from snow melt or stormwater runoff, but the volume does not sustain species that depend upon

wetlands or use aquatic ecosystems. Therefore, the NRC staff concludes the impact on aquatic species at the proposed Lost Creek ISR Project site would be SMALL.

4.6.1.1.4 Construction Impacts on Protected Species

As discussed in GEIS Section 4.2.5.1, if threatened or endangered species are identified on an ISR site, the impact could range from SMALL to LARGE, depending on site conditions. Mitigation plans to avoid or reduce impacts on potentially affected species would be developed by a licensee or applicant. (NRC, 2009a)

No Federally or State-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the proposed Lost Creek project area; therefore, no adverse impacts would be expected. However, several protected wildlife species either have the potential to or do occur within the proposed project area. These species are described below.

Black-footed Ferret

The black-footed ferret (*Mustela nigripes*) (Federally listed as endangered) is found in active prairie dog colonies, however, no active black or white-tailed prairie dog colonies exist within the proposed project area, and the nearest active prairie dog colonies are located 1.6 to 3.2 km [1 to 2 mi] south and southwest of the site (LCI, 2008a). Therefore, no impacts on the black-footed ferret would be expected from construction of the proposed Lost Creek ISR Project.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a Wyoming species of concern and BLM-designated sensitive species and may occur as a sporadic migrant or forage on the site occasionally. The nearest known bald eagle nest is located more than 8 km [5 mi] from the proposed project (LCI, 2008a). Additionally, bald eagles prefer to nest and hunt near large lakes, rivers, and other open bodies of water near forested habitat (WGFD, 2005); therefore, the Lost Creek site would not provide optimal or preferred habitat for the species. Therefore, the NRC staff concludes there would be no impact on this species during ISR construction.

Greater Sage-Grouse

The Greater sage-grouse is Federally listed as a candidate species, a State of Wyoming species of concern, and a BLM-designated sensitive species. After FWS identified the Greater sage-grouse as a candidate species, the Wyoming Governor issued an August 2010 Executive Order (E.O. 2010–4) setting forth current sage-grouse core area protection guidance which provides recommendations for management of sage-grouse in core areas. The Permitting Process and Stipulations for Development in Sage-Grouse Core Areas (presented in E.O. 2010–4, Attachment B) were developed in collaboration with State and Federal agencies, the public, and industry. Representatives from LCI (the applicant) participated in Sage-Grouse Implementation Team (SGIT) meetings and chaired an ISR subcommittee. The applicant developed a Wildlife Protection Plan and Wildlife Monitoring Plan for the proposed action to be consistent with USFWS, BLM, WGFD, and WDEQ-LQD recommendations and requirements as part of the Permit to Mine Application submitted to WDEQ-LQD. The monitoring plan includes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed

project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2008b, Addendum OP-A6-A). This plan contains the mitigation measures included in the applicant license application and summarized in Appendix F and a detailed sage-grouse monitoring plan.

Based on the applicant's baseline wildlife surveys, 1 sage grouse lek of unknown status is located on the proposed project site, and 10 active leks are located within a 6.4-km [4-mi] radius of the proposed Lost Creek ISR Project (WDEQ, 2010c; LCI, 2008b). Additionally, the proposed project site is located within a sage-grouse core area as delineated by the SGIT as shown in SEIS Figure 3-12 (WGFD 2010b). Core areas provide high quality habitat for sage-grouse nesting and brood-rearing and are necessary to maintain sage-grouse populations.

The current planned activities for construction of the proposed Lost Creek ISR Project do not fully conform to E.O. 2010–4 or BLM's Greater Sage-Grouse Habitat Management Policy *(*BLM, 2009*)* related to certain surface occupancy, seasonal use, transportation, overhead line, noise, and vegetation removal stipulations as discussed belo*w*.

Surface Occupancy. E.O. 2010–4 states there will be no surface occupancy (NSO) within a 1-km [0.6-mi] perimeter of occupied or undetermined sage-grouse leks. This means that no surface facilities including roads shall be placed within the NSO area. BLM habitat management policy (BLM 2009) further states that disruptive activity (people and/or the activity within nesting habitats for a duration of 1 hour or more during a 24-hour period during the nesting season) is restricted on or within a 0.4-km [0.25-mi] radius of the perimeter of occupied or undetermined sage-grouse leks from 6 p.m. to 8 a.m. from March 15–May 15.

With respect to E.O. 2010–4 surface occupancy stipulations, the proposed facility design would be too close to (i.e., within 1 km [0.6 mi]) three active leks and one unknown status lek located near the primary access road to the site, two leks near a transmission line, and one lek near the proposed location for a deep disposal well. As explained in SEIS Section 2.1.1.1.2.5, the proposed Lost Creek ISR facility would be serviced by electric power from an overhead transmission line off the Crooks Gap-Wamsutter Road. A 3,300-m [10,800-ft] long 34.5 kV overhead line would connect a power line to a metering point on the western boundary of the proposed project area. Two sage-grouse leks are located within 1 km [0.6 mi] of the proposed transmission line between the western project boundary and Crooks Gap-Wamsutter Road (LCI, 2008b, Figure OP-A6-2), which does not conform with the E.O. 2010–4 stipulation for no surface occupancy. SEIS Section 2.1.1.2.3 describes the main site access as being from the west, off the Wamsutter-Crooks Gap Road on an upgraded existing two-track dirt road. This road would cross the proposed project area and connect Wamsutter-Crooks Gap Road (CR 23) to the west and Sooner Road (BLM Road 3215) to the east. Three sage-grouse leks are located within 1 km [0.6 mi] of the proposed access road upgrade activities. In addition, one deep disposal well would be located approximately 0.8 km [0.5 mi] from the Crooked Well lek in the northeast portion of the proposed project area. These planned activities neither comply with the E.O. 2010–4 stipulation recommendation for surface occupancy nor with BLM habitat management policy (BLM, 2009).

Seasonal Use. E.O. 2010–4 states that activity (production and maintenance activity exempted) will not be allowed within a 1-km [0.6-mi] perimeter of leks in a core area between March 15 and June 30. Activities may be allowed during timing restriction periods on a case-by-case basis. The BLM Rawlins Regional Management Plan states that surface disturbances or

disruptive activity is prohibited or restricted in suitable breeding, nesting, and early brood-rearing habitat between March 1 and June 30 (BLM 2008).

With respect to E.O. 2010–4, seasonal use stipulations, the applicant has stated they would conduct exploration drilling and initiate construction activities in accordance with the BLM timing restriction (LCI, 2008b, Attachment OP-6, Section 1.2). The applicant plans to initiate construction outside the stipulated time restriction periods; however, activities would continue year round within the area of approved disturbance (e.g., wellfield patterns, roads, plant area). Exploration activities occurring outside the stipulated period (i.e., from March 15 to June 30) for disturbance would not be performed. Depending on the timing of project activities, three sage-grouse leks located within 1 km [0.6 mi] of the proposed main access road and one lek located near a deep well location would be affected, and that would neither comply with the E.O. 2010–4 stipulation recommendation for surface occupancy nor BLM habitat management policy (BLM, 2009).

Transportation. E.O. 2010–4 recommends that main roads used to transport production and/or waste products be located greater than 3 km [1 .9 mi] from the perimeter of occupied sage-grouse leks, other roads used to provide facility site access and maintenance be located more than 1 km [0.6 mi] from the perimeter of occupied sage-grouse leks, and that roads be constructed to minimum design standards needed for production activities.

With respect to E.O. 2010–04, transportation stipulations, as previously stated, the proposed main access road would be located within 1 km [0.6 mi] from the perimeter of three sage-grouse leks, less than the recommended distance (i.e., 3 km [1.9 mi]) for transport by the perimeter of occupied sage-grouse leks. This access road would be used to transport yellowcake slurry and waste generated from project activities.

Overhead Lines. E.O. 2010–4 stipulations recommend burying lines when possible; otherwise, overhead lines should be located at least 1 km [0.6 mi] from the perimeter of occupied sage-grouse leks. New lines should be raptor proofed if not buried.

With respect to E.O. 2010–04 overhead line stipulations, as described with respect to the surface occupancy stipulations, the applicant would not meet the surface occupancy recommendations in part because of the proposed overhead transmission line. However, the applicant does propose to use appropriate power pole cross arm designs that follow BLM guidelines to minimize raptor roosting on power poles and to minimize predation on sage grouse (LCI, 2008a, Section 4.6.3.2).

Noise. E.O. 2010–4 stipulations state that noise be limited to 10 dBA above ambient noise measured at the perimeter of a lek from 6 p.m. to 8 a.m. during initiation of breeding (March 1 to May 15).

With respect to E.O. 2010–04 noise stipulations, SEIS Section 3.8 describes the ambient (background) sound levels at the proposed project site as being less than 40 dBA. A summary of noise effects on wildlife populations (Federal Highway Administration, 2004) includes reference to measured average traffic noise levels at 15 m [50 ft] of 54–62 dBA for passenger cars and 58–70 dBA for heavy trucks. As described in GEIS Section 4.2.7.1, noise from a line source like a highway is reduced by about 3 dB per doubling of distance (NRC, 2009a). Using the highest projected noise level of 70 dBA at 15 m [50 ft] along the access road closest to the two active sage-grouse leks located west of the proposed project boundary and east of Wamsutter-Crooks Gap Road, the approximate noise level at the perimeter of the nearest lek

would range from 52–55 dBA above the stipulated noise limits of 10 dBA. Traffic noise along the road would be localized and mostly limited to daylight hours. The traffic volume would decline after the ISR construction phase and startup activities, resulting in a decrease in wildlife impacts. However, the noise from traffic passage on roads could have a relatively higher noise impact on wildlife, particularly at peak (construction) employment.

Vegetation Removal. E.O. 2010–4 stipulations state vegetation removal should be limited to the minimum disturbance required by the project. All topsoil stripping and vegetation removal in suitable habitat will occur in areas that are within the mine units and the processing plant and its appurtenant structures (maintenance building, storage areas, parking).

With respect to E.O. 2010–04 vegetation removal stipulations, the applicant may not meet seasonal use recommendations which stipulate that topsoil stripping and vegetation removal of sage grouse habitat occur between July 1 and March 14 at distances greater than 6.4 km [4.0 mi] from the perimeter of an occupied lek. The applicant states in its Wildlife Protection Plan and Wildlife Monitoring Plan that delineation and installation of the wellfields would occur year round, including necessary topsoil and vegetation removal (LCI, 2008b, Attachment OP-6, Section 1.2). As shown in SEIS Figure 3-12, eight leks are located within 6.4 km [4.0 mi] of the proposed wellfields.

As previously described in this section, WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2008b, Addendum OP-A6-A). In addition, the applicant completed a disturbance evaluation following the Project Impact Analysis Area (PIAA) process as suggested by WGFD (LCI, 2008a, Attachment OP-6, Addendums OP-A6-A and OP-A6-B). The PIAA results showed that less than 1 percent of the PIAA would be disturbed by the proposed Lost Creek ISR Project, which is less than the E.O. 2010–4 maximum allowable disturbance of 5 percent. Data collection and analysis from each year's wildlife protection and monitoring measures would be included in the applicant's annual report to WDEQ-LQD, BLM, and NRC. Consultation with BLM, WGFD, FWS, and WDEQ-LQD would occur, as necessary, prior to completing survey work. Based on the PIAA results, the NRC staff concludes that the impact on suitable sage-grouse habitat would be SMALL. However, because sage-grouse would be impacted as described above by increased traffic noise near occupied leks, access road upgrades and transmission line installation, the drilling of the deep disposal well located within 1 km [0.6 mi] of a lek, and the occurrence of other potential ISR activities within timing restriction periods, the NRC staff conclude there would be a MODERATE impact on sage-grouse.

As described in this section, no Federally or State-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the proposed project area. Therefore, the NRC staff concludes the impacts on protected species during construction would be SMALL except for sage-grouse. However, continued coordination with BLM and WGFD and implementation of the applicant's mitigation and monitoring plan would reduce the potential impact.

4.6.1.1.5 Construction Impacts on Species of Concern

The proposed project area supports suitable habitat for several species of concern, including certain passerine (nongame perching and songbirds) and breeding birds, pygmy rabbits, olive-backed pocket mouse, and prairie vole (WGFD, 2009). These species could all potentially be affected by construction activities.

The sage thrasher, Brewer's sparrow, and sage sparrow [all native species status (NSS) 4 species] have been observed in the proposed project area. Suitable habitat also exists for the lark bunting, though this species has not been observed. Lowland big sagebrush shrubland provided habitat for the highest densities of breeding birds; however, birds have been observed in the upland big sagebrush shrubland habitat. Project construction and operation could result in both the short-term (2 weeks to 6 months) and long-term (greater than or equal to the project life) loss of 115 ha [285 ac] of nesting habitat for these bird species within the proposed project area. Construction and operation activities may displace birds to lower quality habitat areas and could result in localized lower reproduction and increased predation. Another direct impact on sagebrush-obligate birds is mortality from motor vehicle collisions. Impacts could be MODERATE because of direct and indirect impacts on birds described in previous SEIS sections. In addition to the seasonal guidelines for wildlife exclusion periods (SEIS Appendix F, Table F–1), the applicant has committed to implementing the mitigation measures described in SEIS Section 4.6.1.1.1 (e.g.,, minimizing noise, vehicular traffic, and human proximity, especially near sage-grouse leks as discussed in detail in SEIS Section 4.6.1.1.4), which could further reduce impacts to nesting activities to SMALL.

The occurrence of pygmy rabbits in the lowland big sagebrush shrubland habitat was sporadic based on applicant surveys conducted in the summer of 2007 (LCI, 2008b). SEIS Figure 3-7 shows the occurrence of pygmy rabbit habitat (lowland big sagebrush shrubland) within the proposed project area. Project construction and operation would result in the loss of 16 ha [39 ac] of pygmy rabbit habitat within the proposed project area (LCI, 2008a). Since pygmy rabbits typically stay within limited habitat areas, individual pygmy rabbits could be lost during construction activities in lowland big sagebrush shrubland habitat. Project facilities, wellfields, mud pits, storage ponds, and access roads may expose pygmy rabbits to harmful substances or materials. Although the size of the affected pygmy rabbit habitat {16 ha [39 ac]} is small compared to the overall available habitat in the proposed project area, the NRC staff concludes the impact on pygmy rabbits would be MODERATE because imperative habitat for the pygmy rabbits could be fragmented or destroyed and it would take many years to reestablish usable habitat.

The state-listed olive-backed pocket mouse and prairie vole were not observed by the applicant during surveys of the proposed project area; however, suitable habitat exists and these species are known to occur in the region (WGFD, 2004). Potential habitat would be lost during project construction and operation, and mortality could result from earthmoving activities. However, local populations would likely recover rapidly. Although these species have relatively small home ranges, vulnerable habitat, and little is known about the state population distribution, the impact would be SMALL because there is no ongoing significant loss of habitat (WGFD, 2011) and a relatively small amount of land {i.e., 115.5 ha [285.4 ac]} would be disturbed during the life of the proposed project. These species could relocate to suitable habitat adjacent to areas being disturbed (WGFD, 2011).

Because only 115.5 ha [285.4 ac] would be disturbed over the life of the proposed project, no sensitive vegetation species occur on the proposed site, the proposed construction activities would only affect a small portion of the total pygmy rabbit habitat {16 ha [39 ac]} compared to the overall available habitat in the proposed project area, construction is unlikely to affect the local population of birds and small mammals, and the applicant committed to implement sage-grouse guidelines that would limit impacts to other birds, the NRC staff concluded that the overall impacts on species of concern during the ISR construction phase of the proposed Lost Creek ISR Project would be SMALL.

4.6.1.2 Operation Impacts

As described in GEIS Section 4.2.5.2, ecological resources could be altered by operations at an ISR facility as a result of fencing, traffic, and noise; and individual takings could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat, forage, and water could be limited by fencing. However, in Wyoming the WGFD specifies fencing construction techniques to minimize impediments to big game movement. Migratory birds could be affected by exposure to constituents in storage ponds, but the use of perimeter fencing and netting would limit impacts. Wildlife would avoid areas around vehicles, humans, and noise-generating activities. As stated in the GEIS, temporary contamination or alteration of soils could occur from operational leaks and spills and from spillage during the transport of treated wastewater. However, the detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and remediation of potentially impacted soils would limit the magnitude of overall impacts on terrestrial ecology. The GEIS also stated that spill detection and response plans would reduce impacts on aquatic species from spills around well heads and leaks from pipelines (NRC, 2009a). Mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys would limit the potential impact, and the GEIS concluded the impact to wildlife would be SMALL.

The potential impacts to ecological resources anticipated during operations at the proposed Lost Creek ISR Project would be consistent with the findings described in the GEIS because the same activities described in the GEIS are also planned for the proposed Lost Creek ISR Project. The applicant's use of such mitigation measures as perimeter fencing, netting, mosquito control, leak detection and spill response plans, periodic wildlife surveys, noise reduction, and preventing unnecessary traffic as summarized in Table 4-1, would reduce the estimated impacts from MODERATE to SMALL.

4.6.1.2.1 Operational Impacts on Vegetation

During operations at the proposed Lost Creek ISR Project, wellfields and supporting facilities would be accessed frequently using the proposed road network. Only minor impacts to vegetative communities would occur because most of the clearing for the ISR facility would have occurred during the construction phase. Stripping the topsoil layer would increase the susceptibility of the project area to invasive and noxious weeds. The applicant has stated they would minimize surface disturbance by restricting vehicular access on specific roads (see Table 4-1). The applicant also plans to construct or upgrade access roads following BLM and WGFD guidelines to minimize the road width, to limit the impact on vegetation located on road shoulders. In addition, the applicant has stated they would place all utilities in the same right-of-way. Pipelines and transmission lines would be placed in, or adjacent to, the access road right-of-ways to minimize habitat impacts. Disturbed areas would be reseeded with WDEQ-and BLM-approved seed mixture, as soon as conditions allow, to prevent the establishment of competitive weeds. The applicant has stated that it would also conduct annual invasive and noxious weed surveys. Should invasive and noxious weeds become a problem, the applicant would consider other alternatives, such as herbicide application (LCI, 2008b, Attachment OP–6).

Impacts on vegetation from facility operations would be less than that experienced during the construction phase, and impacts resulting from spills around well heads and leaks from pipelines would be SMALL because they would be handled using the spill and leak prevention measures described in SEIS Section 4.4.1.2. Furthermore, disturbed areas would be reseeded with native plants and grasses approved by BLM and WDEQ-LQD as soon as practicable (LCI,

2008b, Attachment OP–6). The applicant's recruitment from native plant populations bordering disturbed areas would facilitate the revegetation process. Because the amount of vegetation disturbed will be less than the amount disturbed during construction, and the applicant committed to use spill and leak prevention measures and quickly reseed disturbed areas, the impact of ISR operations on vegetation would be SMALL.

4.6.1.2.2 Operational Impacts to Wildlife

The potential impacts of ISR facility operations on terrestrial wildlife are described in GEIS Section 4.2.5.2 as: (i) habitat alteration and incremental habitat fragmentation; (ii) displacement/stress on wildlife from human activity; and (iii) direct and/or indirect mortalities from project construction and operation. There would be less noise and less traffic during the operations phase compared to the construction phase; therefore, the potential to disrupt wildlife populations would be reduced along with a decrease in the probability of vehicular collisions. Wildlife use of areas adjacent to ISR operations would be expected to increase as animals became habituated to site activities. (NRC, 2009a)

Movement of big game through the proposed Lost Creek ISR Project area would not be affected by most ISR operations. The risk for direct vehicular collisions with wildlife would decrease due to reduced traffic during the operations phase compared to the construction phase. However, as wildlife becomes habituated to proposed operation activities, wildlife would encroach nearer to the proposed site, therefore increasing the potential for direct mortalities from vehicle collisions. The applicant plans to enforce vehicular speed limits to minimize the frequency of collisions (LCI, 2008b, Attachment OP-6, Section 1.4.1.2). In addition, competition for available forage around the proposed site could increase as wildlife return to the area near or on the project site. The limited use of fencing to impede ingress and egress to the processing plant and wellfields would further mitigate impacts. The applicant has stated they would construct fencing to BLM specifications (LCI, 2008a, Section 4.6.3.2).

Wildlife use of areas adjacent to ISR operations would likely increase as animals become habituated to the activity in the project area (WGFD, 2010). Because wildlife may be in proximity to facility buildings, roads, and wellfields, some impacts on wildlife could occur from direct conflict with vehicular traffic and the presence of onsite personnel. Generally these impacts would be SMALL because the traffic volume would be less than during construction, and collisions would affect only a few individuals thereby not threatening the continued existence of any particular species in the proposed project area. However, proximity to either active sage-grouse leks or raptor nests could adversely affect reproduction of these species and, thus, could have a MODERATE impact on those particular species. The applicant has committed to comply with wildlife mitigation measures described in detail in SEIS Section 4.6.1.1.4 and in its Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2008b, Attachment OP-6) with respect to land disturbance, noise, vehicular traffic, and human proximity to reduce the overall impact on wildlife. These efforts would reduce the operations impacts on sage-grouse and raptors from MODERATE to SMALL.

Potential impacts on migratory birds and other wildlife from exposure to toxic chemicals in the storage ponds could occur. Netting over the storage ponds would be installed to minimize the hazard to migratory birds, sage-grouse, or other wildlife (LCI, 2008b, Attachment OP–6, Section 1.3.3.3). In addition, the applicant proposes to quarterly sample the water quality in the ponds to ensure consistency with agency recommendations, and to also use decoys or other artificial deterrents (LCI, 2008b, Attachment OP–6, Section 1.3.3.3). Based on the applicant's use of mitigation measures, including perimeter fencing and surface netting on the

storage ponds, the NRC staff concludes that the proposed action would result in a SMALL impact on wildlife.

Proposed operations could result in spills of process solutions containing dissolved selenium at the processing plant, wellfields, and header houses or along pipelines connecting these facilities. SEIS Section 2.1.1.1.2.2 describes the applicant's plan to prevent liquid releases to the environment at the processing plant and outdoor storage locations and to implement a Spill Prevention, Control, and Countermeasure (SPCC) plan at the proposed Lost Creek ISR Project. If the applicant managed spills or leaks using approved countermeasures, the impacts on wildlife would be SMALL.

Federally listed threatened and endangered species would not be affected during facility operation because none occur at the proposed site (FWS, 2008). The impact on protected species and species of concern during facility operation would be significantly less than that described for construction because no new facilities would be constructed. Direct impacts to such species include: (i) loss of habitat and displacement of affected species; (ii) mortality of mobile species from motor vehicle collisions; (iii) exposure to toxic chemicals; and (iv) wildlife avoidance of the proposed project area due to human activity. Operation impacts to sage-grouse could include traffic noise near occupied leks, access road use, transmission line maintenance activities, and deep disposal well operations within 1 km [0.6 mi] of the Crooked Well lek, although the impact would be less than during the ISR construction phase. As described in SEIS Section 4.6.1.1.4, the applicant developed a Wildlife Protection Plan and Wildlife Monitoring Plan that describes extensive monitoring to assess sage-grouse populations that may be affected by all phases of the proposed project. WGFD concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2008b, Addendum OP–A6–A) and would reduce the estimated impact to these species.

Because the applicant committed to adhere to the raptor and sage-grouse mitigation and monitoring plans and seasonal guidelines for noise, vehicular traffic, and human proximity, the impact on ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during the operations phase would be SMALL and less than that experienced during the construction phase. Due to the limited occurrence and ephemeral nature of surface water on the proposed Lost Creek ISR Project site, there would be no impact on aquatic species. Because of the limited occurrence and ephemeral nature of surface water on the proposed Lost Creek ISR Project site, there would be no impact on aquatic species.

4.6.1.3 Aquifer Restoration Impacts

GEIS Section 4.2.5.3 describes the potential impacts on ecological resources during the aquifer restoration phase. Impacts could include wildlife disturbance from vehicle traffic and maintenance and restoration activities, although existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Traffic and aquifer restoration activities would be similar to the operations phase. Migratory birds could be affected by exposure to constituents in the storage ponds, but perimeter fencing and netting would reduce impacts. (NRC, 2009a)

Contamination of soils and surface waters could result from leaks and spills of treated wastewater. However, detection and response techniques, and eventual survey and

decommissioning of all potentially impacted soils and sediments, would limit the magnitude of overall impacts on terrestrial and aquatic ecology.

Impacts to ecological resources during the proposed Lost Creek ISR Project aquifer restoration phase would be consistent with the impact determinations made in the GEIS because the site-specific actions fall within the bounds considered in the GEIS. Because the existing infrastructure would be in place, the estimated impact on ecological resources would be similar to facility operation and, therefore, SMALL. Therefore the NRC staff concludes that the anticipated impact on ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, and protected species) during aquifer restoration would be SMALL.

No impact to aquatic species would be expected because of the limited occurrence and ephemeral nature of surface water on the proposed Lost Creek ISR Project site.

4.6.1.4 Decommissioning Impacts

As described in GEIS Section 4.2.5.4, decommissioning and reclamation activities would result in short-term land disturbance as soils are excavated, buried piping is recovered and removed, and structures are demolished and removed. Revegetation and recontouring would restore habitat previously altered during construction and operations. Wildlife that moved back into the area during the operation and aquifer restoration phases would be temporarily displaced, but would return after decommissioning and reclamation are completed and vegetation and habitat are reestablished. Reestablishment of some habitats, however, could span as much as 10 years. Decommissioning and reclamation activities could also result in short-term increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. Therefore, the GEIS concluded the impact from decommissioning would be SMALL. (NRC, 2009a)

As stated in GEIS Section 4.2.5.4, with respect to threatened and endangered species, potential impacts resulting from individual takes could occur due to conflicts with decommissioning activities (equipment, traffic). Short-term land disturbance would occur as structures are demolished and removed and the ground surface recontoured. An inventory of threatened or endangered species developed during the site-specific environmental review of the detailed decommissioning plan would identify unique or special habitats, and Endangered Species Act consultations with the FWS would further assist in reducing impacts. Upon completion of decommissioning, revegetation, and recontouring, habitat would be reestablished and impacts would, therefore, be limited. Impacts on threatened and endangered species could range from SMALL to LARGE, depending on site conditions at the time of decommissioning.

Impacts from decommissioning the proposed Lost Creek ISR Project would, in part, be similar to those described for construction of the facility with respect to increased noise and traffic. The main similarity between the decommissioning phase and the construction phase would be the habitat fragmentation caused by these activities and displacement of birds into adjacent areas. Although these impacts are reversible, they would be long term as identified in SEIS Appendix F, Table F–1, and would be reduced with time as suitable sagebrush habitat was reestablished. Displaced wildlife would likely return to the area when decommissioning and reclamation were complete.

Decommissioning would involve abandonment of the wellfields and removal of the supporting facilities and roads. The applicant proposes reclaiming all roads unless approval is granted for

post-extraction use (LCI, 2008b). The applicant's proposal includes 4.48 ha [11.1 acres] of road (LCI, 2008a) which is approximately 4 percent of the proposed 115 ha [285 acres] of surface disturbance (LCI, 2008a). Should selected roads be approved for continued use beyond the duration of the Lost Creek ISR Project, these roads would represent a small fraction of the land area disturbed by the proposed project and the NRC staff conclude would constitute a small incremental addition to the existing road network in the region and a small fraction of the total land reclaimed during the decommissioning phase.

Stockpiled topsoil would be used to regrade the area surrounding the processing plant and storage ponds to preconstruction contours and to reseed these areas with native vegetation. No loss of additional vegetative communities beyond that previously lost or disturbed during construction would occur. Pipeline removal would impact vegetation that had begun to reestablish, although these areas would also be reseeded. The decommissioning process would generate noise and traffic from building dismantlement and transportation. Wildlife would likely avoid areas with heavy equipment operation. Most vegetation disturbance described previously for the ISR construction phase would also occur during decommissioning within the sagebrush vegetative community type (see SEIS Figure 4-1), which is the crucial habitat necessary to maintain sage-grouse populations (WGFD, 2010). This community type is gaining increasing importance within its range as areas are being lost and converted to grass due to wildfire and human disturbances. The issue is compounded by the difficulty in successfully reestablishing sagebrush, resulting in long-term impacts on vegetation, wildlife habitat, and visual and scenic resources. Refined techniques in seeding sagebrush have shown significant improvements in successful establishment of the species (Lambert, 2005). Such improved methods may include the use of cased-hole punched seeding with polypropylene casings as Seefeldt and Booth described (2005). For those areas previously dominated by sagebrush, the applicant would reestablish sagebrush using such techniques. As required, the applicant would submit an updated reclamation plan to BLM for approval, which would be reviewed and approved by the appropriate State and Federal agencies.

Decommissioning activities would be short term; however, complete reclamation of vegetation communities would be long term and could impact sage-grouse populations until usable habitat is reestablished. The estimated impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians) during decommissioning would be SMALL and comparable to those described for the construction phase. However, because of the sage-grouse dependence on the sagebrush shrubland type, NRC concludes that impacts on protected species and species of concern from decommissioning would be MODERATE. The applicant's adherence to their Wildlife Protection Plan and Wildlife Monitoring Plan and WGFD and BLM seasonal guidelines (WGFD, 2010 and BLM, 2009) with respect to land disturbance, noise, vehicular traffic, and human proximity would further mitigate the estimated impacts on affected species. No impact to aquatic species would be expected because of the limited occurrence and ephemeral nature of surface water located on the proposed Lost Creek ISR Project site.

4.6.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no ISR facility construction associated with this project and therefore no land disturbance or vegetation removal associated with construction, operation, aquifer restoration, or decommissioning. The area would continue to provide vegetation communities and wildlife habitat typical of the region. Land would continue to be used for grazing. When compared to the proposed action, there would be no impacts on ecological resources from the proposed Lost Creek ISR Project under Alternative 2.

4.6.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, NRC would issue the applicant a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing of dry yellowcake as the final product. By doing so, the proposed project would consist of adding equipment for the processing of dry yellowcake. The additional equipment would be installed in the processing plant building with the same footprint size as that located on the Lost Creek site for Alternative 1. The dry yellowcake would be transported from the Lost Creek site directly to Metropolis, Illinois, for ultimate processing into fuel for nuclear reactors. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility before being shipped to Illinois.

The potential impacts on ecological resources from the four phases of the proposed ISR facility development under Alternative 3 would be the same, or less, as those described under Alternative 1 (proposed action). There would be no increased land disturbance because the only change would be the installation of a yellowcake dryer, which would be installed in the processing plant already fitted to house the unit. Because there would be no other construction of roads, buildings, or storage areas required for this alternative in comparison to Alternative 1, NRC staff concludes that the level of impacts is bound by the bases described in SEIS Section 4.6.1. In addition, the addition of a yellowcake dryer in the processing plant would result in fewer shipments of dried yellowcake rather than the proposed action (SEIS Section 4.3.3.2) and would result in fewer potential wildlife mortalities from vehicles and less disturbance from traffic and noise. Therefore, potential impacts on ecological resources would be the same or less for the operation, aquifer restoration, and decommissioning phases as the proposed action.

4.7 Air Quality Impacts

Potential environmental impacts to air quality from the proposed Lost Creek ISR Project could occur during all phases of the ISR facility lifecycle. Nonradiological air emission impacts primarily involve fugitive road dust from vehicles used throughout the facility lifecycle and combustion engine emissions from diesel equipment associated with construction, operation, and decommissioning activities. Radiological air emissions involve radon releases from well system relief valves and resin transfer, and elution. Potential radiological air impacts, including radon release impacts, are addressed in SEIS Section 4.13.

The NRC staff's review of potential air quality impacts included review and consideration of local meteorological data that the applicant provided based on existing sampling stations in the region of the proposed Lost Creek ISR Project site. During the review, the NRC staff concluded that the applicant's monitoring data were collected from stations with brief periods of record and additional data were needed for the applicant to demonstrate that site measurements were consistent with long-term data. After additional data collection and subsequent revision to its technical report (LCI, 2010), the applicant stated that microclimatological differences between the project sites and regional meteorological stations had been observed. The applicant has, therefore, committed to the continued operation of both the Lost Creek and Lost Soldier meteorological stations (SEIS Section 3.7.1) until sufficient data have been collected to support site operations without the need for additional measurements at one or both of the stations (LCI, 2010). This commitment by the applicant is reinforced by inclusion in a NRC license condition to collect and submit for NRC review additional meteorological data on a continuous basis until the collected data are determined by NRC to represent long-term meteorological conditions as documented in the NRC safety evaluation. The following review of air quality impacts assumes that the applicant's meteorological data are representative of the site meteorological conditions.

When the applicant submits its additional data for NRC review, the NRC staff will evaluate whether the conclusions of the following analysis would change based on the additional information and issue a supplement if changes are warranted.

Factors that the NRC staff used in determining the significance of the potential air quality impacts are described in GEIS Section 1.7.2 and include (i) whether the air quality for the site region of influence (ROI) is in compliance with the National Ambient Air Quality Standards (NAAQS) and (ii) whether the facility can be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs. An additional concern would be the presence of Prevention of Significant Deterioration (PSD) Class I areas within the region that could be impacted by emissions from the proposed action. As discussed in the following paragraphs, the proposed Lost Creek ISR Project would not be classified as a major source under New Source Review or Title V of the Clean Air Act, would be located within the attainment area for all NAAQS primary pollutants, and is not likely to affect the closest PSD Class I area.

Air emissions from the proposed Lost Creek ISR Project would comply with the conditions of the WDEQ-approved construction air permit (Table 1-2) (WDEQ, 2010a) and the required WDEQ minor source operating permit. In addition, all of the nonradiological emissions estimates that the NRC staff evaluated (SEIS Section 2.1.1.1.6.1) support the conclusion that the proposed action would not be comparable to, or considered, a major source of emissions. The NRC staff believes that these emissions (i.e., well below the major source thresholds), in an area with atmospheric conditions that are often favorable for dispersion (SEIS Section 3.7.1.2), would not impact attainment for ambient air quality standards in the region surrounding the proposed site areas or in the Class I or Class II areas in the vicinity of the proposed Lost Creek ISR Project. The NRC staff expects that these emissions at levels well below the major source thresholds would not destabilize local air quality, although localized, short-term and intermittent visible air emissions would be possible in the surrounding area (i.e., when vehicles travel on unpaved roads).

The applicant's estimates of fugitive road dust emissions at 154 t/yr [169.9 T/yr] (LCI, 2008b) are below the Clean Air Act threshold for defining a major emitting facility for the prevention of significant deterioration from unspecified sources of any pollutant {227 t/yr [250 T/yr]}. The NRC staff reviewed the applicant's calculations and conducted additional calculations using the same EPA methods and data (EPA, 2006) the applicant used but with different assumptions. The staff also considered that the applicable state air permitting authority, the WDEQ, has conducted a best available control technology analysis for road dust treatment as part of its air construction permit review (WDEQ, 2010). The WDEQ permit requires the applicant to apply dust control measures to a portion of the unpaved roads that the applicant would use to access the site. The staff's calculations assumed that the required road treatment would be effective, but concluded that if no employee carpooling is assumed, and the miles traveled by both incoming and outgoing traffic are considered, the resulting road dust emissions estimates for the untreated portions of the roads could be higher, by about a factor of four, than the applicant's estimate. Although the applicant has not proposed any carpooling programs, if carpooling is assumed to occur at the applicant's assumed 2.6 persons per vehicle (a plausible assumption given the long commuting distances expected from local population centers), then the NRC road dust estimates would be below the aforementioned 227 t/yr [250 T/yr] threshold.

Based on the aforementioned range of road dust estimates, the staff concluded that there is a potential for significant localized dust emissions. Therefore, short-term and intermittent visible air emissions are possible to the local area surrounding the site when vehicles travel on unpaved roads. These impacts would be reduced, but not eliminated by, road treatments that

the applicant proposed and are required by WDEQ (2010a). As a result, while the unpaved transportation network is sparsely populated, the potential exists for intermittent, moderate dust impacts through the town of Bairoil, which is located along one of the potential worker transportation routes. Regarding potential near-field air quality impacts, the NRC staff compared the range of calculated emissions for the Lost Creek ISR Project with a particulate matter (PM_{10}) emission estimate and air modeling analysis for the Atlantic Rim Natural Gas Project (TRC Environmental Corporation, 2006). The Atlantic Rim Project analysis had estimated maximum PM_{10} emissions above the upper end of the range that the NRC staff estimated for the proposed Lost Creek ISR Project and did not exceed the NAAQS when the emissions were modeled to evaluate potential in-field air impacts (TRC Environmental Corporation, 2006). The staff also considered both the relative magnitudes of PM_{10} emissions for the proposed Lost Creek site and the Atlantic Rim Project, and the magnitude of calculated in-field PM_{10} air concentrations in Atlantic Rim air modeling results, and concluded that the Lost Creek PM_{10} emissions would not produce ambient air concentrations that would exceed the Class II PSD increment if calculated using the same methods that were used for the Atlantic Rim Project. Regarding potential far-field impacts, the Atlantic Rim Project study excluded road dust from far-field impact analyses based on reports of near field settling of road dust. The NRC staff also considered the recent WDEQ review of proposed fugitive dust emissions and the subsequent granting of an air quality construction permit. The granting of a permit demonstrates that the potential for regional air quality impacts from the proposed emissions have been evaluated by the applicable permitting authority and any measures deemed necessary by the WDEQ to protect the air quality have been taken. Based on this review, the NRC staff concludes that the regional air quality would not be significantly affected by the proposed road dust emissions.

As described in SEIS Section 3.7.2, the air quality of the region where the proposed Lost Creek ISR Project is located in an area classified as an attainment area for all of the NAAQS primary pollutants. The nearest PSD Class 1 areas, Bridger Wilderness, Fitzpatrick Wilderness, and Mt Zirkel, are located about 96.6 km, 161 km, and 145 km [60, 100, and 90 mi], respectively, to the northwest and south (Mt. Zirkel) of the Lost Creek site (USDOI, 2008). The Popo Agie Wilderness area is the closest Class II area and is located about 93.4 km [58 mi] to the northwest of the Lost Creek site. The attainment status of the air quality surrounding the proposed license area, which includes the aforementioned PSD areas, provides a measure of current air quality conditions and affects whether new emission sources are allowed. In recent years, increased attention has been paid to the air quality of the Upper Green River Basin area of Sublette County due to episodic elevated ozone measurements (Stoeckenius, 2010). This area of concern is in the vicinity of the Bridger and Fitzpatrick Wilderness areas; however, the Upper Green River Basin Area and the Bridger and Fitzpatrick Wilderness areas are located upwind of the Lost Creek ISR Project and therefore, would not be impacted by the proposed emissions.

The proposed facility is not considered a major source of emissions based on a condition in the WDEQ-approved construction air permit (WDEQ, 2010a) that requires the applicant to obtain a minor source operation permit pursuant to Chapter 6, Section 2(a)(iii) of the Wyoming Air Quality Standards and Regulations. In addition, the NRC staff estimated mobile non-road emissions from construction equipment (SEIS Section 2.1.1.1.6.1) that WDEQ air permitting does not address and found these emissions were also well below major source threshold levels. The low magnitude of emissions directly affects the potential for air quality impacts and, therefore, the level of detailed review NRC considered necessary to adequately evaluate potential impacts.

All phases of the proposed Lost Creek ISR Project would result in greenhouse gas emissions, principally carbon dioxide (CO_2); however, the majority of these emissions would be from the use of diesel-powered equipment (including well drilling rigs) during the construction and decommissioning phases (SEIS Section 2.1.1.1.6.1 and Appendix D). Based on methods described in detail in SEIS Appendix D, the NRC staff calculated a maximum annual CO_2 emission from this diesel-powered equipment of 1,722 t/yr [1,900 T/yr] and cumulative CO_2 emissions (total facility lifecycle emissions) as 6,165 t [6,800 T]. For comparison, these calculated emissions from the proposed action are a small fraction of the net total of greenhouse gases produced annually in Wyoming at 20 million t/yr [22 million T/yr] (Center for Climate Strategies, 2007) and for the United States at 6 billion t/yr [6.6 billion T/yr] (EPA, 2009). Based on its assessment of the relatively small carbon footprint of the proposed facility as compared to the annual CO_2 emissions in both the State of Wyoming and the United States, the NRC staff concluded that the atmospheric impacts of greenhouse gases from the proposed facility lifecycle would not be noticeable and additional mitigation would not be warranted.

Nonradiological air quality impacts during construction, operation, aquifer restoration, and decommissioning phases of the proposed Lost Creek ISR Project are described in the following sections. See Chapter 5 for a description of climate change at the proposed site.

4.7.1 Proposed Action (Alternative 1)

4.7.1.1 Construction Impacts

As discussed in GEIS Section 4.2.6.1, fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities from construction would be short term and reduced through BMPs (e.g., wetting of roads and cleared land areas to reduce dust emissions). The GEIS also estimated that fugitive dust emissions during ISR construction would be well below the NAAQS for Particulate Matter$_{2.5}$ ($PM_{2.5}$) and for Particulate Matter$_{10}$ (PM_{10}). Additionally, the GEIS concluded particulate, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) emissions from ISR facilities would be a small percentage (1 to 9 percent) of the PSD Class II allowable increments. For NAAQS attainment areas, the GEIS concluded that nonradiological air quality impacts would be SMALL. In GEIS Section 4.2.2 (Transportation Impacts), the NRC also concluded that, depending on site-specific conditions, MODERATE dust impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads). That GEIS impact conclusion was based on evaluation of fugitive dust as a noticeable nuisance impact on nearby residents rather than a compliance issue with air quality standards however, the NRC staff has included this potential impact as an air quality impact in this SEIS.

Air emissions during the construction phase of the Lost Creek ISR Project (Section 2.1.1.1.6.1) would consist primarily of fugitive road dust and combustion engine exhaust from equipment such as drill rigs, water trucks, bulldozers, and light-duty passenger trucks. Construction activities would create air pollution resulting from incoming, outgoing, and onsite motor-vehicle traffic, heavy-equipment use, and well-field drilling. Therefore, the proposed Lost Creek ISR Project would meet the conditions pertaining to compliance with air quality standards specified in the GEIS as presented in Section 4.7, and impacts would be SMALL. This conclusion is further supported by the limited footprint of the construction area relative to the proposed project area, the low volume of traffic generated by the proposed action (SEIS Section 4.3.1.1), and the dust mitigation measures that the applicant proposed. The applicant proposes to apply water or other agents, as necessary, to control fugitive dust emissions (LCI, 2008b). The WDEQ construction permit (WDEQ, 2010a) also requires the applicant to treat access roads near the plant site to control dust emissions. Roads outside the project area (e.g., Wamsutter Road)

could exhibit potentially significant localized increases in dust generation from the proposed transportation as described in Section 4.7. Despite the use of controls, short-term and intermittent visible air emissions could occur in the local area surrounding the proposed project site when vehicles travel on unpaved roads. In particular, the proximity of housing to the unpaved portion of County Road 22 near Bairoil could cause dust generated by commuting-worker traffic and could cause a MODERATE impact at that location. Therefore, short-term and intermittent MODERATE impacts from fugitive road dust are possible; however, the average air quality is expected to remain in compliance with ambient standards and overall impacts would be SMALL.

The NRC staff calculated the emissions from diesel combustion engines in drilling rigs and construction equipment that would be used during the construction phase and presented these calculations in SEIS Section 2.1.1.1.6.1 and Appendix D. These calculations addressed emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), particulate matter (PM_{10}), formaldehyde, volatile organic compounds (VOCs), and carbon dioxide (CO_2). The results show that emissions of nitrogen oxides and carbon monoxide are the highest of the criteria pollutants evaluated. Estimated emissions of these pollutants are well below major source threshold levels. The calculated annual pollutant emissions of NO_x is 17.2 t/yr [19 T/yr] assuming 2 of the 5 proposed deep disposal wells were drilled in the same year as the first wellfield. If the NRC staff assumed all 5 deep disposal wells were drilled in the same year as the first well-field, the annual NO_x emission result increases to 35.4 t/yr [39 T/yr]. This higher level of calculated emissions is still below the 91 t/yr [100 T/yr] major source threshold, and NRC staff believes that this represents a single-year peak because all proposed deep wells would be completed in that year.

The diesel combustion engine emissions that the NRC staff calculated for the proposed action are below those reported in the GEIS from a prior NRC Environmental Impact Statement (EIS) (NRC, 1997) for a proposed ISR facility in Crownpoint, New Mexico; therefore, the potential impacts to air quality from the proposed action would be less than those reported in the GEIS. The NRC staff considers the emissions and associated potential air impacts from constructing the Crownpoint facility to bound the emissions from constructing the proposed Lost Creek ISR Project based on the following considerations. First, the Crownpoint facility proposed a higher maximum annual production rate than the proposed Lost Creek ISR Project. The ore deposits at the Crownpoint facility are at a much greater depth and, therefore, would require longer drilling times per well during wellfield construction. For example, the Crownpoint ISR facility has ore occurring at an approximate depth of 561 m [1,840 ft] below the ground surface (bgs), whereas the proposed Lost Creek ISR Project has ore occurring at depths that range from 91.5 to 213.4 m [300 to 700 ft] bgs (LCI, 2008b).

Second, the meteorology used at the Crownpoint site to estimate average annual air concentrations of emitted pollutants is also more stable than at the proposed Lost Creek ISR Project site, based on the NRC staff review of available joint frequency data for each site (NRC, 1997; LCI, 2008b), which indicated winds that fall within stability classes E and F occur about four times as frequently at the Crownpoint site than in the region surrounding the proposed Lost Creek Project. The annual average air concentrations for the Crownpoint emissions are also based on a mixing height of 1,000 m [1,090 yd] (NRC, 1997), which is within the range of mixing heights reported for the State of Wyoming of 659 m [718 yd] (morning average) and 4,074 m [4,440 yd] (afternoon average) (EPA, 2010) or 348 m [380 yd] (morning) to 2,300 m [2,515 yd] (afternoon) for the Riverton/Lander area reported by the applicant (LCI, 2008b). Based on the information reviewed, the NRC staff expects the dispersion conditions at the Crownpoint site would be less favorable than at the proposed Lost Creek ISR Project;

therefore, based on the combination of dispersion conditions and higher emissions estimates for the Crownpoint facility, the NRC staff concluded the calculated annual average air concentration values for the emissions reported in the GEIS are conservative and therefore applicable to the proposed Lost Creek ISR Project. As a result, the GEIS conclusions that particulate, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) emissions from ISR facilities would be well below the major source threshold for NAAQS attainment areas and account for a small percentage (1 to 9 percent) of the PSD Class II allowable increments are applicable to the proposed Lost Creek ISR Project.

The NRC staff believes that the calculated magnitude of construction emissions in an area that meets current air quality standards was not sufficient to justify conducting additional detailed quantitative air quality modeling analysis of potential consequences. Considering (i) the aforementioned analyses provided in the GEIS; (ii) the minor classification of emissions indicated in the WDEQ construction air quality permit (WDEQ, 2010a); and (iii) the conditions of the site area and region, the NRC staff concludes that these emissions (i.e., well below the major source thresholds) in an area with atmospheric conditions that are often favorable for dispersion would not impact attainment for air quality standards locally, regionally, or the nearest Class I or II areas. The nearest Class I areas (Bridger Wilderness, Fitzpatrick Wilderness, and Mt Zirkel areas) are located approximately 96.6 km, 161 km, and 145 km [60, 100, and 90 mi], respectively, to the northwest and south (Mt. Zirkel) of the Lost Creek site (Section 3.7.2). Popo Agie Wilderness area is the closest Class II area to the proposed action located about 93.4 km [58 mi] to the northwest of the Lost Creek ISR Project. In addition to the low magnitude of emissions and distance, the prevailing winds would carry emissions to the east-southeast and east, away from these Class I and Class II areas.

The NRC staff concludes that the site-specific conditions at the proposed Lost Creek ISR Project are bounded by those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts to compliance with air quality standards during construction would be SMALL. The staff also concludes that there would be a potential for MODERATE air impacts in the form of visible emissions of fugitive road dust near the town of Bairoil. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that stated in the GEIS.

4.7.1.2 Operation Impacts

GEIS Section 4.2.6.2 stated that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. Additionally, the GEIS concluded that although excess vapor pressure in pipelines could be vented through the system, these emissions would be rapidly dispersed into the atmosphere and so potential impacts would be SMALL, due in part to the expected low volume of gaseous effluent produced. The GEIS also described other potential nonradiological emissions during operations, such as fugitive dust and combustion engine emissions from equipment, transport trucks, and other vehicles. For NAAQS attainment areas, the GEIS concludes that nonradiological air quality impacts would be SMALL.

The NRC staff concludes that during operations of the proposed Lost Creek ISR Project the nonradiological impacts to air quality would be less than the impacts from construction because the use of diesel-powered construction equipment would be reduced, and therefore criteria pollutant levels would remain below the NAAQS; impacts to air quality during operation would

be SMALL. The applicant's proposed mitigative measures described in SEIS Section 4.7.1.1 would continue to limit the potential impacts.

The NRC staff concludes that the site-specific conditions at the proposed Lost Creek ISR Project are bounded by those described in the GEIS for air quality, and incorporates by reference the GEIS conclusions that the impacts to air quality during operations would be SMALL. The staff also concludes that there would be a potential for MODERATE air impacts in the form of visible emissions of fugitive road dust near the town of Bairoil. These road dust impacts were previously described in Section 4.7.1.1 for the construction phase and also apply to the operations phase because the proposed traffic would use the same roads. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact described in the GEIS.

4.7.1.3 Aquifer Restoration Impacts

As described in GEIS Section 4.2.6.3, because the same infrastructure is used during aquifer restoration as during operations, air quality impacts from aquifer restoration would be similar to, or less than, those during operations (NRC, 2009a). Additionally, fugitive dust and combustion engine emissions from vehicles and equipment during aquifer restoration would be similar to, or less than, the dust and combustion engine emissions during operations. For NAAQS attainment areas, nonradiological air quality impacts would be SMALL.

This phase of the proposed Lost Creek ISR Project would use existing infrastructure and equipment similar to those employed during the operations phase. The applicant's proposed mitigation measures described in SEIS Section 4.7.1.1 would also pertain to the aquifer restoration phase and would continue to limit the potential impacts. Vehicular traffic during the aquifer restoration phase would be limited to delivery of supplies and commuting staff, with a decreasing frequency of offsite yellowcake slurry shipments as restoration proceeds. Therefore, fewer trips would occur than during the operation phase.

The NRC staff concludes that the site-specific conditions at the proposed Lost Creek ISR Project are bounded by those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts to compliance with air quality standards during aquifer restoration would be SMALL. The NRC staff concludes there would be a potential for MODERATE air impacts in the form of noticeable emissions of fugitive road dust near the town of Bairoil. These road dust impacts were previously described in Section 4.7.1.1 for the construction phase and also apply to the aquifer restoration phase because the proposed traffic would use the same roads. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact described in the GEIS.

4.7.1.4 Decommissioning Impacts

GEIS Section 4.2.6.4 states that fugitive dust, vehicle emissions, and diesel emissions during land-disturbing activities from decommissioning would come from many of the same sources as used during construction. In the short term, emission levels would increase given the activity (demolishing of process and administrative buildings, excavating and removing contaminated soils, grading of disturbed areas). However, such emissions would decrease as decommissioning proceeds, and therefore, overall impacts would be similar to, or less than, those associated with construction, would be short term, and would be reduced through BMPs (e.g., dust suppression).

The NRC staff's emission estimates for the proposed Lost Creek ISR Project described in SEIS Section 2.1.1.1.6.1 and Appendix D, demonstrate that the emissions from diesel-powered construction equipment during the decommissioning phase would be less than the diesel emissions during the construction phase. As described in SEIS Section 4.7.1.1, based on the minor source classification of emissions in the WDEQ construction permit for the proposed Lost Creek Project (WDEQ, 2010a) and the conditions of the proposed site area and region, the NRC staff concludes that these emissions (i.e., well below the major source thresholds) in an area with atmospheric conditions that are often favorable for dispersion would not result in air concentrations that exceed the ambient air quality standards locally, regionally, or in the nearest Class I or II areas. Further, the level of proposed traffic for the decommissioning phase (Section 2.1.1.1.7) would be less than during the construction phase and therefore, potential fugitive road dust emissions would be lower than described for the construction phase in Section 4.7.1.1. Therefore, based on the preceding analysis for NAAQS attainment areas, nonradiological air quality impacts of the decommissioning phase would be SMALL.

The NRC staff concludes that the site-specific conditions at the proposed Lost Creek ISR Project are bounded by those described in the GEIS for air quality, and incorporates by reference the GEIS conclusions that the impacts to air quality during decommissioning would be SMALL, except for the potential for MODERATE air impacts from fugitive road dust emissions near the town of Bairoil. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that disclosed in the GEIS.

4.7.2 No-Action (Alternative 2)

Under the No-Action alternative there would be no ISR facility construction associated with this project and therefore no increase in air emissions associated with construction, operation, aquifer restoration, or decommissioning. Other sources of air pollution in the region including resource extraction activities would continue. When compared to the proposed action, there would be no impacts on air quality from the proposed Lost Creek ISR Project under Alternative 2.

4.7.3 Dry Yellowcake (Alternative 3)

Alternative 3 would be similar to Alternative 1 (the Proposed Action), except that the uranium processing of yellowcake slurry would be changed to processing dry yellowcake. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility. This change, however, would have no substantial effect on air quality impacts. SEIS Section 4.12 discusses the potential radiological impacts on air quality.

4.7.3.1 Construction Impacts

Under Alternative 3, the construction equipment emissions would only be slightly elevated at the proposed project site relative to the proposed action. This is because the construction of the processing plant would include a yellowcake dryer, involving potentially different heavy equipment utilization compared to the proposed action. Traffic counts may also increase slightly as associated supplies are delivered to the site, however, for the purpose of evaluating potential air quality impacts, the small change in construction activities would not significantly increase annual air pollution emissions relative to the proposed action.

While the construction activities associated with Alternative 3 may result in a slightly greater use of heavy equipment, the NRC staff concludes the small difference in project construction activities under Alternative 3 would not generate significant additional nonradiological air emissions from the project when compared to Alternative 1. Therefore, the impacts would be the same as described for the proposed action in SEIS Section 4.7.1.1. Where the NRC staff concluded that the site-specific conditions at the Lost Creek ISR Project under Alternative 3 are bounded by those described in the GEIS for air quality, and incorporates by reference the GEIS conclusions that the impacts to compliance with air quality standards during construction would be SMALL. The staff also concludes there would be a potential for MODERATE air impacts in the form of noticeable fugitive road dust emissions near the town of Bairoil. These fugitive dust impacts (previously described for the construction phase in Section 4.7.1.1) also apply to Alternative 3 because the fugitive road dust generating daily traffic would not change significantly under Alternative 3. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that described in the GEIS.

4.7.3.2 Operation Impacts

The nonradiological air impacts of operation associated with Alternative 3 would be the less than or equal to those associated with Alternative 1 and described in SEIS Section 4.7.1.2. Because the facility would produce dried yellowcake instead of yellowcake slurry, outgoing shipments would be relatively less frequent (see SEIS Section 4.3.3.2). Fewer trips would result in potentially less fugitive dust being generated by rolling traffic of tractor-trailers and fewer emissions from diesel-truck exhaust. However, because the majority of estimated fugitive dust is associated with commuting-worker traffic, the NRC staff concludes that the effect of the reduced truck traffic on overall emissions would be minor and therefore fugitive dust associated with this alternative would be comparable to the proposed action. The use of vacuum dryer technology for this alternative would reduce uranium particulate emissions from operations to near zero (NRC, 2003b). Based on this analysis, the NRC staff concludes that the site-specific conditions at the Lost Creek ISR Project under Alternative 3 are bounded by those described in the GEIS for air quality, and incorporates by reference the GEIS conclusions that the impacts to compliance with air quality standards during operations would be SMALL. The NRC staff also concludse there would be a potential for MODERATE air impacts in the form of noticeable fugitive road dust emissions near the town of Bairoil. These fugitive dust impacts (previously described for the construction phase of the proposed action in Section 4.7.1.1) also apply to the operation phase of Alternative 3 because project traffic would not change significantly under Alternative 3 and operation traffic would use the same roads. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that described in the GEIS.

4.7.3.3 Aquifer Restoration Impacts

The impacts of aquifer restoration for Alternative 3 would be the same as those stated in the preceding Section 4.7.3.2, and might be less because fewer shipments of process chemicals would be required during the aquifer restoration phase. Based on this analysis, the NRC staff concluded that the site-specific conditions at the Lost Creek ISR Project under Alternative 3 are bounded by those described in the GEIS for air quality, and incorporates by reference the GEIS conclusions that the impacts to compliance with air quality standards during aquifer restoration would be SMALL. The NRC staff also concludes there would be a potential for SMALL air impacts in the form of noticeable fugitive road dust emissions near the town of Bairoil based on the reduced level of proposed commuting workers needed for aquifer restoration activities

relative to the activities of the construction and operation phases. The NRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that described in the GEIS.

4.7.3.4 Decommissioning Impacts

The impacts of the decommissioning of Alternative 3 would be the same as for the proposed action (SEIS Section 4.7.1.4), although there could be a slight increase because of the additional processing plant components. Although offsite haulage may increase relative to the proposed action to account for the disposal of additional infrastructure and equipment, the difference in the level of traffic and the resulting change in dust emissions are not expected to be significantly different for Alternative 3. The remainder of decommissioning activities would be the same as evaluated for the proposed action and therefore would have similar impacts to air quality. Based on this analysis, the NRC staff concluded that the site-specific conditions at the proposed Lost Creek ISR Project are bounded by those described in the GEIS for air quality and incorporates by reference the GEIS conclusions that the impacts compliance with air quality standards during decommissioning would be SMALL. The NRC staff also concluded there would be a potential SMALL air impacts in the form of noticeable fugitive road dust emissions near the town of Bairoil based on the reduced level of proposed commuting workers needed for decommissioning activities relative to the activities of the construction and operation phases. ThNRC staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond that described in the GEIS.

4.8 Noise Impacts

Environmental impacts from noise at the Lost Creek site could occur during all phases of the ISR facility lifecycle from (i) the operation of equipment such as trucks, bulldozers, and compressors; (ii) commuter traffic or material and waste shipments; and (iii) well-field and processing plant activities and equipment. These impacts could affect both humans and wildlife in the vicinity of the site.

As stated in the GEIS, the Occupational Safety and Health Administration (OSHA) has set permissible exposure limits for workplace noise levels (NRC, 2009a). The proposed Lost Creek ISR Project would be required to limit worker exposure in accordance with these regulations; therefore, occupational noise exposure is discussed in Section 4.13. This section describes the potential dispersion of sound to offsite receptors.

The noise analysis for the Lost Creek ISR Project considered both mobile and stationary noise sources to assess the impact on sound levels adjacent to the proposed project area. The GEIS (NRC, 2009a) concluded that the noise impact at an ISR facility could range from SMALL to MODERATE during all four phases of an ISR project, depending on the distance between the proposed activities and residences, communities, and sensitive areas (NRC, 2009a). The following sections detail the environmental impacts from noise during the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek ISR Project.

4.8.1 Proposed Action (Alternative 1)

4.8.1.1 Construction Impacts

As described in the GEIS Section 4.2.7.1, potential noise impacts would be greatest during the construction phase of an ISR facility because of the heavy equipment usage and because of the

likelihood that ISR facilities would be built in rural, previously undeveloped areas where background noise levels are lower. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the wellfields, drill the wells, develop the necessary access roads, and build the production facilities would generate noise that would be audible above ambient background. Noise levels would likely be higher during daylight hours when construction would be more likely to occur and more noticeable in proximity to the operating equipment. For individuals living in the vicinity of a site, the GEIS concluded noise levels would return to ambient (background) conditions at a distance of approximately 300 m [1,000 ft] from the construction activities (NRC, 2009a). For certain wildlife (e.g., sage-grouse), continuous elevated noise levels could reduce their breeding success. Overall, noise impacts would be SMALL given the distance to the nearest resident at a site.

Additionally, as stated in the GEIS, 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 that access the site and access roads within the site, including those within wellfields. Relative short-term increases in noise levels associated with passing traffic would be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities. (NRC, 2009a)

The construction phase of the proposed Lost Creek ISR Project would involve the use of heavy equipment to create and improve road surfaces, furnish supplies, excavate footings, erect buildings, and install the wells and pipelines at the wellfields and storage ponds. Equipment such as bulldozers, graders, tractor trailers, excavators, cranes, and drill rigs would generate audible noise above the 40 dBA background noise level (LCI, 2008a). GEIS Table 4.2-1 presents the sound level for typical equipment that could be used at an ISR site (NRC, 2009a). This type of equipment would also be used for the construction of the proposed Lost Creek ISR Project.

The total sound levels at the proposed Lost Creek ISR Project would be generated by construction equipment, motor vehicles, and drill rigs. In general, construction activity would be restricted to daylight hours, which would result in a 24-hour average sound level onsite below the criteria of 85 dBA (A-scale) for hearing protection (OSHA 29 CFR 1910.95).

Stationary onsite sources of noise at the proposed Lost Creek ISR Project would have no impact on offsite receptors because the nearest resident is located 24 km [15 mi] from the site. The noise from commuting and truck traffic could have a MODERATE impact for lightly traveled rural roads through smaller communities such as Bairoil and Jeffrey City. Based on the analysis of transportation impacts in SEIS Section 4.3.1.1, traffic volume through Bairoil could increase by about 17 percent if SR 73 was used to access the site, which would be noticeable, but below a threshold at which traffic volume would be a concern. The incremental increase in project-related traffic on the relatively well-traveled public roadways in the area (e.g., I–80, US 287) would not be noticeable. Because uranium would be extracted from a total of six wellfields, no more than two wellfields would be operational at one time, and well-field construction would take place sequentially over approximately 7 years, the NRC staff concludes that the overall impact from construction would be MODERATE for those living along transportation routes in smaller communities and SMALL on more highly-traveled major roadways. The noise impact on sage-grouse at the proposed project is considered in SEIS Section 4.6.1.1.4.

4.8.1.2 Operation Impacts

As described in GEIS Section 4.2.7.2, noise-generating activities associated with an ISR processing plant would occur indoors, thus limiting potential offsite sound levels. Well-field equipment (e.g., pumps, compressors) would also be contained within structures (e.g., header houses, satellite facilities), also reducing offsite sound levels. During operations, 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 through wellfields. Relative short-term increases in noise levels associated with this traffic would be SMALL for the larger road, and could be MODERATE for lightly traveled rural roads, particularly through smaller communities. Thus, the GEIS concluded that the overall impact from noise during operations could range from SMALL to MODERATE. (NRC, 2009a)

Because the wellfields would be developed sequentially at the proposed Lost Creek ISR Project, construction and operation activities for five wellfields would overlap in specific years over the duration of the project (Figure 2-1). As such, during these periods of overlapping activities for approximately the first 5 years of operation, the noise impact would be comparable to that described for the construction phase in SEIS Section 4.8.1.1. The final 2 years of operation would coincide with either construction, operation, aquifer restoration or decommissioning activities in one or more of the proposed wellfields, therefore, noise would be generated by multiple activities. However, because the nearest residence is located 24 km [15 mi] northeast of the site, there would be no impact at that location from stationary noise sources. However, as noted in SEIS Section 4.3.1.2, because a small increase in the traffic volume would be expected during the operation phase, the noise from commuting and truck traffic could have a MODERATE impact on lightly traveled rural roads through smaller communities such as Bairoil and Jeffrey City and a SMALL impact on more highly traveled major roadways. However, because of decreasing noise levels with distance from the thoroughfare, if the residence, community, or sensitive area was more than 300 m [1,000 ft] from the traffic route (NRC, 2009a), there would be a SMALL, temporary impact. The noise impact on sage-grouse at the proposed project is considered in SEIS Section 4.6.1.1.4.

4.8.1.3 Aquifer Restoration Impacts

GEIS Section 4.2.7.3 states that general noise levels during aquifer restoration would be similar to or less than those levels experienced during operations. Buildings and other enclosed structures housing pumps and other well-field equipment would reduce sound levels to offsite receptors. Existing operational infrastructure would be used, and the traffic volume would be less than that during the ISR construction and operations. Therefore, the GEIS concluded the impact from noise could range from SMALL to MODERATE depending on the location of residences, communities, or sensitive areas (NRC, 2009a). Noise during the aquifer restoration phase is generated from the continued operation of the facility to circulate and treat production zone aquifer water and vehicular traffic and therefore would be less than or equal to noise generated during the operations phase. Vehicular traffic would be limited to delivery of supplies and staff accessing the site; therefore, fewer trips would occur than during the operation phase (NRC, 2009a). These types of activities would also occur at the proposed Lost Creek site. Vehicular traffic would be limited to supply delivery and staff travel to and from the site; therefore, fewer trips would occur than during the operations phase, which means that there would be less traffic on roads passing by the smaller communities such as Bairoil and Jeffrey City. Because the nearest resident is located 24 km [15 mi] northeast of the site, this person would not notice a change in background noise. Given that traffic would be less than during the operations phase (SEIS Section 4.3.1.3), the noise impact at the proposed project would be

SMALL. The noise impact on sage-grouse at the proposed project is considered in SEIS Section 4.6.1.1.4.

4.8.1.4 Decommissioning Impacts

GEIS Section 4.2.7.4 describes the noise impacts during decommissioning. General noise levels during decommissioning and reclamation would be less than or equal to those levels experienced during construction. Equipment used to dismantle buildings and milling equipment, remove contaminated soils, or grade the surface as part of reclamation activities would generate noise above background. These noise levels would be short term; when decommissioning and reclamation activities are complete, noise levels would return to ambient, with only an occasional vehicle for longer term monitoring activities. Like the construction phase, noise levels would be higher during daylight hours when decommissioning and reclamation is more likely to occur and more noticeable in proximity to the operating equipment. Given the distance to nearby residents from the activity (i.e., greater than 300 m [1,000 ft]), the GEIS concluded that project noise would not be discernable by offsite residents or communities. Therefore, the GEIS concluded the noise impact from decommissioning would be SMALL. (NRC, 2009a)

Sound levels generated from decommissioning the proposed Lost Creek site would be similar to or less than those during the construction phase. Activities and would include earthmoving, excavation, and building demolition. The noise impact from decommissioning would be less than or equal to the activities during the construction phase at the site. Decommissioning activities would result in a large, but short-term, noise impact onsite, but would not affect the nearest resident, located approximately 24 km [15 mi] northeast of the proposed project area. Although the estimated traffic volume during the decommissioning phase at Lost Creek was slightly higher than that estimated for the GEIS, which is dominated by offsite disposal of materials, the NRC staff concludes that the relatively low traffic volume would result in a SMALL noise impact. The noise impact on sage grouse at the proposed project is considered in SEIS Section 4.6.1.1.4.

4.8.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no change in the sound levels in the proposed project area or at any surrounding receptors. While natural resource exploration activities would continue and could expand in the future, these activities would typically be of short duration and would involve few vehicles and no permanent, noise-emitting infrastructure. These activities, coupled with the remote and rural setting of the proposed project area, would result in sound levels remaining at background. This alternative would result in no noise impacts from the proposed action.

4.8.3 Dry Yellowcake (Alternative 3)

Alternative 3 would be similar to the proposed action, except that the uranium processing of yellowcake would change from a slurry to a dry powder, and equipment (vacuum dryer) would be added to process the dry yellowcake. Because the equipment would be installed inside the processing plant, the noise impact at the project boundary would remain the same as the proposed action. The addition of this process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility, which would result in a different transportation route. Instead of trucks exiting the proposed project area to the east and passing through the town of Bairoil to the Christensen Ranch facility, trucks would exit to the west, travel south on the Crooks Gap-Wamsutter Road to I-80, and then travel

east to Metropolis, Illinois. Further, there would be no noise impact on residences, communities, and sensitive areas from transportation. Since the nearest resident is located 24 km [15 mi] northeast of the site, there would be no impact. The noise impact on sage grouse during the ISR phases described next is considered in SEIS Section 4.6.1.1.4.

4.8.3.1 Construction Impacts

Under Alternative 3, the sound levels during construction would be similar to the proposed action (Alternative 1) because the construction footprint of the processing facility would be identical to that under the proposed action. Traffic counts could increase under Alternative 3 from supply shipments associated with yellowcake dryer resulting in a slight increase in noise-producing heavy truck traffic; however, because the transportation route would not go through any area with residences, communities, or sensitive areas, the impact would be SMALL.

4.8.3.2 Operation Impacts

Under Alternative 3, the sound levels during operation would also be similar to those described for the proposed action (Alternative 1). Because the vacuum dryer would operate in an enclosed structure, there would be no noise impact at the project boundary. In addition, because the end product would be dry yellowcake instead of a slurry, the outgoing shipments would occur less frequently, resulting in less tractor-trailer noise. Further, because the nearest resident is located 24 km [15 mi] northeast of the site and the transportation route would not go through any area with residences, communities, or sensitive areas, the impact would be SMALL.

4.8.3.3 Aquifer Restoration Impacts

Under Alternative 3, the impact from noise during the ISR aquifer restoration phase would be similar to that during the ISR operation phase, except that fewer shipments of process chemicals would be required, which would result in less noise-generating truck traffic. Further, because the nearest resident is located 24 km [15 mi] northeast of the site and the transportation route would not go through any area with residences, communities, or sensitive areas, the impact would be SMALL.

4.8.3.4 Decommissioning Impacts

The impact from decommissioning under Alternative 3 would be similar to that described for the proposed action (Alternative 1). The use of heavy equipment could be slightly more than the proposed action because of impacts associated with the removal of the yellowcake dryer components; the other demolition and decommissioning activities would generate the same noise impacts as the proposed action. Further, because the nearest resident is located 24 km [15 mi] northeast of the site and the transportation route would not go through any area with residences, communities, or sensitive areas, the impact would be SMALL.

4.9 Historical, Cultural, and Paleontological Resources Impacts

Potential environmental impacts to historic, cultural, and paleontological resources at the proposed Lost Creek ISR Project could occur during all phases of the ISR facility lifecycle. As stated in the GEIS, these impacts would predominantly result from the loss of or damage to, historical, cultural, and archaeological resources and from temporary access restrictions to

these resources. Detailed discussion of the potential environmental impacts to historic and cultural resources from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.9.1 Proposed Action (Alternative 1)

Under Alternative 1 (Proposed Action), the NRC would issue the applicant a license for ISR uranium milling and processing at the Lost Creek site. The ISR facilities would occupy approximately 115 ha [285 ac]. The wellfields and access road encompass about 102 ha [254 ac] of the site. For archaeological sites, the impacts from various actions are linked to the physical footprints of the infrastructure. In the case of Alternative 1, the following facilities would directly impact the cultural settings: wellfields, processing plant, secondary access roads, power-line corridors, and storage ponds.

4.9.1.1 Construction Impacts

4.9.1.1.1 Historical and Cultural Resources

As discussed in Section 4.2.8.1 of the GEIS, the potential impacts during ISR facility construction could include loss of or damage to historic and cultural resources due to excavation activities as a part of construction. Additionally, access to historic, cultural, and archaeological resources could be temporarily restricted during construction.

As stated in the GEIS, the NRC expects the applicant to conduct the appropriate historic and cultural resource surveys as part of prelicense-application activities. The GEIS also states that eligibility determination for listing in the *National Register of Historic Places* (NRHP) under criteria in 36 CFR 60.4(a)–(d) and as Traditional Cultural Properties (TCP) would be conducted as part of the site-specific review. TCPs are historic and cultural resources that are important for a group to maintain its cultural heritage and are most often associated with Native American religious or cultural practices. Most TCPs are identified through consultation. To determine whether significant historic and cultural resources would be avoided or mitigated, consultations involving the NRC, the applicant, WY SHPO, other government agencies, and Native American Tribes would occur. Additionally, as stated in the GEIS, an NRC licensee would likely be required, under conditions in its license, to stop work upon discovery of previously undocumented historic or cultural resources and to notify the appropriate Federal, tribal, and State agencies with regard to appropriate mitigation measures. The GEIS concluded that potential impacts on historic and cultural resources from construction could range from SMALL to LARGE, depending on site-specific conditions. (NRC, 2009a)

As stated in Section 3.9.2.1 of the SEIS, prior to archaeological fieldwork commencing at the proposed Lost Creek ISR project, the applicant’s contractor conducted a Class I file search. The file search found that that three Class III surveys were conducted in the proposed project area. Two surveys were completed for earlier projects not related to the proposed Lost Creek ISR Project. Three archaeological sites (48SW16604, 48SW16608, and 48SW16765) were recommended eligible to the NRHP (Kinneer, et al., 2007). All remaining sites and isolated finds were determined ineligible for listing on the NRHP. Archaeological site 48SW16604 is located within a proposed wellfield, cannot be avoided and would be adversely affected by the proposed project. In 2008, the applicant’s contractor developed a treatment plan for site 48SW16604. To mitigate the wellfield’s impact on the site, a memorandum of agreement (MOA) was developed and executed among the NRC, BLM, WY SHPO, and the Eastern Shoshone and Northern Arapaho Tribes. For reference, the MOA is enclosed in Appendix E.

Archaeological site 48SW16608 is intersected by two existing two-track roads. Site 48SW16765 is located outside of a proposed well-field. Avoidance of these sites is recommended, but if avoidance is not possible, then site-specific treatment plans would be developed and submitted to the NRC and Wyoming SHPO for review (Kinneer, et al., 2007). The treatment plans would be implemented after the license is issued, but prior to the start of construction that would affect these sites.

In addition to formalizing the data recovery plan for site 48SW16604, the applicant also established an inadvertent discovery provision within the MOA. Should any unrecorded subsurface artifacts or graves be encountered, work would cease and the location would be stabilized. LCI would have an archaeologist examine and evaluate the discovery for significance and appropriate notifications would be made in accordance with applicable laws and regulations. In its environmental report, the applicant stated that it would avoid disturbing any NRHP eligible sites. Archaeological site boundaries would be clearly marked on controlled maps and a buffer around the sites would be maintained. Construction and operation activities that occur near NRHP properties will be monitored by an archaeologist (LCI, 2007).

As stated above, one site–48SW16604–would be directly affected by construction activities. Two additional NRHP-eligible sites are located near proposed construction areas and will be avoided. Based on the review of archaeological surveys, consultation with WY SHPO and with Native American tribes, applicant-committed mitigation measures, and other information, the NRC staff concludes the impacts to historic and cultural resources at the proposed Lost Creek ISR project would be MODERATE. NRC staff concludes that most impacts would be the result of the adverse effects to site 48SW16604. This MODERATE impact would be mitigated by implementing the treatment plan that is finalized in the MOA and adherence to applicant-committed measures. If issued, the license would contain license conditions that incorporate any mitigation measures in the license application and any agreements that address historic and cultural resources.

4.9.1.1.2 Paleontological Resources

As stated in Section 3.9.5, the proposed project area is marked by the presence of Class 2 Quaternary age, near-surface deposits and Class 3A to 3B Tertiary-age formations. Class 2 deposits are not likely to yield vertebrate fossils or significant nonvertebrate fossils, nor are Tertiary-aged deposits likely to be exposed. Under the Potential Fossil Yield Classification system, the Battle Spring Formation is assigned a ranking of Class 3A to 3B (moderate to unknown). No known scientifically significant paleontological resources are present in the proposed project area.

Construction could impact both geological units including the near-surface Quaternary deposits and near-surface Battle Spring Formation deposits. However, based on the geology of the site and the poor exposure of fossil-bearing sediment, the NRC staff concludes that the proposed Lost Creek ISR Project would not significantly impact any fossil remains. If fossil remains are discovered during construction, the applicant would stop work and contact the appropriate State and Federal agencies. Therefore, the NRC staff concludes the impact from construction on paleontological resources would be SMALL.

4.9.1.2 Operation Impacts

Section 4.2.8.2 of the GEIS concluded that potential impacts on historic and cultural resources from operations would be less than during construction (NRC, 2009a). Conditions in the NRC

license typically require the licensee to stop work upon discovery of previously unrecorded historic or cultural resources and to notify the appropriate Federal, Tribal, and State agencies with regard to appropriate mitigation measures. For these reasons, the GEIS determined that ISR operational impacts on historic and cultural resources would be SMALL.

There would be no impacts from facility operation on NRHP-eligible sites at the proposed Lost Creek ISR project. Any impacts on historic and cultural resources from construction would be mitigated prior to initial facility construction (ground-disturbing activities). There are no cultural resources known in the proposed project area that would be affected by facility operation or maintenance. As stated in Section 4.9.1.1.1, the applicant would avoid all NRHP-eligible sites and applicant-committed mitigation measures would remain in effect. Should ground disturbing activities occur within the vicinity of NRHP-eligible sites, site boundaries would be clearly marked on controlled maps and a buffer area would be established. In addition, activities occurring near NRHP resources would be monitored by an archaeologist. If an NRHP-eligible site cannot be avoided, then the applicant would prepare site-specific treatment plans (data recovery plans) prior to work commencing (LCI, 2007). Should ground disturbing activities occur outside of previously surveyed areas, then additional archaeological surveys would be conducted prior to the activity commencing. If historic or cultural resources are encountered during routine maintenance activities, the applicant would stop work and notify NRC, WY SHPO, and other appropriate agencies. Therefore, NRC staff concludes that impacts to historic and cultural resources during operations would be SMALL.

No known scientifically-significant paleontological resources are present in the project area. Operational impacts to paleontological resources could occur during routine maintenance actions that involve some ground-disturbing activities. However, maintenance actions are usually near the surface and would likely be limited to pre-disturbed areas. If fossil remains are discovered during operations, the applicant would stop work and contact the appropriate State and Federal agencies. Therefore, the NRC staff concludes the impact from operations on paleontological resources would be SMALL.

4.9.1.3 Aquifer Restoration Impacts

In GEIS Section 4.2.8.3, aquifer restoration impacts to historic and cultural resources would be similar to, or less than, potential impacts from operations (NRC 2009a). Aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing plant, and well sites). Additionally, NRC license conditions regarding inadvertent discoveries of historic or cultural resources and notification of the appropriate Federal, Tribal, and State agencies would remain in effect. For these reasons, the GEIS determined that the potential impacts from aquifer restoration on historic and cultural resources are SMALL.

No sites will be directly affected by aquifer restoration activities. As stated in Section 4.9.1.1.1, the applicant would avoid all NRHP-eligible sites and applicant-committed mitigation measures would remain in effect. Should ground disturbing activities occur within the vicinity of NRHP-eligible sites, site boundaries would be clearly marked (controlled maps) and a buffer area would be established. In addition, any activities occurring near NRHP resources would be monitored by an archaeologist. If an NRHP-eligible site cannot be avoided, then the applicant would prepare site-specific treatment plans (data recovery plans) prior to work commencing (LCI, 2007). Should ground disturbing activities occur outside of previously surveyed areas, then additional archaeological surveys would be conducted prior to the activity. If historic or cultural resources are encountered during the aquifer restoration phase, the applicant would

stop work and notify NRC, WY SHPO, and other appropriate agencies with regard to appropriate mitigation measures. Therefore, NRC staff concludes that impacts to historic and cultural resources during aquifer restoration activities would be SMALL.

Aquifer restoration impacts to paleontological resources are unlikely to occur as aquifer restoration activities do not involve exposure of potential fossil-bearing strata beneath the Battle Spring Formation. Therefore, NRC staff concludes that the impact from aquifer restoration on paleontological resources would be SMALL.

4.9.1.4 Decommissioning Impacts

GEIS Section 4.2.8.4 discusses potential impacts from decommissioning and reclamation activities to historic and cultural resources. It is expected that activities would focus on previously disturbed areas, and that historic and cultural resources within the potential area of effect would already be known. As a result, the GEIS concluded the potential impacts on historic, cultural, and archaeological resources during decommissioning and reclamation to be SMALL.

There would be no decommissioning impacts on historical, cultural, and paleontological resources at the proposed Lost Creek ISR project. No cultural sites would be directly affected during the decommissioning phase. As stated in Section 4.9.1.1.1, the applicant would avoid all NRHP-eligible sites and applicant committed mitigation measures would remain in effect. Should ground disturbing activities occur within the vicinity of NRHP-eligible sites, site boundaries would be clearly marked (controlled maps) and a buffer area established. In addition, any activities occurring near NRHP resources would be monitored by an archaeologist. If an NRHP-eligible site cannot be avoided, then the applicant would prepare site-specific treatment plans (data recovery plans) prior to work commencing (LCI, 2007). If any unidentified cultural resources were encountered during decommissioning activities, the applicant would stop work and notify the appropriate State and Federal agencies. Should ground-disturbing activities occur outside of previously surveyed areas during the decommissioning phase, then archaeological surveys would be conducted prior to the activity and appropriate mitigation responses would be identified at that time. As buildings are dismantled and lands are reclaimed, there would be less impact over time. Therefore, NRC staff concludes that the impacts to historic and cultural resources would be SMALL.

Impacts on paleontological resources are unlikely to occur as decommissioning does not involve exposure of potential fossil-bearing strata beneath the Battle Springs Formation. Therefore, NRC staff concludes that the impact from decommissioning on paleontological resources would be SMALL.

4.9.2 No-Action (Alternative 2)

Under the No-Action alternative, no ISR facility would be constructed or operated at the proposed Lost Creek ISR project. No archaeological sites, isolated cultural resources, or paleontological resources would be affected by the proposed action. The cultural impacts from current land activities, such as cattle ranching, would continue.

4.9.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the wet yellowcake slurry currently proposed would be further processed to a dry powder on-site. Additional equipment to process the yellowcake would be installed in the

processing plant located at the proposed Lost Creek site; however, the facility configurations outlined in Alternative 1 would be the same. Because there would be no change in the physical layout of the site, the impacts on historical, cultural, and paleontological resources described under the proposed action would also apply to Alternative 3.

4.10 Visual and Scenic Resources Impacts

Visual and scenic impacts from the proposed Lost Creek ISR Project could occur during all phases of the ISR facility lifecycle. These impacts would primarily be associated with the use of equipment such as drill rigs; dust and other emissions from equipment; construction of the processing plant and storage structures, site, and well-field access roads; land clearing and grading activities; and lighting for nighttime operations. These impacts could be mitigated by rolling topography, color considerations for structures, and dust suppression techniques.

As described in SEIS Section 3.10, the BLM Visual Resource Management (VRM) classification of the proposed Lost Creek ISR Project was VRM Class III, which allows an activity to contrast with basic elements of the characteristic landscape to a limited extent (BLM, 2007).

4.10.1 Proposed Action (Alternative 1)

The proposed action would result in temporary, SMALL impacts to the visual and scenic resources of the area. Potential visual and scenic impacts would result from the physical presence of the wellfields, buildings, and project infrastructure. For the proposed action, the following features could directly affect the visual and scenic setting of the site: (i) wellfields (including drill rigs, header houses, wellhead covers, and two-track roads; (ii) the processing plant; (iii) secondary access roads; (iv) power lines; and (v) storage ponds. The visual impact from this infrastructure would be consistent with the BLM VRM Class III designation.

4.10.1.1 Construction Impacts

GEIS Section 4.2.9.1 describes visual impacts in the Wyoming West Uranium Milling Region from ISR construction that could result from equipment (drill-rig masts and cranes), dust and diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of a proposed ISL facility relative to viewpoints such as highways, process facility construction and drill rigs could be visible. A typical truck-mounted rotary drill rig varies from 9 to 12 m [30 to 40 ft] in height (USACE, 2001). For nighttime operation, the drill rigs would be lighted, and this would create an additional visual impact because the drill rigs would be most visible and provide the most contrast, particularly if they were located on topographic highs. Most visual impacts would be short term because the construction and drilling equipment would be removed when activities conclude at a specific location. Additionally, the GEIS stated that because ISR sites are generally located in sparsely populated areas, in generally rolling terrain, most visual impacts during construction would be limited to about 1 km [0.6 mi] from the activity. As previously described, Prevention of Significant Deterioration (PSD) Class I areas require more stringent air quality standards that could also affect the visual impact; however, there are no PSD Class I areas in the Wyoming West Uranium Milling Region. Finally, the GEIS identified proposed ISR facilities as likely being located more than 16 km [10 mi] from the closest VRM Class II area, and that the visual impact from ISR construction would be consistent with the predominant VRM Classes III and IV classifications of the area. Therefore, the GEIS concluded the visual impact from ISR construction would be SMALL (NRC, 2009a).

Because the viewscape surrounding the proposed Lost Creek ISR Project is classified as a VRM Class III area with two-track roads, well pads, fences, and utility lines that have previously disturbed the landscape, implementing the proposed action would not substantially change the existing character of the landscape. Because approximately 400 wells would be installed per wellfield for ISR operations (the Lost Creek site would have 6 wellfields), multiple drill rigs would be operating simultaneously during wellfield construction. (According to NRC personnel who have inspected operating ISR facilities, four drill rigs have generally been observed operating at a given time.) Once a well is completed and conditioned for use, the drill rig would move to a new location to drill the next hole. Because temperatures stay below freezing for long periods during the year, wellheads would be covered to prevent freezing and to protect the well. These covers are small, low structures generally less than 1 m [3 ft] high and 0.6 m [2 ft] in diameter. Their color contrasts slightly with the existing landscape. At the Lost Creek site, with its gently rolling terrain, these structures would not be visible from distances of 1 km [0.6 mi].

Visual and scenic impacts from earthmoving activities during construction would be short term, lasting about 9–12 months. Wellfield development would occur first in Wellfield 1 and then in Wellfield 2. Restoration in Wellfield 1 would occur concurrently with operations in Wellfield 2, while development (drilling and installation of wells) would be taking place in Wellfield 3. This sequence would continue until the uranium ore from all six wellfields has been extracted.

The visible surface structures for the proposed Lost Creek ISR Project include wellhead covers, header houses, electrical distribution lines {mounted on 6-m [20-ft] wooden poles}, and the processing plant {122 × 30 m [400 × 100 ft]}. The applicant would use both existing and new roads to access each header house and the processing plant. Temporary and short-term visual impacts from dust emissions during the construction period in each wellfield would result from header house construction, well drilling, and construction of access roads and electrical distribution lines. Following completion of wellfield installation, disturbed areas would be reclaimed. The applicant has stated it would use a water spray to reduce dust emissions on unimproved roads (LCI, 2008a, b). However, short term impacts from dust emissions could result in MODERATE (see SEIS Section 4.7.1.1) impacts. In the longer term (>1 year), as major construction activities are completed, dust and equipment emissions would decrease. Because the area surrounding the proposed Lost Creek ISR Project is classified as VRM Class III and the proposed activities are consistent with ongoing activities in the area, the NRC staff concludes the construction impact on visual and scenic resources would be SMALL.

4.10.1.2 Operation Impacts

GEIS Section 4.2.9.2 states that visual impacts during operations in the Wyoming West Uranium Milling Region would be less than those associated with construction. Most of the wellfield surface infrastructure would have a low profile, and most piping and cables would be buried. The tallest structures would include the uranium processing facility ({approximately 10 m [30 ft] tall)} and power lines ({about 6 m [20 ft] high)}. Because ISR sites are in sparsely populated areas, typically in generally rolling topography, most visual impacts during operations would not be visible from more than about 1 km [0.6 mi] away. The irregular layout of wellfield surface structures, such as wellhead protection and header houses, would further reduce visual contrast. Further, the GEIS described the uranium districts in the Wyoming West Uranium Milling Region as being more than 16 km [10 mi] from the closest VRM Class II region, and because the visual impact from ISR construction would be consistent with the predominant VRM Classes III and IV classification of the area, the GEIS concluded that the visual and scenic impacts from operations would be SMALL.

Because uranium deposits are typically irregular in shape, the network of pipes, wells, and power lines would not be laid out in a regular in pattern or appearance (i.e., a grid), reducing visual contrast and the associated visual impact. In addition, wellhead covers (described earlier) would be colored to blend-in with the landscape, as would each header house. The processing plant at the proposed Lost Creek ISR Project would measure 49 m by 79 m [160 ft by 260 ft], with a maximum ridge height of 12.5 m [41 ft]. Header houses, while more numerous, would be much smaller in scale than the uranium processing building. However, a disturbed area around each header house would be necessary to provide an adequate area for turnaround of operations and maintenance vehicles. Electrical distribution lines would connect header houses to existing electrical distribution lines.

Though the operations phase of the proposed Lost Creek ISR Project is estimated to take about 8 years, the NRC staff concludes the impact on visual and scenic resources would be SMALL because of the BLM VRM Class III classification of the area, the existing mineral extraction activities ongoing in the region, and the remoteness of the area.

4.10.1.3 Aquifer Restoration Impacts

GEIS Section 4.3.9.3 addressed visual and scenic impacts from aquifer restoration in the Wyoming West Uranium Milling Region. The GEIS stated that aquifer restoration activities would take place some years after the facility had been in operation and that restoration activities would use in-place infrastructure. As a result, the GEIS concluded that the visual impacts would be similar to those experienced during operations, and therefore the impacts would be SMALL. (NRC, 2009a)

The visual resource impacts from aquifer restoration at the proposed Lost Creek ISR Project would be similar to those described for the operations phase in SEIS Section 4.10.1.2. The same buildings and equipment used to support operations would be used for aquifer restoration. There would be no modifications to either scenery or topography during aquifer restoration. Therefore, the NRC staff concludes that the impact on visual and scenic resources from aquifer restoration would be SMALL.

4.10.1.4 Decommissioning Impacts

GEIS Section 4.3.9.4 described the impacts on visual and scenic resources from decommissioning in the Wyoming West Uranium Milling Region. Similar equipment would be used for decommissioning activities as would be used during the construction phase. As a result, the impact on visual and scenic resources would also be similar. Most visual impacts during decommissioning would be temporary and diminish as structures, equipment, and other features are removed, the disturbed land surface reclaimed, and vegetation reestablished. NRC licensees are required to conduct final site decommissioning and reclamation under an NRC-approved decommissioning plan, with the goal of returning the landscape to preconstruction conditions. While some roadside cuts and hill slope modifications could persist beyond decommissioning and reclamation, the GEIS concluded that visual and scenic impacts from decommissioning would be SMALL. (NRC, 2009a)

Changes to landscape and topographic features would not persist after restoration is completed. When project operations cease (the operational period of the proposed Lost Creek ISR Project is estimated at about 8 years), the applicant would return lands disturbed by the facility to their preextraction land use of livestock grazing and wildlife habitat. Reclamation would return the landscape to its pre-extraction conditions and reduce the visual impact by removing buildings

and the associated infrastructure. After reclamation activities are completed, there would be no restrictions on surface use. The applicant would submit a decommissioning plan to the NRC, in accordance with 10 CFR Part 40, prior to final site decommissioning.

During decommissioning and reclamation, temporary impacts to the visual landscape would be similar to those that occurred during the construction period. Dismantling buildings and milling equipment, removing contaminated soil, and grading the land surface would create temporary visual contrasts. Visual and scenic resources would also be affected by fugitive dust emissions from decommissioning activities. The applicant has stated it would use a water spray on demolition activities and on unimproved roads to reduce dust emissions (LCI, 2008a, b). Overall impacts to the visual landscape would be temporary, but some of the short-term impacts on visibility from dust and equipment emissions could be MODERATE (see SEIS Section 4.7.1.1). Once decommissioning and reclamation activities are complete the visual landscape would be returned to its pre-extraction condition except for the main access roads needed for long-term monitoring of the site. The long-term decommissioning impact on visual and scenic resources would be SMALL.

4.10.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no ISR facility construction and, therefore, no change to existing visual and scenic resources at the proposed project area or in the region. The existing two-track roads, well pads, fences, and utility lines within the proposed project area would remain. No additional structures or uses associated with the proposed Lost Creek ISR Project would be introduced to affect the existing viewscapes, and the existing scenic quality would be unchanged. The visual resource classification would remain as BLM Class III, as described in SEIS Section 3.10.

4.10.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the NRC would issue the applicant a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing of dry yellowcake as the final product. By doing so, the proposed project would consist of the proposed action described in SEIS Section 4.10.1, plus the addition of vacuum dryer equipment for the processing of dry yellowcake. The vacuum dryer would be installed in an existing space within the processing plant; therefore, the footprint of the facility would not change from the proposed action and there would be no impact on the visual setting. The dry yellowcake would be transported from the Lost Creek site directly to Metropolis, Illinois, for ultimate processing into fuel for nuclear reactors. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility before shipment to Illinois. As a result, the visual and scenic impacts would not differ from those of the proposed action; therefore, the NRC staff concludes the impact would be SMALL.

4.10.3.1 Construction Impacts

Construction of the Lost Creek ISR facility to produce a dry yellowcake would have nearly the same environmental impact as the facility that would only produce a yellowcake slurry under the proposed action. The exterior features of the processing plant would be nearly the same as the proposed action. The “dry” processing plant would have the same footprint as the “wet” (slurry) processing plant, and the wellfields, header houses, and piping would also be the same. The difference between the two facilities, would be the inclusion of a uranium “drying train,” which

would require space for a vacuum dryer and storage area for dried yellowcake. The impact on visual resources would be the same as the proposed action.

Therefore, the NRC staff concludes the impacts from the construction of the Lost Creek vacuum dryer would be SMALL.

4.10.3.2 Operation Impacts

Like the proposed action, visual impacts from the operation of an ISR facility would be less than those from construction. While the addition of the vacuum dryer at the proposed Lost Creek ISR Project would change the production end product, all other features and processes would be the same as the proposed action. The wellfields (injection, production, and monitoring wells), header houses, and piping would function in the same way as the proposed action. The impact from implementing Alternative 3 would be the same as for the proposed action, except for liquid effluent. A small volume of liquid effluent could drain from the vacuum dryer, as all of the liquid slurry would not be evaporated and discharged to the atmosphere. This effluent stream is described in SEIS Section 4.14.3.2. Air pollution control (APC) equipment, such as a bag house, would be used to capture particulates from this process; these particulates would be returned to the vacuum chamber. The drying train would operate under a negative pressure in the processing plant to avoid atmospheric emissions. There would be no impact on visual and scenic resources. Therefore, the NRC staff concludes the visual impact from the operations phase under Alternative 3 would be SMALL.

4.10.3.3 Aquifer Restoration Impacts

Visual resource impacts from groundwater sweep and aquifer restoration would be the same as those described for the proposed action (Alternative 1). The activities associated with this phase would be similar to those described for the operation phase, except that less uranium would be produced. As was the case with operations, this phase of the dry yellowcake alternative (Alternative 3) would not be visible from the public road network. Because there would be no change in the visual setting and because of the remote location of the facility, the NRC staff concludes the impacts from aquifer restoration under Alternative 3 would be SMALL.

4.10.3.4 Decommissioning Impacts

Similar to the proposed action, decommissioning under the dry yellowcake alternative (Alternative 3) at the Lost Creek site would not result in impacts to the landscape or terrain that would persist once restoration and reclamation are completed. When final project operations are completed (estimated to be 10 to 12 years after license approval), all facilities and equipment (including the vacuum dryer) would be decommissioned and removed. Like the proposed action, reclamation efforts are intended to return the visual landscape to baseline contours and would reduce the impact from operations and minimize permanent impacts on visual resources (LCI, 2008a). Before the NRC license is terminated, the licensee must submit an acceptable site reclamation plan under 10 CFR Part 40. Recontouring disturbed surfaces (including access roads) and reseeding them with native vegetation would be the same as for the proposed action.

During decommissioning and reclamation of the dry yellowcake alternative (Alternative 3), temporary impacts on the visual landscape (primarily dust and equipment exhaust) would be the same as those described for the proposed action. When decommissioning and reclamation activities are complete, the visual landscape would be returned to its preextraction condition

except for the site access roads used for long-term monitoring activities. Most of the decommissioning activities would not be visible from the public road network (>3 miles from the site borders). The applicant would implement BMPs, such as dust control and maintenance of equipment, to prevent visibility impacts. Therefore, the NRC staff concludes the visual impact from decommissioning of the dry yellowcake alternative (Alternative 3) would be SMALL.

4.11 Socioeconomic Impacts

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the proposed action could affect regional employment, income, and expenditures. Job creation is characterized by two types: (i) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact on the region, and (ii) operation-related jobs in support of facility operations, which have the greater potential for permanent, long-term socioeconomic impacts in the region.

The socioeconomic region of influence (ROI) represents a geographic area where ISR facility employees and their families would reside, spend their income, and use their benefits, thereby affecting the economic conditions of that region. As previously stated, the SEIS analysis focuses on the impacts of constructing and operating the proposed ISR facility in Sweetwater County. A discussion of the socioeconomic impacts from the construction, operation, and decommissioning of the proposed ISR facility and aquifer restoration at Lost Creek is presented in the following sections.

The GEIS socioeconomic analysis is based on 2000 U.S. Census Bureau (USCB) data. The socioeconomic analysis presented in this SEIS for the proposed Lost Creek ISR Project ROI is based on a combination of 2000 USCB data, USCB 2007–2009 American Community Survey 3-Year Estimates, and USCB 2009 State and County QuickFacts (USCB, 2009). Though specific numbers may differ, the analysis of socioeconomics presented in GEIS Section 4.2.10 remains valid for the proposed Lost Creek ISR Project as explained in the following sections.

4.11.1 Proposed Action (Alternative 1)

4.11.1.1 Construction Impacts

GEIS Section 4.2.10.1 discusses the socioeconomic impacts from construction of an ISR facility in the Wyoming West Uranium Milling Region, in which the Lost Creek site is located. Socioeconomic conditions would be predominantly impacted from employment at an ISR facility and from the demands on the existing public and social services, tourism and recreation, housing, infrastructure (schools, utilities), and the local workforce. The GEIS estimated that construction at an ISR facility would last from 12 to 18 months and total peak construction employment would be about 200 people. The GEIS also estimated an additional 140 jobs could be created from the construction of an ISR facility and that during construction of surface facilities and wellfields, a general practice would be to use local contractors (e.g., drillers, construction workers), as available, and local building materials and building supplies to the extent practical. (NRC, 2009a)

The GEIS assumed that most construction workers would choose to live in larger communities with access to more services. Some construction workers would commute from outside the county to the construction site, and skilled workers (e.g., engineers, accountants, managers) would come from outside the local workforce. During construction, some workers could

temporarily relocate to the proposed project area and contribute to the local economy through purchasing goods and services and paying taxes. (NRC, 2009a)

The applicant estimates that construction of the ISR facility at Lost Creek would last 6–8 months and would employ approximately 94 workers (LCI, 2011). The NRC staff concludes that the site-specific impact on socioeconomic conditions from constructing the Lost Creek would be less than described in the GEIS and SMALL.

The following subsections describe the effects of ISR facility construction on demographic conditions, income, housing, employment rate, local finance, education, and health and social services.

4.11.1.1.1 Demographics

Because of the short duration (6–8 months) and small size of the construction workforce (94 workers), the impacts of construction on demographic conditions would be limited. It is assumed that the applicant would employ workers from the surrounding area, which would reduce demands for public services. Also, due to the short duration of the construction phase, workers would not likely relocate their families to the region. Therefore, demographic impacts from the proposed action would be SMALL.

4.11.1.1.2 Income

It is expected that construction workers would be paid at rates typical of the region. Impacts would therefore be SMALL.

4.11.1.1.3 Housing

The number of construction workers would cause a short-term increase in the demand for temporary (rental) housing units in Sweetwater County. However, the number of available housing units has kept pace with the population increase in the county (see SEIS Section 3.11.1 and 3.11.3). Any changes in employment would have little to no noticeable effect on the availability of housing in Sweetwater County. Because of the short duration of the construction activity and the availability of housing in the region, there would be little or no employment-related housing impacts. Therefore, the impact on housing availability would be SMALL.

4.11.1.1.4 Employment Rate

Construction of the proposed ISR facility at Lost Creek would create employment opportunities for approximately 94 workers supporting this ISR phase with the potential of up to 66 additional jobs being generated to support this activity in the local economy. However, because of the short duration (6–8 months for building construction; 18 – 24 months for wellfields), and small size of the construction workforce for the proposed ISR facility at Lost Creek, the effect on employment in the region would be SMALL.

4.11.1.1.5 Local Finance

Construction of the proposed ISR facility at Lost Creek would generate some tax revenue in the local economy through the purchase of goods and services. Additional tax revenue would be generated through an increased tax base, which would increase county and state tax revenues. Because of the short duration (6–8 months for building construction and 18–24 months for

wellfield construction) and the small size of the construction workforce (approximately 94 workers), construction of the proposed ISR facility at Lost Creek would have a SMALL impact on local finances.

4.11.1.1.6 Education

Because of the short duration of the construction activity (6–8 months for building construction and 18 – 24 months for wellfield construction) workers would not be expected to bring families and school-aged children with them; therefore, there would be no impact on educational services during construction of the ISR facility at Lost Creek.

4.11.1.1.7 Health and Social Services

The number of construction workers would cause a short-term increase in the demand for health and social services in Sweetwater County. However, because of the short duration of the construction activity and the small size of the construction workforce (94 workers), there would be little or no impact on health and social services and the impact would be SMALL.

4.11.1.2 Operation Impacts

Operation of the proposed Lost Creek ISR facility is expected to last 8 years and employ an estimated 89 workers (LCI, 2011). GEIS Section 4.2.10.2 describes employment levels during ISR facility operations and assumed 50 to 80 workers would support this phase of the ISR lifecycle (NRC, 2009a). The GEIS also stated that the complexity of ISR facility operations would require technically skilled workers that would not be available locally. The majority of the operational workforce would be staffed from outside the region, particularly during initial operations. According to the GEIS, the effects on community services (e.g., education, healthcare, utilities, shopping, recreation) during facility operations would be similar to the effects experienced during construction, except fewer people would be employed for a longer duration (NRC, 2009a).

The ISR operations phase at Lost Creek would generate new jobs during the life of the proposed project, such as project managers, plant operators, lab technicians, and drilling contractors. The operations workforce would impact the local economy through the creation of jobs, the purchasing of local goods and services, and the increase in county and state tax revenues. Severance tax on the uranium extracted would also be collected at the state level and would contribute to the State of Wyoming’s general fund.

Because of the small size of the operations workforce, the impact on socioeconomic conditions from the ISR facility operations at Lost Creek would be SMALL. The following subsections describe the impact on components of the socioeconomic system including income, housing, employment rate, local finance, education, and health and social services.

4.11.1.2.1 Demographics

The applicant estimates there would be approximately 89 operations workers (LCI, 2011) with the potential addition of up to 30 to 40 jobs being generated to support this activity in the local economy. Because of the small size of the operations workforce, demographic conditions in Sweetwater County are not likely to change. The combined effect of 110 to 120 new jobs in the region (assuming that all of the workers would relocate to the ROI) constitutes less than 1

percent of the current civilian labor force in Sweetwater County. The impact on demographic conditions would therefore be SMALL.

4.11.1.2.2 Income

The average annual salary for full-time Lost Creek ISR employees would be approximately $45,000 (LCI, 2008a) which is slightly less than the Wyoming average of $48,205 (USCB, 2008). Because these salaries are comparable with current salaries in the area, the operations phase of the proposed Lost Creek Project would have a SMALL impact on local income.

4.11.1.2.3 Housing

Demand for permanent housing is anticipated to increase in the communities surrounding the proposed Lost Creek ISR Project site before the startup of ISR facility operations. The surrounding towns and cities of Rawlins, Lander, Casper, Green River, and Rock Springs are within commuting distance of the proposed project area. Because of the small size of the operations workforce (approximately 89 workers) and the potential addition of 62 indirect workers to support facility operations, the impact on housing availability during ISR facility operations could range from SMALL for the region to MODERATE for nearby small communities.

4.11.1.2.4 Employment Rate

As previously discussed, the proposed ISR facility operations at Lost Creek would generate approximately 89 new jobs, such as project managers, plant operators, lab technicians, and drill contractors. Some skilled positions would likely be filled by people moving into the area rather than providing employment opportunities for people living in nearby communities. ISR facility operations could also provide some jobs in the local economy. However, because it is likely that most skilled workers would be drawn from areas outside of the ROI, the proposed ISR facility operations at Lost Creek would not noticeably affect employment conditions in Sweetwater County. Therefore, the impact on employment structure would be SMALL.

4.11.1.2.5 Local Finance

Sweetwater County would receive some tax revenue during ISR facility operations. A county *ad valorem* tax for production would also contribute to local government revenue. Indirectly, the county would benefit from increased sales tax revenue from the increased number of workers relocating to the ROI and from increased demand for goods and services. In addition, a state mineral severance tax would be applied to the uranium extracted from the site; however, this tax would not come directly back to the county. Therefore, the operation of the proposed ISR facility at Lost Creek would have a SMALL impact on local finance.

4.11.1.2.6 Education

The number of school-aged children could increase because 89 workers and their families could relocate to Sweetwater County during ISR facility operations, which could have an impact on local public schools and education-related services. The average family size in Wyoming is 2.88 (USCB, 2011); therefore, a conservative estimate for the number of school-aged children that could relocate to the ROI would be 89 children. Comprising various ages and spread across schools and classrooms in the county (kindergarten and grades 1 through 12), this small number of children would not likely have a noticeable effect on student-to-teacher ratios.

Schools could accommodate a small increase in the number of students given the schools are not at capacity and the new elementary school construction initiated in 2010 (Throgmorton, 2010). The impact on schools and education-related services during the ISR facility operations would be SMALL.

4.11.1.2.7 Health and Social Services

There would be a small increase in the demand for health and social services during ISR facility operations from workers and their families relocating to the ROI. Operational impacts would not likely differ significantly from those during the construction phase of the ISR facility. The impact on health and social services during operations would remain SMALL.

4.11.1.3 Aquifer Restoration Impacts

GEIS Section (4.2.10.3), stated that socioeconomic impacts from aquifer restoration would be similar to those experienced during facility operations because the number of workers at the ISR facility and demand on services in the region would not change. The GEIS concluded that the impact would be SMALL (NRC, 2009a).

However, aquifer restoration at the Lost Creek site would require fewer workers than ISR facility operations. Since the restoration would be short term (1 to 2 years) and would not require specialized skills, the NRC staff expects that some ISR facility operations workers would remain to assist in the aquifer restoration, which would be conducted sequentially on the wellfields, with the remainder drawn from the local labor pool. Based on this information, the impact on socioeconomic conditions during aquifer restoration would be less than during ISR facility operations because the applicant estimates 17 workers would support this phase (LCI, 2011). Therefore, the impact on socioeconomic conditions from aquifer restoration would be SMALL.

4.11.1.4 Decommissioning Impacts

The applicant has estimated that decommissioning will take approximately 26 months for the processing plant and approximately one year per wellfield and employ approximately 11 workers. By the time the last wellfield would be decommissioned, the five other wellfields would have been mostly dismantled along with portions of the processing plant (LCI, 2011). Therefore, substantially fewer workers would be involved in decommissioning than estimated in the GEIS (i.e., 200 workers).

The NRC has regulations and guidance for decommissioning. These regulations are found in 10 CFR Part 40. Additional guidance on how to decommission a nuclear facility is provided in the Consolidated NMSS Decommissioning Guidance, NUREG–1757. Decommissioning of the proposed Lost Creek facility would be subject to a separate safety and environmental review. The decommissioning process would commence when the licensee informed the NRC that it intends to decommission the facility or has ceased principal activities at the entire site or in any building or outdoor area. The licensee would prepare a decommissioning plan and submit it to the NRC for review. Upon approval of the decommissioning plan, the NRC would amend the license to allow decommissioning to proceed. At the completion of decommissioning, the licensee would conduct a final status survey to demonstrate compliance with criteria established in the decommissioning plan. After NRC has confirmed that the criteria in the decommissioning plan to release the site or portion of the site have been met, NRC would either terminate or amend the license, depending on the intended use of the site.

The NRC staff concludes the impact on socioeconomic conditions from decommissioning the proposed Lost Creek facility would be SMALL.

4.11.2 No-Action (Alternative 2)

Under the No-Action alternative, the ISR facility would not be constructed and operated at Lost Creek. Socioeconomic conditions in Sweetwater County would remain unchanged.

4.11.3 Dry Yellowcake (Alternative 3)

The impact on socioeconomic conditions from the construction, operation, aquifer restoration and decommissioning of the proposed ISR facility at Lost Creek under Alternative 3 would be the same as that described for the proposed action. While there would be additional machinery and infrastructure developed for the production of the dry yellowcake within the processing plant and some additional construction, the applicant has proposed to design the processing plant with space allocated for a yellowcake dryer as part of the proposed action, therefore, the size of the workforce would remain unchanged. These changes would not impact socioeconomic conditions at the proposed facility. Therefore, the impact on socioeconomic conditions from implementing this alternative would be the same as described for the proposed action, SMALL.

4.12 Environmental Justice Impacts

Under Executive Order 12898 (59 FR 7629), "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," Federal agencies are required to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

In 2004, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040), which states, "The Commission is committed to the general goals set forth in E.O. 12898 (59 FR 7629), and strives to meet those goals as part of its NEPA review process."

The Council of Environmental Quality (CEQ) provides the following information in *Environmental Justice: Guidance Under the National Environmental Policy Act* (1997):

> **Disproportionately High and Adverse Human Health Effects**. Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as employed by NEPA [National Environmental Policy Act]) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group. (CEQ, 1997)
>
> **Disproportionately High and Adverse Environmental Effects**. A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse

> environmental impact is an impact that is determined to be both harmful and significant (as employed by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered. (CEQ, 1997)

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from the construction and operation of the proposed ISR facility at Lost Creek. In assessing the impacts, the following CEQ (1997) definitions of minority individuals and populations and low-income population were used:

Minority individuals. Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.

Minority populations. Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Low-income population. Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

4.12.1 Analysis of Impacts

Methodology

The NRC addresses environmental justice matters for license reviews through (i) identifying minority and low-income populations that may be affected by the proposed construction and operation of the proposed Lost Creek ISR Project, and (ii) examining any potential human health or environmental effects on these populations to determine whether these effects may be disproportionately high and adverse.

The 2000 Census provides race and poverty characteristics for census tracts and block groups in Sweetwater County. The proposed Lost Creek ISR Project and a 3-km [2-mi] perimeter are contained within one block group that encompasses Sweetwater County.

Sweetwater County was selected as the geographic area for comparison of demographic data for the affected census tract populations. This comparison was made to determine the concentration of minority or low-income populations in the affected census tracts relative to the state.

Census block group data are available from the 2000 Census. Table 4-2 shows the percentage of people living in poverty and the minority population in the United States, Wyoming, Sweetwater County, the census tract, and the block group closest to the proposed Lost Creek ISR Project.

Impact Analysis

In 2000, the population of Sweetwater County was 37,613. Approximately 11 percent of the Wyoming population was classified as being minority (Table 4-2). The minority population in Sweetwater County was 13.1 percent, and the census tract, and block group surrounding the proposed Lost Creek ISR Project it was 10.9 and 10.0 percent, approximately 0.3 and 1.2 percent, respectively, below the state average of 11.2 percent.

Table 4-2. Percentage of Population Living in Poverty and Percentage Minority Population in 2000

Geographic Unit	Percent Living in Poverty	Percent Minority
U.S.	13.0	30.9
Wyoming	11.4	11.2
Sweetwater County	7.8	13.1
Census Tract 9716	8.8	10.9
Block Group 9716-1	10.7	10.0

According to American Community Survey 3-Year Census data estimates (2007–2009), the population of Sweetwater County increased to 40,163. Minority populations are estimated to have increased since 2000 by approximately 1,900 persons. The estimated minority population in Sweetwater County rose to 17.1 percent. Most of this increase was due to an estimated influx of Hispanic or Latinos (more than 1,400 persons), an increase in population of 39.3 percent from 2000 (USCB, 2011).

According to the 2000 Census, the population living below the poverty level was 13 percent in the United States and 11.4 percent in Wyoming (The 1999 Federal poverty threshold was $17,029 for a family of four). The percentage of people living below the poverty level within Sweetwater County, the census tract, and the block group surrounding the proposed ISR facility at Lost Creek was 7.8, 8.8, and 10.7 percent, respectively. In 2008, 5.8 percent of the persons living in Sweetwater County were living below the poverty level.

According to American Community Survey 3-Year Census data estimates, the median household income for Wyoming for the years 2007–2009 was $52,951, with 9.7 percent of the state population and 6.1 percent of families living below the Federal poverty threshold. Sweetwater County had a much higher estimated median household income average ($70,273) and lower percentages of individuals (7.6 percent) and families (5.4 percent) living below the poverty level than the state average (USCB, 2011).

The percentage of minority populations living in the affected block groups is similar to the percentage of minority populations recorded at the state and county level and well below the national level. No minority population block groups were identified as residing near the proposed Lost Creek ISR Project. The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of the proposed ISR facility at Lost Creek. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. A disproportionately high environmental effect refers to an impact or risk of impact on the natural or physical environment in a low-income or minority community that is significant and

appreciably exceeds the environmental impact on the larger community. These effects may include ecological, cultural, human health, economic, or social impacts (CEQ, 1997). Some of these potential effects have been identified in resource areas described in SEIS Chapter 4. For example, increased demand for rental housing during construction could disproportionately affect low-income populations. Minority and low-income populations are subsets of the general public residing around the Lost Creek site, and all would be exposed to the same health and environmental effects generated from construction, operations, aquifer restoration, and decommissioning activities.

4.12.2 Proposed Action (Alternative 1)

Potential impacts to minority and low-income populations due to the construction, operation, and decommissioning of the proposed ISR facility and aquifer restoration at Lost Creek would mostly consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and limited to onsite activities. Minority and low-income populations residing along site access roads could experience increased commuter vehicle traffic during construction and operational shift changes. As construction and operations employment increases at the Lost Creek site, employment opportunities for minority and low-income populations may also increase. Increased demand for rental housing during peak construction could disproportionately affect low-income populations. However, according to the latest census information, there were more than 1,000 vacant housing units in Sweetwater County (see Section 3.11.3). Based on this information and the analysis of human health and environmental impacts presented in Chapter 4, there would be no disproportionately high and adverse impacts on minority and low-income populations from the construction, operation, and decommissioning of the proposed ISR facility and aquifer restoration at Lost Creek.

As part of addressing environmental justice associated with license reviews, NRC also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Subsistence Consumption of Fish and Wildlife

Section 4-4 of Executive Order 12898 (59 FR 7629) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and wildlife for subsistence and to communicate the risks of these consumption patterns to the public. In this SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. The staff considered special pathways that took into account the potential levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the proposed ISR facility site at Lost Creek.

Potential impacts on minority and low-income populations would mostly consist of radiological effects; however, radiation doses from ISR facility operations are expected to be well below regulatory limits (see SEIS Section 4.13). Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the proposed construction, operation,

and decommissioning of the proposed ISR facility and aquifer restoration would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations residing in the vicinity of Lost Creek.

4.12.3 No-Action (Alternative 2)

Under the No-Action alternative, the proposed ISR project at Lost Creek would not occur. There would be no disproportionately high and adverse impacts to minority or low-income populations from this alternative.

4.12.4 Dry Yellowcake (Alternative 3)

Under Alternative 3, impacts to minority and low-income populations during the construction and operation of the proposed ISR facility at Lost Creek would be the same as stated for the proposed action. There would be no disproportionately high and adverse impacts to minority and low-income populations from this alternative.

4.13 Public and Occupational Health and Safety Impacts

Potential radiological and nonradiological impacts on public and occupational health and safety could occur during all phases of activities proposed for the Lost Creek ISR Project. These impacts could occur as a result of normal operations and accidents.

This section discusses the estimated environmental impacts on public and occupational health and safety from construction, operation, aquifer restoration, and decommissioning phases of the proposed Lost Creek ISR Project.

4.13.1 Proposed Action (Alternative 1)

4.13.1.1 Construction Impacts

As described in SEIS Chapter 2, construction activities associated with the Lost Creek ISR Project would include site preparation, buildings, storage ponds, access roads, wellfields, and other structures and systems. The important radiation exposure pathway during the construction phase would be through direct exposure, inhalation or ingestion of radionuclides during well construction, construction activities that disturbed surface soil, and fugitive dust from vehicular traffic during construction.

GEIS Section 4.2.11.1 states that radiological impacts to both the public and site workers from inhalation of fugitive dust during construction would be SMALL because the radionuclide concentrations would be low. (NRC, 2009a)

Drilling wells at the proposed Lost Creek ISR Project would use a common technique known as mud rotary drilling. This uses drilling fluid induced through the drill stem, out the drill bit, and back to the surface between the drill stem and host rock. When the fluid has returned to the surface, it passes through a trough to a mud pit, where the cuttings settle out and the fluid is recycled down the borehole. When the drilling is complete, the mud pit is allowed to dry and is covered with native soil and vegetation. Because the cuttings are taken from very near and within the ore deposits, they have the potential to be more contaminated than soil samples at the surface. To ensure the cuttings do not create an external occupational or public health

hazard, the applicant would ensure that semiannual gamma radiation surveys are performed on at least 12 of the completed drill mud pits.

The average concentration of radionuclides measured in the soil at the Lost Creek site are low, as described in Section 3.13, and the NRC staff estimates that the inhalation of fugitive dust would not result in any significant dose to the public or site workers. Therefore, the GEIS conclusions about the radiological impacts to the public and workers during construction are considered to be valid for the construction phase of the proposed Lost Creek facility (i.e., construction would have a SMALL impact on radiological dose to workers and the general public).

Construction equipment would likely be diesel powered and would emit diesel exhaust, which includes small particles ($<PM_{10}$). The impacts and potential human exposures from these emissions would be small because the releases are usually short, , are readily dispersed into the atmosphere. Section 4.7 describes in greater detail the potential impacts to air quality from proposed diesel emissions including comparisons with health-based standards. Therefore, the NRC staff concludes the impact and potential human exposure from these particulate emissions would be SMALL, consistent with the GEIS conclusions in Section 4.2.11.1 (NRC, 2009a).

4.13.1.2 Operation Impacts

4.13.1.2.1 Radiological Impacts on Public and Occupational Health and Safety From Normal Operations

As stated in GEIS Section 4.2.11.2.1, some amounts of radioactive materials would be released to the environment during ISR operations. The GEIS estimated the impacts by using the MILDOS-AREA computer code to calculate the offsite doses based on historical Rn-222 release data for six current or former ISR operations. The GEIS estimated offsite exposure (human receptor) to range between 0.004 mSv [0.4 mrem] per year for the Irigaray facility in Campbell County, Wyoming, and 0.32 mSv [32 mrem] per year for the Crow Butte facility near Crawford, Nebraska. All doses were well below the 10 CFR Part 20 annual radiation dose limit of 1 mSv [100 mrem] per year. (NRC, 2009a)

LCI (2008a, Attachment 7.2-1) identified several normal operation activities that are expected to release radon-222 and that would result in the exposure of workers and members of the public. The primary radionuclide of interest at an ISR facility is radon-222; other key radionuclides that may also be released, which are also in the uranium decay scheme, include uranium, Th-230, Ra-226, and Pb-210. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors. Table 4-3 summarizes the applicant's estimated releases for each major functional activity as a function of time. Note that not all activities would occur concurrently.

The applicant evaluated the radiation doses at 17 site boundary locations shown in Figure 7.2-2 of the applicant's technical report (LCI, 2008b) using the MILDOS-AREA code in conjunction with the release estimates presented in Table 4-3. The highest dose at the site boundary (a hypothetical person living in the southeast corner of the proposed project area, referred to as Site 1) is 0.03 mSv [3.01 mrem] per year total effective dose equivalent (TEDE), which is 3 percent of the 1 mSv [100 mrem] per year dose limit for a member of the public specified in 10 CFR 20.1301 and within the dose range for similar facilities as reported in the GEIS and

discussed above. The estimated dose results are summarized in LCI (2008a, Section 4.12.1.2) and LCI (2008b, Section 7.2).

GEIS Section 4.2.11.2.1 provides a summary of doses to occupationally exposed workers at ISR facilities. As stated, doses would be similar regardless of the facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 50 mSv [5,000 mrem]. The largest annual dose average over the period [1994 to 2006] was 7 mSv [700 mrem]. More recently, the maximum total dose equivalents reported for 2005 and 2006 were 6.75 and 7.133 mSv [675 and 713 mrem]. (NRC, 2009a)

The proposed operations at the Lost Creek ISR Project as well as the programs for control of occupational exposure proposed by the applicant would be similar to those used in the operations reviewed in the GEIS and used to estimate typical occupational exposures reported in the GEIS. Therefore, the NRC staff expects occupational exposure at Lost Creek to be similar to that reported in the GEIS.

As noted in the previous discussions, site-specific conditions and assessments are consistent with or bounded by the information and analysis presented in the GEIS. Therefore, the NRC staff concludes the overall radiological impacts on public and occupational health and safety from normal operations would be SMALL.

4.13.1.2.2 Radiological Impacts on Public and Occupational Health and Safety From Accidents

The GEIS identified, discussed, and assessed the consequences for bounding abnormal and accident conditions that may occur with an ISR operation. The GEIS information was based on

Table 4-3. Estimated Rn-222 Releases (Ci/yr)

Location	2009	2010	2011	2012	2013	2014	2015	2016	2017
New Wellfields	5.1×10^{3}	5.7×10^{3}	5.7×10^{3}	5.7×10^{3}	5.7×10^{3}	5.7×10^{3}	6.1×10^{4}	0.0×10^{00}	0.0×10^{00}
Production Venting	4.2×10^{00}	1.2×10^{2}	1.5×10^{2}	1.4×10^{2}	1.5×10^{2}	1.5×10^{3}	1.6×10^{2}	3.4×10^{1}	0.0×10^{00}
Ion-exchange + Prod Purge	9.5×10^{1}	2.7×10^{1}	3.4×10^{1}	3.4×10^{1}	3.4×10^{1}	3.4×10^{1}	3.3×10^{1}	6.8×10^{00}	0.0×10^{00}
Restoration Venting	0.0×10^{00}	0.0×10^{00}	3.7×10^{1}	1.1×10^{2}	1.1×10^{2}	1.1×10^{2}	1.2×10^{2}	1.3×10^{2}	8.5×10^{1}
Restoration Purge	0.0×10^{00}	0.0×10^{00}	1.9×10^{1}	5.8×10^{1}	5.8×10^{1}	5.8×10^{1}	5.8×10^{1}	5.8×10^{1}	3.9×10^{1}
TOTAL	5.1×10^{00}	1.5×10^{2}	2.4×10^{2}	3.4×10^{2}	3.5×10^{2}	3.5×10^{2}	3.7×10^{2}	2.3×10^{2}	1.2×10^{2}
Source: LCI (2008b)									

previous radiological hazard assessments (Mackin, et al., 2001) that considered the various stages of an ISR facility. The GEIS considered three separate accidents, which represent events resulting in higher levels of radioactivity being released: thickener failure and spill, pregnant lixiviant and loaded resin spills (radon release), and yellowcake dryer accident release (not relevant to the proposed action (Alternative 1) at Lost Creek). The GEIS concluded potential impacts to workers could be MODERATE based on the estimated consequences of an unmitigated dryer release, but doses to the general public would be SMALL.

An overview of the first two of these accident scenarios, as evaluated in the GEIS along with a specific application to the Lost Creek facility, is presented in the following paragraphs. The

yellowcake drying accident is not reviewed in this discussion, because the proposed Lost Creek operation under Alternative 1 does not involve the production of yellowcake.

4.13.1.2.2.1 Thickener Failure and Spill.

Thickeners are used to concentrate a yellowcake slurry before it is transferred to a dryer or packaged for offsite shipment. Radionuclides could be inadvertently released to the atmosphere through thickener failure or spill. This accident scenario, as evaluated in the GEIS, assumed a tank or pipe leak that releases 20 percent of the thickener inside and outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 500 m [1,640 ft] was selected because it was found to be the shortest distance between a processing facility and an urban development for currently operating ISR facilities. Offsite, unrestricted doses from such a spill could result in a dose of 0.25 mSv [25 mrem], or 25 percent of the annual public dose limit of 1 mSv [100 mrem] per year with negligible external doses based on sufficient distance between facility and receptor (Table 4-4). (NRC, 2009a)

As stated in the GEIS, doses to unprotected workers inside the facility have the potential of exceeding the annual dose limit of 0.05 Sv [5 rem] if timely corrective measures are not taken to remediate the spill. Typical protection measures, such as monitoring, respiratory protection, and radioactive material control, which would be a part of the applicant's Radiation Protection Program, would reduce worker exposures and resulting doses to a small fraction of those evaluated. (NRC, 2009a)

Under the proposed action, Lost Creek would not be producing dry yellowcake and would not be using thickeners. However, the applicant's facility would have bulk quantities of yellowcake uranium slurry that would be stored in tanks that could accidentally be released inside the processing buildings. The applicant reports that the tank area would be surrounded by a berm to contain leaks or spills and reduce the likelihood that such a release would migrate to the outside environment. The applicant further states that emergency response and mitigation procedures would be available to direct workers to minimize or eliminate the possibility of the material leaking to the outside environment. In LCI (2008a, Section 4.3.3), the applicant stated that impacts to soils from spills would be mitigated through the use of a spill prevention, control, and countermeasure (SPCC) plan. The plan contains accidental discharge reporting procedures, spill response, and cleanup measures. (LCI, 2008a)

4.13.1.2.2.2 Pregnant Lixiviant and Loaded Resin Spills

Process equipment (e.g., ion-exchange columns) would be located on curbed concrete pads to prevent any liquids from spills or leaks from exiting the building and contaminating the outside environment of the facility. Therefore, except for wellfield leaks, the NRC staff does not consider an accidental liquid release with liquid pathways of exposure to be realistic. The primary radiation source for liquid releases within the facility would be the resulting airborne radon-222 released from a liquid or resin tank spill.

The GEIS assumed a radon accident release scenario in which a pipe or valve of the ion-exchange system, containing pregnant lixiviant, develops a leak and releases (almost instantaneously) all the radon-222 at a high activity level {2.96×10^7 Bq/m^3 [8×10^5 pCi/L]}. For a 30-minute exposure, the dose to a worker located inside the building performing light activities without respiratory protection was estimated as 13 mSv [1,300 mrem], which is below the 10 CFR Part 20 occupational dose limits in Table 4-4(NRC, 2009a). The GEIS did not

evaluate public dose. However, considering that atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, any dose to a member of the public would be less than the 1 mSv [100 mrem] public dose limit of 10 CFR Part 20. Radiation Protection Program controls and monitoring measures would minimize the magnitude of any such release and further reduce the consequences of this type of accident.

In LCI (2008a, Section 4.3.3), the applicant stated that impacts on soils from spills would be mitigated through the use of an SPCC plan. The plan contains accidental discharge reporting procedures, spill response, and cleanup measures. Therefore, the NRC staff concludes that the potential impacts from tank releases would be SMALL based on the implementation of the SPCC plan.

As stated by the applicant (LCI, 2008a, Section 1.2.2.3), and described in more detail in its December 2008 responses to the NRC's requests for additional information, the impact on soil from wellfield leaks would be minimized through a series of multiparameter (e.g., pressure, flow rate) monitors and alarms, and an automatic emergency shutdown system (LCI, 2008b). The applicant also stated that routine visual inspections of plant operations would be conducted as additional protective measures (LCI, 2008b). In the event of any spill, the applicant would be required to comply with NRC requirements for reporting incidents in 10 CFR 20, Subpart M, "Reports", and 10 CFR 40.60. Incidents that meet NRC criteria for reporting must be followed by notification of NRC by telephone within 24 hours, followed by submittal of a written report within 30 days of the notification detailing the conditions leading to the spill or incident/event, corrective actions taken, and results achieved.

4.13.1.2.2.3 Accident Analysis Conclusions

NRC staff reviewed and evaluated site-specific and project-specific information related to potential accidents during its independent review of the Lost Creek ISR Project. The NRC staff determined that the types of accidents and their potential consequences that were analyzed in the GEIS bound those that could occur for the proposed Lost Creek ISR Project. The NRC staff determined that there would be no significant radiological impacts from potential accidents to the public or occupationally exposed workers beyond those described in the GEIS. Because the proposed Lost Creek ISR Project does not include drying operations, the NRC staff considers the GEIS consequence estimates and conclusions of potential MODERATE impacts based on a dryer accident scenario do not apply to this proposal. Based on this finding, the NRC staff concludes that the impacts from potential accidents for both occupationally exposed workers and members of the public would be SMALL.

Table 4-4. Generic Accident Dose Analysis for ISR Operations for Lost Creek

Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill*	50 mSv [5,000 mrem]	0.25 mSv [25 mrem]
Pregnant lixiviant, resin spill	13 mSv [1,300 mrem]	<0.13 mSv [<13 mrem]

*Doses for a tank release at Lost Creek would be much lower, given that yellowcake slurry exists in liquid-like form and has a very low potential to be released to the atmosphere or become airborne. In the event of an accidental slurry release, the potential for radiological airborne contamination would be SMALL because of the facility's use of engineering and administrative controls (e.g., spill/leak response plans).

4.13.1.2.3 Nonradiological Impacts on Public and Occupational Health and Safety from Normal Operations

The GEIS provides a list of the various chemicals, hazardous and nonhazardous, along with quantities that are typically used at ISR facilities (NRC, 2009a). The use of hazardous chemicals at ISR facilities is controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary Federal regulations applicable to the use and storage of hazardous chemicals include the following:

- 40 CFR Part 68, Chemical Accident Prevention Provisions. These regulations include a list of regulated toxic substances and threshold quantities for accidental release prevention.

- 29 CFR § 1910.119, OSHA Standards [which includes process safety management (PSM)]. This regulation provides a list of highly hazardous chemicals, including toxic and reactive materials that could cause a catastrophic event at or above the threshold quantity (TQ).

- 40 CFR Part 355, Emergency Planning and Notification. These regulations containsa list of extremely hazardous substances and their threshold planning quantities (TPQs) for the development and implementation of emergency response plans (ERPs). A list of reportable quantity (RQ) values is also provided for reporting releases.

- 40 CFR § 302.4, Designation, Reportable Quantities, and Notification—Designation of Hazardous Substances. This regulation provides a list of *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) hazardous substances compiled from the *Clean Water Act*, *Clean Air Act*, *Resource Conservation and Recovery Act* (RCRA), and the *Toxic Substances and Control Act*.

- As identified in LCI (2008b), chemicals used in bulk quantities at the Lost Creek facility would include

- Sodium chloride (NaCl, salt)

- Sulfuric acid (H_2SO_4)

- Oxygen (O_2)

- Liquid hydrogen peroxide —50 percent (H_2O_2)

- Carbon dioxide (CO_2)

- Sodium carbonate (Na_2CO_3)

- Hydrochloric acid (HCl)

- Diesel, gasoline, and bottled gases

Typical onsite quantities for some of these chemicals exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices. Compliance with applicable regulations

reduces the likelihood of a release. Offsite impacts would be SMALL and do not typically pose a significant risk to the public. Workers involved in a response and cleanup could experience MODERATE impacts if the proper emergency and cleanup procedures and worker training are not adequate or are absent.

In general, the handling and storage of chemicals at the proposed Lost Creek ISR Project would follow standard industrial safety standards and practices. As identified in LCI (2008a), industrial safety aspects associated with the use of hazardous chemicals at Lost Creek are regulated by the Wyoming Department of Employment (State OSHA Program).

Salt would be delivered in bulk and offloaded into a water-filled tank equipped with a bag house. Because salt dissolves readily in water, the only air emissions would be during offloading. The applicant estimated total emissions at 8 kg [17.5 lb] per year. (LCI, 2008a)

The facility would store soda ash in a dry storage bin equipped with a fabric bag house. Material would be blown into the storage bin from the delivery truck. The soda ash would be conveyed with a screw auger or drag chain to a sealed tank filled with water. Using EPA methods, the applicant estimated an annual airborne soda ash emission rate to the atmosphere of 6 kg [14 lb] per year. (LCI, 2008a)

In response to questions from WDEQ, the applicant stated that hydrochloric acid at 37 percent solution would be delivered to the facility via bulk shipments (LCI, 2009a). It would be stored in a vessel fitted with a scrubber. Acid fume emissions would occur from downloading the acid into the storage vessel and during storage. The applicant's analysis of potential emissions showed that with the assistance of pollution-control mechanisms, the annual emission of hydrochloric acid would be approximately 4.5 kg [10 lb] per year. (LCI, 2008a)

Other process-related chemicals to be stored in bulk at the proposed Lost Creek processing plant include carbon dioxide, oxygen, sodium sulfide, and hydrogen peroxide.

In the State of Wyoming, the Wyoming Department of Employment (State OSHA Program) regulates industrial safety at ISR mills. The applicant has proposed an overall chemical safety program that is compliant with the following regulations:

- Risk Management Planning, as required in 40 CFR Part 68
- Process Safety Management of Highly Hazardous Chemicals standard, contained in 29 CFR § 1910.119
- Threshold Planning Quantities, listed in 40 CFR Part 355
- Reportable Quantities for spills from CERCLA in 40 CFR § 302.4

The types and quantities of chemicals (hazardous and nonhazardous) proposed for use at the Lost Creek ISR site are bounded by those evaluated in the GEIS. The NRC staff reviewed the information provided for Lost Creek and determined that the information and assessment presented in the GEIS regarding estimated impacts on public or occupational health and safety bound those that could occur from the planned use of chemicals at the proposed Lost Creek ISR Project. Therefore, the NRC staff finds the estimated impact from the use of chemicals at the proposed Lost Creek ISR facility would be SMALL.

4.13.1.2.4 Nonradiological Impacts on Public and Occupational Health and Safety From Accidents

The risks from accidents associated with the use of the typical hazardous and nonhazardous chemicals for an *in-situ* uranium recovery facility are not different from those for other typical industrial applications. In general, these risks are deemed acceptable as long as design and facility safety policies and practices meet industry and regulatory standards. Past history at current and former ISR facilities has shown these facilities can be designed and operated with appropriate measures to ensure proper safety for workers and the public (GEIS Section 4.2.11.2.4). (NRC, 2009a)

GEIS Appendix E, Hazardous Chemicals, provides an accident analysis for the more hazardous chemicals. As stated, chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. The GEIS did not evaluate potential hazards to workers or the public due to specific types of high consequence, low probability accidents (e.g., a fire or large magnitude sudden release of chemicals from a major tank or piping system rupture). The application of common safety practices for handling and use of chemicals is expected to decrease the likelihood of these high consequence events.

Spills of reportable quantities from chemical bulk storage areas would be reported to WDEQ in accordance with WDEQ-water quality division (WQD) Rules and Regulations, Chapter 17, Part E and 40 CFR Part 302 (CERCLA).

The types and quantities of chemicals (hazardous and nonhazardous) proposed for use at Lost Creek ISR facility are bounded by those evaluated in GEIS Section 4.2.11.2.4 (NRC, 2009a). Information provided for Lost Creek does not contain any new or significant information that is contrary to or varies from the information and conclusions presented in the GEIS regarding non-radiological impacts on public and occupational health and safety from chemical accidents. The consequences from potential accidents related to use of chemicals pose a significant health hazard to workers at the facility and therefore impacts from an accident could be MODERATE; however, the proposed storage and handling facility design and chemical safety programs limit the overall risk to workers, both in terms of likelihood and consequences and therefore the NRC staff conclude worker impacts would be SMALL. Offsite impacts would be SMALL and do not typically pose a significant risk to the public. Based on these findings and the GEIS conclusions, the impacts from potential accidents for both occupationally exposed workers and members of the public would be SMALL.

4.13.1.3 Aquifer Restoration Impacts

As stated in GEIS Section 4.2.11.3, aquifer restoration activities involve activities similar to those during operations (e.g., operation of wellfields, wastewater treatment and disposal); the types of impacts on public and occupational health and safety would be similar to operational impacts. The GEIS concluded that the overall impacts to workers and the general public from aquifer restoration would be SMALL. (NRC, 2009a)

Aquifer restoration at Lost Creek would involve activities similar to those analyzed in the GEIS. The radiation doses associated with aquifer restoration would be less than the impacts of normal operations, which are evaluated in GEIS Sections 4.12.2.2.1 and 4.12.2.2.3. Accident consequences would be smaller than those evaluated in GEIS Sections 4.12.2.2.2 and 4.12.2.2.4. Therefore, the NRC staff concludes that aquifer restoration would have a localized, SMALL impact on workers and the general public (primarily from radon gas).

4.13.1.4 Decommissioning Impacts

As stated in GEIS Section 4.2.11.4, radiological and nonradiological environmental impacts to the public and workers from the decommissioning of an ISR facility are expected to be SMALL. The degree of potential impact decreases as hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to preoperational conditions. Typically, the initial decommissioning steps include removal of hazardous chemicals, so that the majority of safety issues that are addressed during decommissioning involve radiological hazards at the facility. (NRC, 2009a)

To ensure the safety of workers and the public during decommissioning, the NRC requires licensed facilities to submit a decommissioning plan for review. The plan includes details of the radiation safety program that would be implemented during decommissioning activities to ensure that workers and the public would be adequately protected and that doses from exposure would comply with 10 CFR Part 20 limits. An NRC-approved plan would also provide as low as reasonably achievable (ALARA) provisions to further ensure that the best safety practices are used to minimize radiation exposures. Adequate protection of workers and the public during decommissioning is further ensured through NRC plan approval, license conditions, and inspection and enforcement.

Following decommissioning, the site could be released for unrestricted use in conformance with the conditions of the NRC license and the dose criteria for site release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination that may exist at the site after decommissioning is completed to levels that are sufficiently low to protect public health and safety.

The NRC staff reviewed the applicant's information and determined that the assessment presented in GEIS Section 4.2.11.4 regarding potential impacts on public and occupational health and safety from decommissioning bounds the potential impacts of decommissioning the proposed Lost Creek ISR Project. The NRC staff concluded that the impacts from decommissioning the Lost Creek ISR Project would be SMALL.

4.13.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no occupational exposure to radiation. There would be no additional radiological exposure to the general public from project-related effluent releases, and there would be no impact on long-term environmental radiological conditions. Radiation exposure and risk to the general public would continue to be determined by exposure from natural background, medical-related exposures, consumer products, and exposure from existing residual contamination.

4.13.3 Dry Yellowcake (Alternative 3)

Alternative 3 is the same as the proposed alternative, except wet yellowcake would be processed to a dry powder as the final product.

4.13.3.1 Construction Impacts

Construction of a new ISR facility at Lost Creek to produce a dry yellowcake would result in the same impact on public and occupational health and safety as the proposed action, which produces a yellowcake slurry. Radioactive material would not be generated or handled during

the construction phase, so there would be no public or occupational exposure. Therefore, the NRC staff concludes the impact on public and occupational health and safety during the ISR construction phase would be SMALL.

4.13.3.2 Operation Impacts

Operations of a dryer facility would require additional handling and processing of radioactive material, which would result in small incremental impacts to workers and the public for normal operations. Regarding potential accidents, the GEIS estimated the consequences to workers and the public from a potential unmitigated yellowcake drying accident and concluded worker impacts could be MODERATE and public impacts would be SMALL (NRC, 2009). The GEIS further considered that the likelihood of an unmitigated accidental dryer release is low, and therefore the overall risk to workers (considering both likelihood and consequence) is low. Therefore, the NRC staff concludes impacts during the operations phase to workers and the public under Alternative 3 would be SMALL because the likely of unmitigated dryer accident occurring is low and the impacts to the public under Alternative 3 would be SMALL.

4.13.3.3 Aquifer Restoration Impacts

Processing wet yellowcake into a dry powder would not change the nature or magnitude of aquifer restoration activities. Impacts under this scenario would be similar to those from the proposed action. Therefore, this alternative would have a SMALL impact on public and occupational health and safety.

4.13.3.4 Decommissioning Impacts

The decommissioning impacts from implementing this alternative would involve a small incremental increase in public and occupational health exposure relative to the proposed action, but the impacts would be bounded by those evaluated in GEIS Section 4.2.11.4 (NRC, 2009a). Regardless of the magnitude of the projected decommissioning activities, the NRC requires licensees to submit a decommissioning plan for NRC review. The NRC’s review of this plan, application of site-specific license conditions, and NRC inspection and enforcement activities would keep the magnitude of public and occupational health and safety impacts from all decommissioning activities, including dryer facilities, SMALL.

4.14 Waste Management Impacts

Potential environmental impacts from waste management at the proposed Lost Creek ISR Project could occur during all phases of the ISR facility lifecycle. ISR facilities generate radiological and nonradiological liquid and solid wastes that must be handled and disposed of properly. The types of waste streams to be disposed of at the proposed Lost Creek ISR Project are discussed in SEIS Section 2.1.1.1.6. (See the text box in Section 2.1.1.1.6 for a list of liquid and solid waste types.) The primary radiological wastes to be disposed of at the proposed Lost Creek ISR Project are process-related liquid wastes and process-contaminated structures and soils, all of which are classified as byproduct material. Before operations can begin, the NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material (NRC, 2009a). The applicant has committed to dispose of byproduct material at a licensed disposal site. This disposal agreement must be in place prior to the start of operations, as required by a license condition.

A detailed description of the potential environmental impacts from waste management actions during the construction, operations, aquifer restoration, and decommissioning phases of the proposed Lost Creek ISR Project are provided below. Discharges of storm water runoff to surface waters are described in Section 4.5.1.

4.14.1 Proposed Action (Alternative 1)

Under the proposed action, the applicant has proposed to dispose of liquid effluent via a Class I injection well described in Section 4.14.1.1 of this SEIS. Alternative wastewater disposal options, including evaporation ponds, surface water discharge, land application, and disposal via Class V injection wells are described in SEIS Section 4.14.1.2.

4.14.1.1 Disposal Via Class I Injection Well

4.14.1.1.1 Construction Impacts

Section 4.2.12.1 of the GEIS stated that waste management impacts from the construction phase of an ISR facility would be SMALL. This is because construction activities at an ISR facility are relatively small-scale, and sequential wellfield development would generate low volumes of construction waste (NRC, 2009a). Most of the wastes projected for disposal at Lost Creek during the construction phase would be nonhazardous solid wastes, such as scrap metal and other building materials, municipal sludge, and piping. As discussed in Section 3.13.2, the applicant would likely dispose of nonhazardous solid wastes at the Carbon County landfill north of Rawlins, Wyoming (LCI, 2009b). The municipal waste and the construction and demolition waste cells at the Carbon County landfill are not at or near capacity (Kisselman, 2010). Any hazardous wastes generated during construction, such as solvents and used oil, would be transported to the Sweetwater County landfill in Rock Springs, as noted in Section 3.13.1 (LCI, 2008a).

Based on the available disposal capacity and the proposed small-scale development and resulting low volumes of waste that would be generated, the NRC staff concludes that the site-specific conditions at the proposed Lost Creek ISR Project are comparable to the generic conditions described in the GEIS for waste management. Therefore, this SEIS supports the GEIS conclusions that the impacts on waste management during construction would be SMALL.

4.14.1.1.2 Operation Impacts

Section 2.7 of the GEIS stated that wastes generated during the operations phase would primarily be liquid waste streams consisting of process bleed (1 to 3 percent of the process flow rate). Wastes would also be generated from flushing of depleted eluent to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant-wash-down water. The method used to handle and process these wastes (deep well injection) would reduce the solid waste volume that must be disposed of at an approved facility. State permitting actions, NRC license conditions, and NRC inspections ensure that proper practices are used to comply with safety requirements to protect workers and the public. Therefore, the GEIS concluded that waste management impact from operations would be SMALL (NRC, 2009a).

At the proposed Lost Creek ISR Project, the liquid processing wastes from operations (Section 2.1.1.1.6.2) are classified as byproduct material and would be disposed of via deep well injection, which is regulated by WDEQ. The applicant proposes to drill five wells to various depths beyond 1829 m [6000 ft] (WDEQ, 2010b). The WDEQ has issued a permit to the

applicant to drill, operate, and complete these wells in specific geologic formations (WDEQ, 2010b). The permit specifies well construction, testing and operating conditions that the applicant must follow to ensure adequate protection of the public and environmental health and safety. Based on an average flow rate of 643 L [170 gal] per minute over a 9-year period, approximately 1,015 kg [2,235 lb] of natural uranium and 4.6 Ci of radium-226 would be disposed of in the wells (LCI, 2009c). The WDEQ permit application review determines whether potential underground sources of drinking water would be affected by proposed deep disposal wells.

As discussed in Sections 2.1.1.1.2 and 2.1.1.1.3, LCI also proposes to construct two storage ponds to provide temporary storage capacity for liquid byproduct material in the event the disposal wells become inoperable or are shut down for maintenance. The proposed capacity of each pond is about 2.8 million L [750,000 gal]. LCI received Permit No. 13595R from the Wyoming State Engineer's Office on May 28, 2010 (Wyoming State Engineer's Office, 2010). The permit establishes a capacity limit for the system of about 5.6 million L [4.58 ac-ft]. LCI would monitor the leak detection systems and the monitoring wells for the ponds on a quarterly basis, as required by an NRC license condition. Because the applicant would need to comply with the State Engineer permit conditions for the ponds, as well as all WDEQ and NRC license conditions for the ponds and disposal wells, the NRC staff concludes that LCI's proposed operations for the management of liquid byproduct material would provide the necessary waste isolation capacity to support the proposed operations and would not impact underground sources of drinking water. Therefore, the NRC staff concludes the waste management impacts from the disposal of process-related liquid effluents at the proposed Lost Creek Project site would be SMALL.

Nonhazardous solid wastes generated during operations could include facility trash, tires, septic solids, and other uncontaminated solid wastes (e.g., piping, valves, instrumentation, and equipment). The applicant has stated that these wastes would be reused, recycled, or disposed of at a nearby landfill, such as the Carbon County landfill in Rawlins or the Sweetwater County landfill in Rock Springs, which are described in Section 3.13.2. The estimated impact would be SMALL because a small volume of material would be disposed of relative to the available nearby landfill capacity. This is consistent with the discussion of solid waste generation and disposal impacts in the GEIS.

Solid byproduct material that could be generated during operations (i.e., material that does not meet NRC criteria for unrestricted release) would likely include maintenance and housekeeping rags and trash, packing materials, replacement components, filters, protective clothing, solids removed from process pumps and vessels, and any soils or other materials that cannot be decontaminated. The applicant estimates that approximately 61 to 77 m^3 [80 to 100 yd^3] of solid byproduct material would be generated each year during operations (LCI, 2008b). This material would be stored on-site inside a secure (fenced or inside a structure) area until sufficient volume is generated for shipment to a licensed treatment or disposal facility. The byproduct material would be temporarily stored on-site in containers called "super-sacs." Sacs that are full would be sealed and stored in the plant or outdoors in a tightly-sealed container capable of preventing the spread of contamination from high winds or precipitation. The applicant would use covered roll-off containers approved by the USDOT for transportation of Low Specific Activity (LSA) material to store material outdoors; this material would be transported to, and disposed of at, a licensed facility (LCI, 2009b). As previously discussed, the applicant does not yet have an agreement in place with a licensed site to accept its solid byproduct material for disposal. Prior to the start of operations, as required by an NRC license condition, the applicant would need to enter into a written agreement with a disposal site, which would ensure that there is available

capacity for the disposal of its solid byproduct material. The NRC staff concludes the waste management impacts would be SMALL because the applicant will be required by license condition to develop a disposal agreement with an approved NRC or agreement state byproduct disposal facility prior to the start of operations.

Hazardous wastes are regulated by the WDEQ's Solid and Hazardous Waste Division, under the Wyoming Hazardous Waste Management regulations. As described in Section 2.1.1.1.6.3, the applicant expects that the Lost Creek facility would be classified as a Conditionally Exempt Small Quantity Generator (CESQG). A CESQG: (i) must determine if their waste is hazardous; (ii) must not exceed the 100-kilogram hazardous waste limitation or, except with regard to spills, more than 1 kilogram of acutely hazardous waste, at any time; (iii) may not accumulate more than 1,000 kilograms of hazardous waste on-site at any time; and (iv) must treat or dispose of their hazardous waste either in an on-site or off-site U.S. treatment, storage, or disposal (TSD) facility that meets specific 40 CFR § 261.5 requirements. Examples of the types of hazardous wastes that would be generated include rechargeable batteries, fluorescent light bulbs, used petroleum products and chemical wastes. All wastes would be handled and disposed of in accordance with Federal and State regulations governing hazardous waste. Used oil would either be burned on-site for energy recovery in accordance with EPA regulations or sent to a facility permitted to handle used oil (such as the Sweetwater County landfill). Other hazardous wastes would be segregated and transported to a licensed facility (LCI, 2008a) (such as the Sweetwater County landfill, which can accept small quantities of hazardous wastes).

Based on the type and quantity of expected waste generation, and the availability of disposal options, the NRC staff concludes that the operations phase of the proposed Lost Creek Project would have a SMALL impact on waste management.

4.14.1.1.3 Aquifer Restoration Impacts

Section 4.2.12.3 of the GEIS described waste management activities that would occur during the aquifer restoration phase of an ISR project and noted that the same treatment and disposal options would be implemented as used during operations. Therefore, the waste management impacts would be similar to the impacts during the operations phase of an ISR project. Some increase in wastewater volumes could occur, but the increase in volume would be offset by the decrease in production capacity. The GEIS concluded that the impact to waste management from aquifer restoration would be SMALL. (NRC, 2009a)

At the proposed Lost Creek Project, water from aquifer restoration (Sections 2.1.1.1.4.1.2; and 2.1.1.1.6.2) would be treated through the combination of ion exchange and reverse osmosis processes and injected back into the production aquifer. The proposed water treatment and reinjection into the aquifer would help limit the amount of water that would be consumed from the production aquifer. The concentrated waste solutions resulting from this treatment would be classified as byproduct material and would be disposed of in the deep disposal wells. The potential impacts associated with the use of the deep disposal wells during aquifer restoration would be the same as described for the operations phase in Section 4.14.1.1.2. Other waste management activities during aquifer restoration would also be similar to the operations phase (e.g., use of storage ponds), and therefore, the impact, would be SMALL.

4.14.1.1.4 Decommissioning Impacts

Section 2.6 of the GEIS states that wastes generated from decommissioning an ISR facility would be predominantly byproduct material and nonhazardous solid waste (GEIS, Section 2.6).

Section 4.2.12.4 of the GEIS states that decommissioning byproduct material (including contaminated facility demolition materials, process and wellfield equipment, excavated soil, and pond bottoms) would be disposed of at a licensed facility. As stated previously, to ensure that sufficient disposal capacity is available for byproduct material (including that generated by decommissioning activities), the NRC requires a pre-operational agreement with a licensed disposal facility to accept byproduct material for disposal. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a decommissioning plan required by the NRC prior to initiation of decommissioning activities. The decommissioning plan would describe how a 10 CFR Part 20-compliant radiation safety program would be implemented to ensure the safety of workers and the public. The GEIS concluded that the amount of radioactive, chemical, and solid wastes generated during decommissioning would be minimal, and the waste management impacts would also be SMALL. (NRC, 2009a)

For decommissioning the proposed Lost Creek ISR project, the applicant proposes to recycle much of the process equipment and materials or reuse it at other ISR sites. Materials would be surveyed for residual radioactive material contamination. Uncontaminated materials would be removed for reuse or disposal. Contaminated materials would either be decontaminated, transferred to another licensed facility for use, or disposed of as byproduct material. The cement foundations for the buildings would be removed for appropriate disposal as construction and demolition material, or crushed for reuse (LCI, 2008a). The applicant would use wellfield monitoring instruments and routine wellfield visual inspections for timely identification and remediation of well and pipeline leaks and spills. The NRC staff concludes that this would reduce the potential for generating large volumes of contaminated soil that would need to be excavated and disposed of as byproduct material at a licensed facility. In addition, during decommissioning the applicant would remove any sludge that has accumulated in the storage ponds and liners and dispose of this material off-site at a licensed disposal facility (LCI, 2008a). Any hazardous wastes generated during decommissioning would be stored in accordance with WDEQ regulations and transported to the Sweetwater County landfill.

As described in Section 2.1.1.1.6.3, the staff's cumulative facility lifecycle estimate for byproduct material from decommissioning the plant facilities and all wellfields (over a planned 6 year period) is 3,032 m^3 [3,966 yd^3]. This estimate is less than the decommissioning byproduct material volume considered in the GEIS. As described in SEIS Section 2.1.1.1.6.3, the applicant does not yet have an agreement in place with a licensed site to accept its solid byproduct material for disposal. One potential option for disposal of byproduct material in the region is the Pathfinder-Shirley Basin site in Mills, Wyoming. If that facility does not have sufficient capacity at the time a request for an agreement is made, then the applicant could engage other byproduct material disposal facilities that are licensed to accept byproduct material. Existing NRC-licensed facilities that can accept byproduct material for disposal include the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico and three other sites that are licensed by NRC Agreement States to accept byproduct material for disposal. These agreement states site include: the Energy Solutions site in Clive, Utah; the White Mesa uranium mill site in Blanding, Utah; and the Waste Controls Specialists site in Andrews, Texas. Based on the disposal options currently available, and the disposal agreement that the NRC will require by license condition prior to operations, NRC staff concludes that the potential waste management impacts from the disposal of byproduct material from decommissioning the proposed Lost Creek ISR Project would be SMALL.

The staff's cumulative estimate of nonhazardous solid waste that would be generated from decommissioning is 1251 m^3 [1380 yd^3](Section 2.1.1.1.6.3). This material would be generated during a 2-year period as the processing plant facilities are decommissioned resulting in an

annual solid waste disposal volume of approximately 528 m^3 [690 yd^3]. This estimated annual solid waste volume is lower than the quantity analyzed in the GEIS and would be less than 1 percent of the annual waste volume disposed of at the Sweetwater County landfill in Rock Springs (derived from the daily rate described in Section 3.13.1). Based on this analysis, the NRC staff concludes that the region has sufficient disposal capacity for the volume of nonhazardous solid waste that would be generated by the proposed action. Therefore, the NRC staff concludes that the waste management impacts from disposal of decommissioning nonhazardous solid waste would be SMALL.

4.14.1.2 Alternative Wastewater Disposal Options

LCI has already obtained its UIC Class I injection well permit. However, for comparison purposes, this section discusses the environmental impacts for the alternate wastewater disposal options identified in Section 2.2.2. All of these alternate wastewater disposal options would involve treatment of the wastewater that would generate solid waste, which also must be managed.

In most of the alternative wastewater disposal options, areal requirements would increase over disposal via UIC Class I injection wells (Section 4.14.1.1). Choosing one of the wastewater storage options would lead to more land disturbance and an increased use of construction equipment, with consequent increases in potential impacts on resource areas such as ecological systems, cultural and historical resources, and nonradiological air quality. The applicant would have to amend its license application to select one of these alternative wastewater disposal options; and the NRC staff would have to perform an additional environmental and safety review prior to deciding whether to grant or deny the licensing application with the new wastewater disposal option. The applicant would have to survey the affected areas prior to construction, and the NRC would have to consult with the Wyoming SHPO, the WGFD, the EPA, and the FWS. Mitigation measures, such as avoidance of sensitive areas or documentation of cultural resources, would be established as part of these consultations, as necessary. With these mitigation measures in place, it is anticipated that the potential adverse impacts could be SMALL.

4.14.1.2.1 Evaporation Ponds

The types of waste streams and the infrastructure necessary for using evaporation ponds as a wastewater disposal option are described in Section 2.1.1.2. The types and amounts of wastewater that could be disposed of in an evaporation pond would be the same as described in the section for disposal by deep injection into a Class I UIC well. Before the applicant could begin disposing wastewater into an evaporation pond system the NRC staff would review the design and construction of the ponds and monitoring system against the criteria in 10 CFR Part 40, Appendix A (NRC, 2003b; 2008). The applicant would be required to demonstrate that the evaporation ponds could be designed, operated, and decommissioned to prevent migration of wastewater to subsurface soil, surface water, or groundwater. Applicants would also be required to demonstrate that monitoring requirements would be established to detect any migration of contaminants to the groundwater. The NRC staff would establish any license conditions needed to ensure the applicant meets the necessary requirements.

Individual evaporation ponds would need to have a minimum surface area of up to 2.5 ha [6.25 ac], and the total pond system could be as much as 40 ha [100 ac]. During the period of operations for the proposed Lost Creek ISR Project facility, this area would be fenced to exclude wildlife and livestock. A 40 ha [100 ac] footprint would be less than 3 percent of the total

permitted area {1,705 ha [4,220 ac]} for the proposed Lost Creek ISR facility (LCI, 2008a; 2008b). However, it would be much larger than the footprint {4 ha [10 ac]} that would be cleared of vegetation to construct the uranium processing plant. The additional land disturbance required to install an evaporation pond system for wastewater disposal would be nearly double the amount of land that would be cleared of vegetation and topsoil as part of the current proposed action {115 ha [285 ac]} for the entire proposed Lost Creek ISR Project facility (Section 4.2.1 of this SEIS). It is also anticipated that the applicant would need to have at least one other wastewater disposal option or storage capacity during the winter months in Wyoming when evaporation ponds would be frozen. Although a wastewater disposal option that uses an evaporation pond system would double the facility footprint of the UIC Class I injection wells option, the total amount of disturbed and fenced land would be small compared to the permitted area and bounded by the conditions stated in the GEIS with respect to land use. For these reasons, the overall impacts on land use associated with an evaporation pond system would be SMALL.

Similar to the construction of the processing plant, construction of an evaporation pond system would require earthmoving equipment, such as bulldozers, backhoes, and trucks, to prepare the site and construct the impoundment. The equipment would produce diesel emissions and fugitive dust emissions during construction that would have an effect on nonradiological air quality. Depending on how the applicant elected to phase in the pond system, these effects could extend into the operational phase of the facility, as well. Wetting unpaved roads would minimize fugitive dust, and as described in SEIS Section 4.7.1, diesel emissions associated with planned construction activities at the proposed Lost Creek ISR Project would be well below NAAQS threshold levels; therefore, taking into consideration the likely short-term duration of the construction period, the anticipated the potential impacts on nonradiological air quality would be SMALL.

The applicant may also need to obtain a National Emission Standards for Hazardous Air Pollutants (NESHAPS) review to evaluate whether the anticipated radiological releases to air from the evaporation ponds would meet the criteria in 40 CFR Part 61, Subpart W. The applicant would also be required to have an NRC-approved air monitoring system for the wastewater disposal system. Keeping the pond wet to reduce dust and radon emissions would effectively reduce potential air emissions; therefore, the potential impacts on radiological air quality would be SMALL.

As described in NRC (2008), the evaporation ponds would be designed and constructed with clay or geotextile liners to reduce the potential for infiltration into the subsurface. An NRC-approved monitoring system would be installed to detect leaks from the ponds, and the applicant would also implement an NRC-approved inspection plan for the ponds (NRC, 2008). Based on these monitoring and inspection measures, it is anticipated that potential impacts to surface water and groundwater resources would be SMALL.

As described in Section 4.6, the proposed Lost Creek ISR Project with one or more UIC Class I injection wells could potentially have MODERATE impacts on avian species of concern. A wastewater disposal option that uses an evaporation pond system could triple the facility footprint. The evaporation ponds, however, would be constructed at the same time and with the same mitigation measures described in Section 4.6 for the construction of the remainder of the facility. Additional measures such as netting could be used to prevent birds from landing on the ponds. For these reasons, the potential impact from an evaporation pond disposal system would be MODERATE, but could be reduced to SMALL.

At the end of the operational phase of the facility, all the pond liners and berms, as well as accumulated precipitates and sludges, would be classified as solid byproduct material. For example, the GEIS reports that about 52 m^3 [68 yd^3] of byproduct material would be generated during evaporation pond decommissioning. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of byproduct decommissioning wastes, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity in the local area, it is anticipated that the impacts from an evaporation pond wastewater disposal system on waste management could range from SMALL to MODERATE during the decommissioning phase of the facility. It is important to note that at the conclusion of operations, the licensee would be required to provide a detailed decommissioning plan that demonstrates that it has a disposal path for any decommissioning wastes, including those related to the wastewater disposal system. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.2.2 Land Application

For the land application of process liquid effluent, the applicant would be required to meet the regulatory provisions in 10 CFR Part 20, Subparts D and K, and Appendix B (NRC, 2003b). The applicant would also be required to analyze the chemical toxicity of radioactive and nonradioactive constituents, including an assessment of projected concentrations of radioactive contaminants in the soil and projected impacts on groundwater and surface water quality and on land uses, especially crops and vegetation. The applicant would also be required to obtain NRC approval of a monitoring program that would include periodic soil surveys to verify that contaminant levels in the soil would not exceed those projected, and it should also include a remediation plan that could be implemented if projected levels are exceeded. The applicant would also need to treat the wastewater to quality requirements for surface discharge under a WYPDES permit from WDEQ. Finally, the applicant would also need to demonstrate that the soils in the land application area would meet the criteria in 10 CFR Part 40, Appendix A, at the time of decommissioning. These practices would be subject to NRC license conditions and verified through the NRC inspection program to ensure protection of public health and safety and the environment.

Land application typically requires large areas to ensure soil concentrations do not exceed regulatory levels. Typical land application areas are on the order of about 40 ha [100 ac], similar to an evaporation pond system. During the period of operations for the proposed Lost Creek ISR Project facility, this area would be fenced to exclude wildlife and livestock. Similar to a wastewater disposal system using evaporation ponds, land application would provide a footprint that is less than 3 percent of the total permitted area {1,705 ha [4,220 ac]} for the proposed Lost Creek ISR Project facility. As with the evaporation pond system, it would be much larger than the footprint {4 ha [10 ac]} of the uranium processing plant described in the proposed action (Section 4.2.1) (LCI, 2008a; 2008b). The additional land disturbance required to install a land application system for wastewater disposal would be double the amount of land that would be cleared of vegetation and topsoil for the current proposed action {115 ha [285 ac]} (Section 4.2.1). It is also anticipated that the applicant would need to have at least one other wastewater disposal option or storage capacity during the winter months in Wyoming when evaporation rates would be low or zero and the ground would be frozen or covered by snow. Like the evaporation pond system, a wastewater disposal option that uses land application would double the facility footprint of a UIC Class I injection well system. The amount of disturbed and fenced land, however, would be small compared to the permitted area and is

bounded by the conditions stated in the GEIS. For these reasons, the overall impacts on land use associated with wastewater disposal by land application would be SMALL.

Establishing the land application area would not require extensive use of earthmoving equipment other than to install pipelines, small berms, access roads, and fencing. As a result, the potential impacts on land use would be SMALL. The wastewater, however, would likely require additional treatment to meet WYPDES standards, including facilities such as an ion-exchange circuit, reverse osmosis, one or more radium-settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, and purge storage reservoirs {4 ha [10 ac] or more}. Constructing these treatment facilities, basins, and storage reservoirs would require earthmoving equipment, such as bulldozers, scrapers, backhoes, and trucks, to prepare the site and construct the impoundments. The equipment would produce diesel emissions and fugitive dust emissions during construction that could have an effect on nonradiological air quality. Wetting unpaved roads would minimize fugitive dust, and as described in SEIS Section 4.7.1, diesel emissions associated with construction activities at the proposed Lost Creek ISR Project would be well below NAAQS threshold levels; therefore taking into consideration the likely short-term duration of the construction period, the anticipated potential impacts on nonradiological air quality would be SMALL. The applicant may also need to consider potential radiological releases to air from the land application area(s). Given the low radionuclide content anticipated for the wastewater and low calculated radon fluxes for similar application areas (NRC, 1997; 2003b), the anticipated impacts on radiological air quality would be SMALL. As described in Section 4.6, the proposed Lost Creek ISR Project with one or more UIC Class I injection wells could potentially have MODERATE impacts on avian species of concern, as two storage ponds would also be constructed. A wastewater disposal option that uses a land application system, while doubling the facility footprint, could effectively reduce the avian impact to SMALL because there would be no surface waters to attract birds.

The applicant would be required to demonstrate that the soil in a land application area would meet the 10 CFR Part 20 requirements. In addition, during operations the applicant would be required to routinely monitor the soil to ensure that predicted concentrations would not be exceeded. For these reasons, it is anticipated that decommissioning the land application area would not produce any additional solid byproduct material for disposal, and the potential impacts on waste management would be SMALL during the decommissioning phase of the facility. For decommissioning the wastewater treatment facility, all pond liners and berms associated with radium-settling basin(s), as well as accumulated precipitates and sludge generated at an estimated rate annual of about 22.4 m^3/yr [29.3 yd^3/yr] (see Section 2.1.1.2.2), would be classified as solid byproduct material. These solids, as well as any other solid byproduct material generated by the wastewater treatment process (e.g., spent resins and contaminated building debris), would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of byproduct decommissioning wastes, therefore, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity, the potential impacts on waste management from decommissioning the radium-settling basin(s) and other storage facilities associated with treating wastewater for disposal by land application could range from SMALL to MODERATE.

It is important to note that at the conclusion of proposed operations, the licensee would be required to provide a detailed plan for decommissioning any wastewater treatment facilities for NRC review (NRC, 2003b). The decommissioning plan would include final radiological surveys that identify whether there are any areas of soil contamination that would require disposal as

byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.2.3 Surface Water Discharge

For the surface discharge wastewater, the applicant would be required to meet the regulatory provisions in 10 CFR Part 20, Subparts D and K, and Appendix B. The applicant would also be required to obtain a zero-release WYPDES permit from WDEQ. The applicant would be required to distinguish between "process wastewater" generated during uranium recovery operations, and "mine wastewater" generated during aquifer restoration (NRC, 2003b). In accordance with EPA regulations, the applicant would not be allowed to discharge "process" wastewater to navigable waters of the United States (NRC, 2003a). The applicant would not be allowed to discharge treated wastewater directly into navigable waters of the United States. The ephemeral drainages in the vicinity of the proposed Lost Creek ISR Project facility, however, are not considered jurisdictional waters under Section 404 of the Clean Water Act, as determined by the USACE. An approved Jurisdictional Determination was issued on August 18, 2010, by the Cheyenne Office of the Corps of Engineers (USACE, 2010). The applicant would either need to develop storage capabilities, depending on whether it intended to maintain separate wastewater streams, or commingle (mix) "process" and "mine" wastewater prior to treatment to 10 CFR Part 20 standards. In addition, the applicant would need to address any radioactivity at the discharge point or from storage facilities (tanks, impoundments), radium-settling basins, and related liners and sludges as part of the decommissioning of the facility (NRC, 2003b; Cohen and Associates, 2008b).

Establishing the discharge point for the treated effluent could require short-term use of earthmoving equipment to install pipelines, small berms, access roads, and fencing to exclude livestock and wildlife. The amount of land to be fenced for the discharge point alone would be limited (see Section 2.1.1.2), and the potential impacts on land use would be SMALL. As would be the case with land application, however, the wastewater could require additional treatment to meet WYPDES zero-release permit requirements, including treatment at facilities such as an ion-exchange circuit, reverse osmosis, one or more radium-settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, and purge storage reservoirs (4 ha [10 ac] or more). These treatment facilities would also be fenced to exclude wildlife and livestock and limit access to the public. The amount of land needed for the wastewater treatment facilities would be similar to that for land application, but if the applicant segregates "process" and "mine" wastewater to meet the WYPDES permit requirements, the involved land area would need to be greater to provide separate storage facilities. Similar to evaporation ponds and land application, the increased footprint required for the additional wastewater treatment facilities needed to meet WYPDES requirements would be small relative to the entire permitted area {1,705 ha [4,220 ac]}, but somewhat larger than for the uranium processing plant as described in the proposed action (Section 4.2.1) (LCI, 2008a; 2008b). The current proposed action identifies about 115 ha [285 ac] of land to be cleared of vegetation and topsoil for the proposed Lost Creek ISR Project facility. Overall, the increase in the amount of disturbed land required to accommodate the addition of a wastewater treatment facility would be about 10 to 20 percent, and would only have a SMALL impact on land use.

Constructing the wastewater treatment facilities (e.g., radium-settling basins) would require earthmoving equipment such as bulldozers, backhoes, and trucks to prepare the site and construct the impoundment(s). The equipment would produce diesel emissions and fugitive dust emissions during construction that could have an effect on nonradiological air quality. Wetting unpaved roads would minimize fugitive dust. Taking into consideration the likely short-term duration of the construction period, the anticipated impacts on nonradiological air

quality would be SMALL. The applicant may also need to consider emissions of radionuclides, such as radon, from the surface discharge points. Because the WYPDES permit would require the applicant to monitor and maintain low radionuclide concentrations for the treated wastewater, the impacts on radiological air quality would be SMALL.

The proposed Lost Creek ISR Project facility surface water discharge points would be entirely within the Battle Spring Draw drainage basin (SEIS Section 3.5.1.4). Although Battle Spring Draw drains into Battle Spring Flat about 14 km [9 mi] to the southwest, much of the water conveyed through the ephemeral channels does not reach Battle Spring Flat and either evaporates or infiltrates into the alluvium (LCI, 2008b). The Battle Spring Draw drainage basin is dry the majority of the year with no known fish populations or use as a drinking water supply (LCI, 2008b). A surface water discharge option, however, could create more reliable water flow, could lead to the development of aquatic habitat, and could lead to an increase in erosion and suspended sediments in existing stream channels. Sediment loads would be expected to taper off quickly both in time and distance; therefore, long-term impacts would be SMALL.

The applicant would be required to demonstrate that any soil affected by the surface discharge of treated wastewater would meet 10 CFR Part 20 requirements. In addition, during operations, the applicant would also be required to routinely monitor the soils and discharge water to ensure that predicted concentrations would not be exceeded. For these reasons, it is not anticipated that decommissioning the surface discharge point would produce any additional solid byproduct material for disposal, and the potential impacts from waste management would be SMALL. Similar to the land application wastewater disposal option, however, decommissioning wastewater treatment facilities may produce solid byproduct materials such as spent resins, sludges and liners from radium-settling basin(s), and contaminated building debris. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of byproduct decommissioning wastes, thereby increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity, it is anticipated that the potential impacts from decommissioning the radium-settling basin(s) and other storage facilities associated with treating wastewater for surface water discharge could range from SMALL to MODERATE.

At the conclusion of operations, the licensee would be required to provide for NRC review a detailed plan for decommissioning any wastewater treatment facilities to be submitted (NRC, 2003b). The detailed decommissioning plan would include final radiological surveys that identify whether there were any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.1.2.4 Class V Injection Well

The potential impacts associated with wastewater disposal through a UIC Class V deep injection well would be similar to those associated with the proposed action (disposal via a UIC Class I deep injection well). Under the terms of a WDEQ UIC Class V permit, however, the wastewater would require additional treatment to meet Class of Use or Federal drinking water standards (whichever is more stringent) prior to injection, because disposal would be in an aquifer that lies above an aquifer that is a supply of drinking water.

The potential impacts associated with constructing, operating, and decommissioning the necessary wastewater treatment facilities would be similar to those described in the

previous sections for land application (Section 4.14.1.2.2) and surface water discharge (Section 4.14.1.2.3) disposal options. For example, although the footprint of the Class V well itself would be small {0.1 ha [0.25 ac]}, the wastewater would likely require additional treatment to meet the necessary discharge requirements (Class of Use or Federal drinking water standards). This treatment would require facilities such as an ion-exchange circuit, reverse osmosis, one or more radium-settling basins {0.1 to 1.6 ha [0.25 to 4 ac]}, and purge storage reservoirs {4 ha [10 ac]}. These treatment facilities would be fenced to exclude wildlife and livestock and limit access to the public. The amount of land needed for the wastewater treatment facilities would be similar to that for land application or surface discharge. The increased footprint of the additional wastewater treatment facilities would be minimal relative to the entire permitted area {1,705 ha [4,220 ac]}, but more than the 4.1 ha [10 ac] for a uranium processing plant (Section 4.2.1) (LCI, 2008a; 2008b). The proposed action identifies about 23.5 ha [58 ac] of land that would be cleared of vegetation and strip topsoil. Overall, the increase in the amount of disturbed land by the addition of a wastewater treatment facility would be about 10 to 20 percent, and would have a SMALL impact on land use.

Constructing the additional wastewater treatment facilities (e.g., radium-settling basins) would require earthmoving equipment such as bulldozers, backhoes, and trucks to prepare the site and construct the impoundment(s). The equipment would produce diesel emissions and fugitive dust emissions during construction that could have an effect on nonradiological air quality. Wetting unpaved roads would minimize fugitive dust. Taking into consideration the likely short-term duration of the construction period, the anticipated impacts on nonradiological air quality would be SMALL. The applicant may also need to consider emissions of radionuclides, such as radon, during the wastewater treatment process. These emissions would be monitored as part of the NRC-approved monitoring plan for the facility. However, the impacts on radiological air quality would be SMALL.

As with the land application and surface discharge wastewater disposal options, the solid wastes generated by decommissioning wastewater treatment facilities associated with a UIC Class V injection well such as piping, spent resins, sludges and liners from radium-settling basin(s), or contaminated building debris, would need to be disposed of as byproduct material. These solids would need to be transported to a licensed facility for disposal as part of the decommissioning program. This would increase the total amount of byproduct decommissioning wastes, therefore, increasing the number of truck trips needed to transport the materials to a disposal facility. Given the potential limitations on available byproduct waste disposal capacity, it is anticipated that the potential impacts on waste management from decommissioning the radium-settling basin(s) and other storage facilities associated with treating wastewater for surface water discharge could range from SMALL to MODERATE.

At the conclusion of operations, the licensee would be required to provide for NRC review a detailed plan for decommissioning any wastewater treatment facilities (NRC, 2003b). The decommissioning plan would include final radiological surveys that identify whether there are any areas of soil contamination that would require disposal as byproduct material. The NRC staff would conduct detailed technical and environmental reviews of the proposed decommissioning program for the facility at that time.

4.14.2 No-Action (Alternative 2)

Under the No-Action alternative, there would be no waste generated at the Lost Creek site. There would be no deep well injection of liquid wastes, storage ponds, and a decommissioning plan would not be submitted. In addition, there would be no need for agreements with a

licensed radioactive waste disposal facility to dispose of radioactive wastes generated during operation and decommissioning. There would be no impacts from waste management associated with this alternative.

4.14.3 Dry Yellowcake (Alternative 3)

Under this alternative, the thickened yellowcake slurry would be further pressed to remove additional water, dried into a dry “yellowcake” powder, and packaged onsite. A yellowcake vacuum dryer would be added to the system to perform these functions. The heating system would be isolated from the yellowcake so that no radioactive materials are entrained in the heating system. The yellowcake would be removed from the bottom of the dryer and packaged in drums for eventual shipping offsite. As mentioned in SEIS section 2.1.3, processing wet yellowcake into a dry powder is not expected to change the nature or magnitude of waste management impacts. Waste management activities would typically use the same treatment and disposal options as for the proposed action and, therefore, impacts would be the same as for the proposed action, SMALL.

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5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality (CEQ)'s *National Environmental Policy* Act (NEPA) regulations, as amended (40 CFR Part 1500 to 40 CFR Part 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 effects or impacts[1] can result from individually minor but collectively significant actions taking place over a period of time. The proposed project could contribute to cumulative effects when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions. For this SEIS, other past, present, and future actions in the proposed project area include (but are not limited to) coal mining, oil and gas production, other *in-situ* uranium recovery (ISR) operations, conventional uranium mining and milling, wind farms, and cattle and sheep grazing.

The analysis of the cumulative impacts of the proposed action was based on publicly available information on existing and proposed projects, information in the GEIS (NRC, 2009), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable actions that could occur. The primary activity in the area is the resurgence in interest in mineral mining and oil and gas development within the last few years, although this interest has not necessarily translated into active projects. No long-term changes to the environment are anticipated as a result of the proposed Lost Creek ISR facility within about 8 km [5 mi] of the site, except for the possible installation of dirt roads. No long-term changes are anticipated within this area due to extensive restoration and reclamation activities the applicant planned. Within about 32 km [20 mi] from the site, there are several ISR and conventional uranium projects in the decommissioning and prelicensing stages, as well as oil and gas operations that could contribute to the cumulative effects in the area. At greater distances, it has been assumed that the resurgence in extractive industries, along with government and industry efforts to develop infrastructure, would continue.

The GEIS (NRC, 2009) provides an example methodology for conducting a cumulative impacts assessment. Section 5.1.1 describes other past, present, and reasonably foreseeable future actions (RFFA) considered in the cumulative impact analysis. The methodology used to conduct the cumulative impact analysis in this SEIS is provided in Section 5.1.2.

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The Lost Creek project area is located within the Wyoming West Uranium Milling Region (NRC, 2009), which includes approximately 23,309 km^2 [9,000 mi^2] of land, 61 percent of which is administered by, the Bureau of Land Management (BLM). Only 24 percent of the land area is privately owned. The remainder comprises State, U.S. Forest Service, and Indian Reservation lands. Land uses include BLM grazing land, wildlife habitat, wilderness areas, hunting,

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[1]For the purposes of this analysis, "cumulative impacts" is deemed to be synonymous with "cumulative effects."

dispersed recreation and off-road vehicle use, wildlife habitat management, oil and gas recovery, gas and carbon dioxide pipelines and transmission lines, and cultural and historic sites (NRC, 2009). This region encompasses parts of Carbon, Fremont, Natrona, and Sweetwater Counties. More specifically, the proposed Lost Creek ISR Project is located within the northern part of the Great Divide Basin, an oval shaped, hydrologically closed basin covering about 8,960 km^2 [3,500 mi^2] that includes portions of Carbon, Fremont, and Sweetwater Counties.

There are various oil and gas, uranium, and other natural resource extraction and exploration operations and that are planned for future operation within the Great Divide Basin. For example, the Lost Soldier-Wertz oil fields are located proximate to the proposed project area, and have been a significant source of exploratory drilling and oil extraction. These, along with other uses such as rangeland and recreational activities contribute to the overall cumulative impacts in the area. Figure 5-1 illustrates the locations of coal, wind power, and uranium extraction operations within an 80-km [50-mi] radius of the proposed project area.

The various past, present, and reasonably foreseeable future actions in the Great Divide Basin are described separately. Applicable and relevant projects are also listed in the following sections.

5.1.1.1 Uranium Recovery Sites

Uranium was discovered in Wyoming in the Powder River and Wind River Basins during the 1950s, and continued exploration for uranium resulted in discovery of additional sedimentary uranium deposits in the major basins of central and southern Wyoming, including the Great Divide Basin. Uranium production in Wyoming declined in the mid-1960s, but increased again in the late 1960s and 1970s. Conventional mine production peaked in 1980 and then decreased in the early 1980s through the early 1990s when ISR facilities were developed. ISR replaced conventional mines and milling as the preferred means for extracting uranium ores in the United States. Currently, only ISR facilities are producing uranium in Wyoming.

Past, existing, and potential future uranium recovery sites in the Great Divide Basin are listed in Table 5-1. Of nine past and existing uranium recovery operations, there are three ISR facilities (one licensed and on standby, two with terminated licenses), and six conventional uranium milling facilities in the area. Four of the six existing conventional sites are in the decommissioning process, one is licensed and on standby, and one is listed as a *Uranium Mill Tailings Radiation Control Act* (UMTRCA) Title I processing site. In addition, there are seven potential uranium recovery sites where NRC has received from a commercial company either a license application or a Notice of Intent to file a license application for the proposed facility. For these potential sites, four would be developed as ISR operations, one would be a combined ISR/conventional site, one would be developed as a conventional uranium mill, and the final site would be developed using heap leaching. A license application has been submitted for the JAB and Antelope site, but the proposed ISR facility has been placed on-hold by its owner, Energy Metals Corporation (NRC, 2009).

The applicant has identified a total of eight uranium properties in the Great Divide Basin (Ur-Energy, 2011a,b; NRC, 2011a). Of these properties, four are only in the early stages of exploration and it is unclear at this time whether a license application will ever be filed for these properties (NRC, 2011a). The cumulative impact analysis considers the remaining four

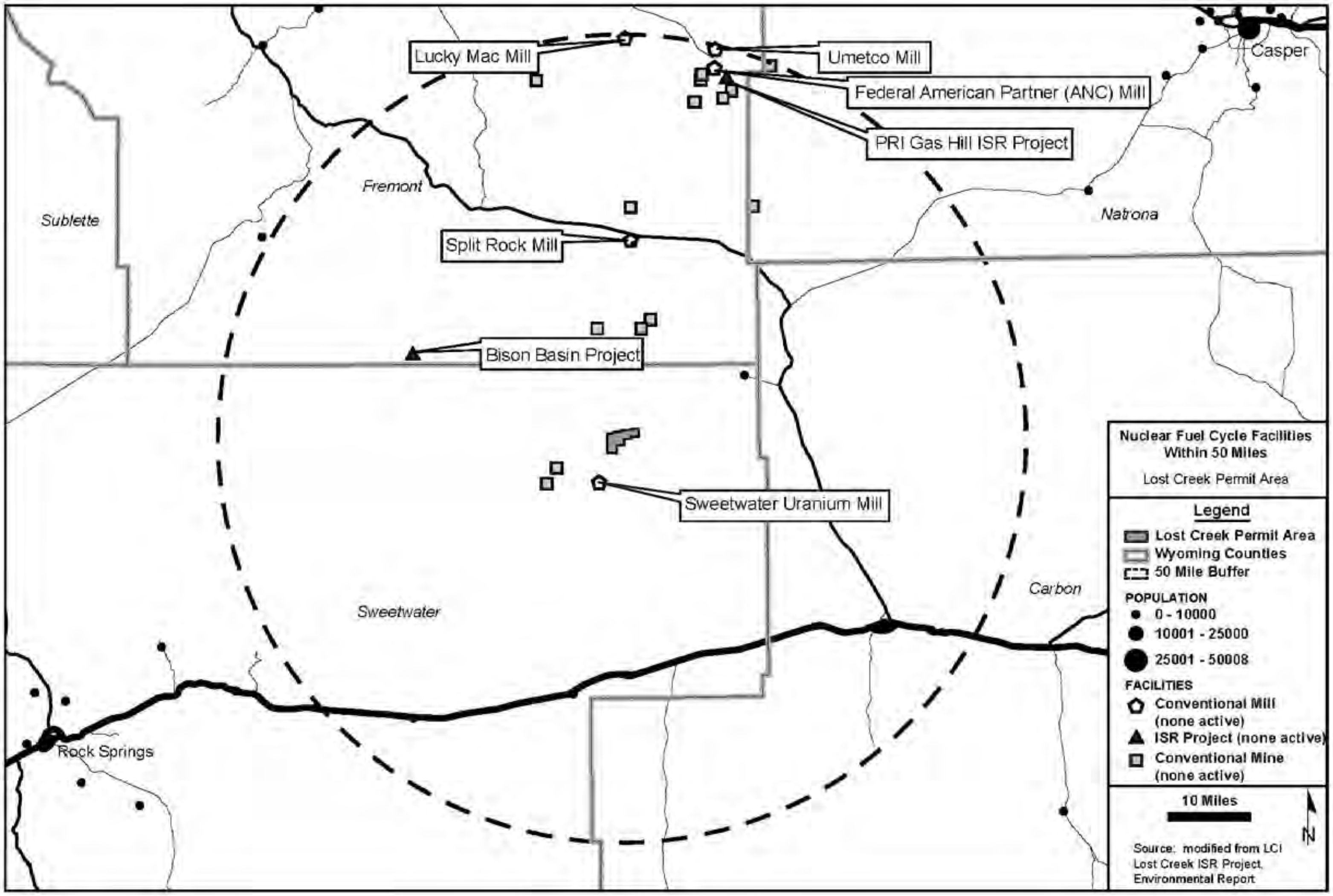

Figure 5-1. Uranium Recovery, Coal, and Wind Power Facilities in the Vicinity of the Proposed Lost Creek ISR Project
Source: The University of Wyoming WyGISC Data Server (http://partners.wygisc.uwyo.edu/website/dataserver/viewer.htm)

Table 5-1. Uranium Recovery Sites* in the Wyoming West (Great Divide Basin) Uranium Milling Region

Site Name	Company/ Owner	Type†	County	Status‡	Approximate Distance km [mi]	Direction
Lost Creek North	UR-Energy Corp.	ISR	Sweetwater	Potential site	1 [0.6]	N
Lost Creek South	UR-Energy Corp.	ISR	Sweetwater	Potential site	1 [0.6]	SSE
Lost Creek (deeper KM horizon)	UR-Energy Corp.	ISR	Sweetwater	Potential site	0.5 [0.3]	S
Lost Soldier	UR-Energy Corp.	ISR	Sweetwater	Potential site	22.5[14]	NE
West Alkali Creek	Wildhorse Energy	ISR	Fremont	Potential site	45 [28]	NW
Nine Mile Lake	Rocky Mountain Energy Co.	ISR	Natrona	License terminated	154 [96]	NE
Gas Hills	Power Resources Inc.	ISR	Natrona and Fremont	Licensed - on standby	83 [51]	NNE
Bison Basin	Ogle Petroleum	ISR	Fremont	License terminated	45 [28]	NW
Jab & Antelope	Uranium One	ISR	Fremont	Potential site - license application review on hold (applicant's request)	21 [13]	NNW
Sheep Mountain	Titan Uranium USA, Inc.	Heap Leach	Fremont	Potential site	29 [18]	NW
Lucky Mc	Pathfinder Mines Corp.	Conventional	Fremont	Decommissioning	79 [49]	NNE
Split Rock	Western Nuclear, Inc.	Conv.	Fremont	Decommissioning	42 [26]	N
Riverton	US Dept. of Energy (DOE)	Conv.	Fremont	UMTRCA Title I processing site	106 [66]	NNW
Gas Hills	Strathmore Minerals Corp.	Conv.	Natrona and Fremont	Potential site	81 [50]	NNE
Gas Hills	Umetco Minerals Corp.	Conv.	Natrona and Fremont	Decommissioning	83 [51]	NNE
Sweetwater	Kennecott Uranium Co.	Conv.	Sweetwater	Licensed - on standby	9 [6]	SSW
Sweetwater	Wildhorse Energy	ISR/Conv.	Sweetwater	Potential site	12 [8]	SW
Sky	Strathmore Minerals Corp.	ISR	Fremont	Potential site	73 [46]	NNW
Gas Hills	American Nuclear Corp.	Conv.	Fremont	Decommissioning	76 [47]	NNE

*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 1/28/2011." <http://www.nrc.gov/materials/uranium-recovery/license-apps/ur-projects-list-public.pdf> (February 2011).
†Type: 1 = Research and Development/Pilot
‡Status: 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

properties that the applicant identified as likely candidates for license applications (NRC, 2011a). Two of these properties, Lost Creek North and Lost Creek South are adjacent to the proposed Lost Creek ISR Project area, while the deeper KM horizon (145 m [475 ft] below the ground surface) occurs in the Battle Spring Formation below Mine Unit 1 (Ur-Energy, 2011c).

The applicant plans to pursue licensing for these three properties within the next 20 years (NRC, 2011a). The applicant has also submitted a letter of intent to NRC announcing plans to submit an application for ISR production at the Lost Soldier site, about 22.5 km [14 mi] northeast of the Lost Creek project area (Ur-Energy, 2010). If licensed by NRC, Lost Creek North and South, the deeper KM horizon, and Lost Soldier would be developed to use the infrastructure at the proposed Lost Creek ISR Project to the extent possible. For example, rather than developing new satellite facilities, pregnant lixiviant would be piped from all four of these properties to the proposed processing plant for uranium recovery, and the deeper KM horizon would be produced in sequence with the six wellfields identified for shallower HJ horizon in the proposed Lost Creek ISR Project (NRC, 2011a). The applicant anticipates submitting an application to amend the NRC license for Lost Creek to add a vacuum dryer, to drill to the deeper KM horizon, and to conduct operations at Lost Soldier (LCI, 2010a).

The analyses presented in this SEIS are based on a maximum annual yellowcake production of 453,600 kg U_3O_8/yr [1 million lb U_3O_8/yr]. The applicant has indicated that the designed processing plant capacity will be 907,200 kg U_3O_8/yr [2 million lb U_3O_8/yr] (NRC, 2011b; LCI, 2011). This would not change the size or footprint of the processing plant, so the potential cumulative impacts for some resource areas such as land use, visual, historical cultural, and ecological would not be likely to change. Some resource areas, such as socioeconomics and environmental justice, might experience limited additional cumulative impacts from the slightly larger workforce that would be needed for a higher production capacity. However, for those resource areas (transportation, geology and soils, groundwater, noise, and waste management), that are affected by volumes of waste and effluent or the number of yellowcake shipments, additional potential cumulative impacts would be likely to scale directly with the increased production. For example, doubling the annual production of yellowcake at the proposed Lost Creek ISR Project would be expected to also double the number of shipments from the processing plant.

The BLM Landers Field Office Planning Area issued a report titled *Final Mineral Occurrence and Development Potential Report* (BLM, 2009a). The Landers Field Office management area is located north of the Proposed Lost Creek site. Forecasts from the report projected that uranium development will continue at levels similar to that of the mid-to-late 2000s, and possibly experience a moderate increase as hydrocarbon-based sources of energy give way to alternate fuels such as uranium. In addition, it is expected that a limited number of the prospects currently under development will eventually be permitted as ISR mines. However, in the near term, with the recent (through April 2011) downward change in uranium prices, the Lander Planning Area is expected to experience a level of uranium mining activity somewhat lower compared with the level of activity occurring through the end of 2008. BLM anticipates that exploration and development activity will increase in the planning area as the world-wide economic recession eases (BLM, 2009a).

5.1.1.2 Coal Mining

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. Two surface coal mining operations in the Great Divide Basin are located in Sweetwater County (NRC, 2009): the Bridger Coal mine {approximately 82 km [51 mi] to the southwest}, which includes approximately 4,069 ha [10,054 ac] of disturbed land, and the Black Butte Coal mine {approximately 84 km [52 mi] to the southwest}, which encompasses approximately 4,647 ha [11,483 ac] of disturbed land.

Production for the two mines in 2009 was approximately 5.5 million tonnes [6.1 million tons] for Bridger Coal and 3.4 million tonnes [3.8 million tons] for Black Butte (Wyoming Mining Association, 2010). The Bridger Coal Company submitted a coal "lease by application" to convert surface mining operations to underground mining to extend the life of the mine.

The Elk Mountain Mine is located in Carbon County approximately 136 km [85mi] east of the proposed facility. The site produced 237,740 tons of coal in 2009 (Wyoming Mining Association, 2010). The Carbon Basin Coal Lease is a proposed application that will involve a total of 1,983 ha [4,896 ac] of surface disturbance throughout the life of the mine, which is projected at 11 years (BLM, 2008b). This same operation would include an underground mine that would last for approximately 17 years. The total coal projected from the Carbon Basin Coal Lease is 28.2 million tonnes [31.1 million tons] for the surface operation and 101.6 million tonnes (112 million tons) for the underground operation. Table 5-2 summarizes coal mine operations in the Wyoming West Region.

5.1.1.3 Oil and Gas Production

Regional oil and gas development activities (e.g., exploration, production, and pipeline development) have the potential to generate potential cumulative impacts (BLM, 2008b). Most of Wyoming current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low (WSGS, 2002, as cited in BLM, 2008a). Carbon County currently has 47 gas production units (13 active, 34 inactive), while Sweetwater County currently has 26 gas production units (23 inactive, 3 active). The Lost Soldier-Wertz Oil fields are the primary source for oil and gas extraction in the Great Divide Basin. The Rawlins RMP summarized oil and gas development projects previously or currently subject to NEPA analysis in Southwestern Wyoming: 6,469 producing wells and 8,030 wells that can still be drilled/produced, encompassing approximately 121,405 ha [300,000 ac] of land (BLM, 2008b). Figure 5-2 illustrates coal, oil and gas, and coal bed methane in the vicinity of the proposed Lost Creek ISR Project.

Table 5-2. Coal Mines in the Wyoming West (Great Divide Basin)*

Site Name	Company /Owner	Type	County	Production Tonnes (Tons)	Production Year	Approximate Distance Km [Mi]	Direction
Jim Bridger	Bridger Coal	Surface	Sweetwater	4,712,910 [5,195,094]	2009	82 [51]	SW
Black Butte	Black Butte Coal	Surface	Sweetwater	3,516,943 [3,876,766]	2009	84 [52]	SW
Elk Mountain Mine	Arch of Wyoming	Surface	Carbon	237,740	2009	136 [85]	E
*Wyoming Mining Association. "Wyoming Coal." <http://www.wma-Minelife.com/coal/coalfrm/coalfrm1.htm> (9 August 2010).							

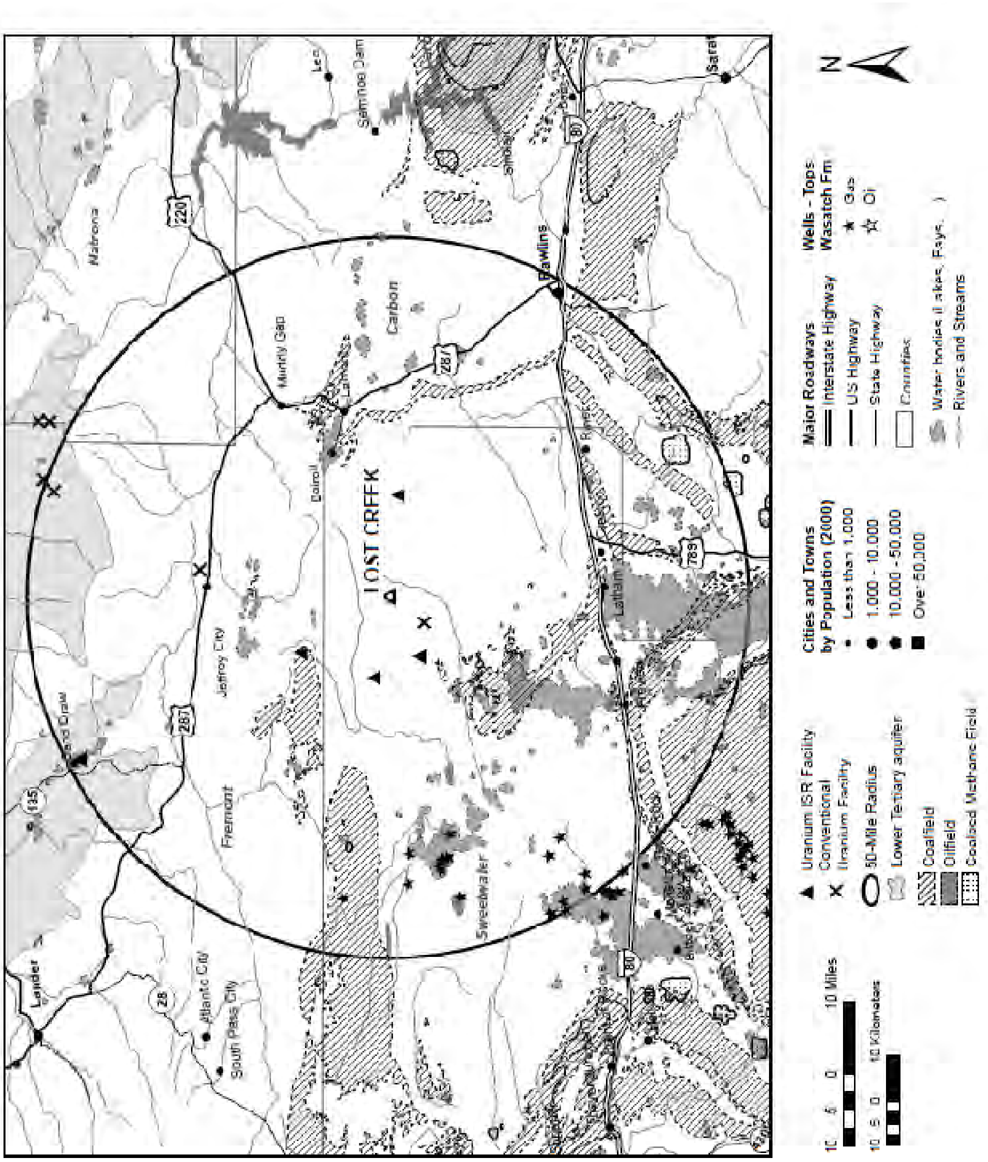

Figure 5-2. Coal, Oil and Gas, and Coal Bed Methane in the Vicinity of the Proposed Lost Creek ISR Project (Open Triangle). Source: EIA, 2007; USGS, 2003; WOGCC, 2010; WyGISC, 1990.

5.1.1.4 Coal Bed Methane

Coal bed methane is located where there are abundant coal resources. For this reason, the majority of coal bed methane production in Wyoming occurs in the Powder River Basin, more than 160 km [100 mi] northeast of the proposed Lost Creek ISR Project (De Bruin, et al., 2004; Jones and Cottingham, 2009). As described previously, there are three active coal mines within about 150 km [90 mi] of Lost Creek. There are other coalfields nearby that are not being actively mined for coal, but could be considered as potential targets for coal bed methane development. For example Atlantic Rim coal bed methane and natural gas development project in the Great Divide Basin is approximately 86 km [52 mi] south of the proposed Lost Creek Project and was previously evaluated for environmental impacts (BLM, 2006). This project proposed drilling 1,800 coal bed methane wells and 200 natural gas wells. Taking into account the more distant Green River and Hanna coalfields, the total amount of estimated recoverable coal bed methane resources represents about 421 billion m^3 [4.5 trillion ft^3] or about 14 percent of the total for Wyoming (De Bruin et al., 2004; Jones and Cottingham, 2009). Production of these coal bed methane regions could contribute to potential cumulative impacts associated with the proposed Lost Creek ISR Project, depending on the geographic area that is appropriate for a particular resource.

5.1.1.5 Wind Power

While there is potential in the Great Divide Basin for wind power generation to contribute to meeting forecasted electric power demands, they are dependent on (i) the location of sage-grouse core breeding areas and (ii) available transmission capacity to send power to users. Both the location of core area sage-grouse breeding areas and transmission capability are constraining factors (BLM, 2008a, Wyoming Executive Order 2010-4, 2010). Wind energy projects (Table 5-3) currently operating in Wyoming range in capacity from one turbine (produces 2.0 to 2.5 MW) to 80 turbines (produces 144 MW) (AWEA, 2009). There are four additional projects under construction ranging in capacity from 20 turbines (produces 42 MW) to 66 turbines (produces 99 MW) (AWEA 2009), but none in the Great Divide Basin. Under new sage-grouse guidelines, developed by the Governor's Sage-Grouse Implementation Team (SGIT) (Wyoming Executive Order 2010-4, 2010), no new wind projects would be allowed in core areas (much of the Great Divide Basin is covered by core areas). In addition, the wind generation potential in the Great Divide Basin is classified as Fair by the Wyoming State Geological Survey (WSGS, 2011) based on information developed by the National Renewable Energy Laboratory.

5.1.1.6 EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

One indicator of present and reasonably foreseeable future actions (RFFAs) in the region of interest is the number of recent NEPA documents prepared by federal agencies. Using information in NUREG–1910 (NRC, 2009, GEIS Section 5.2.2) and publicly available information, several EISs were identified for proposed actions in the Great Divide Basin, in addition to draft and final programmatic EISs for large-scale actions related to several states, including Wyoming (See GEIS Tables 5.2-1 and 5.2-2). The Rawlins BLM Field Office website provides a list of projects in the Great Divide Basin, along with the associated environmental documents (BLM, 2009b). These projects could contribute to both local and regional cumulative impacts on air quality, land use, terrestrial plants and animals, and groundwater and surface water resources.

Table 5-3. Wind Energy Projects in Wyoming*

Owner	Number of Turbines	Location	Capacity	Approximate Distance km [mi]	Direction
Airforce	1	near Cheyenne	2 MW	269 [167]	SE
PacificCorp	26	near Glenrock	39 MW	194 [120]	NE
PacificCorp	66	near Glenrock	99 MW	119 [74]	NE
PacificCorp	66	near Glenrock	99 MW	198 [123]	NE
Duke Energy	14	near Cheyenne	29.4 MW	262 [163]	SE
Edison Mission Group	38	Evanston	79.8 MW	244 [152]	SW
Edison Mission Group	29	Evanston	60.9 MW	240 [149]	SW
F.E. Warren Air Force Base	2	Cheyenne	1.32 MW	269 [167]	SE
Clipper Windpower	1	Medicine Bow	2.5 MW	138 [86]	ESE
FPL Energy	80	Evanston	144 MW	259 [161]	WSW
Shell Wind Energy	50	near Medicine Bow	50 MW	151 [94]	ESE
Caithness	28	near Medicine Bow	16.8 MW	148 [92]	ESE
Platte River Power Authority	2	Medicine Bow	1.32 MW	137 [85]	ESE
PacifiCorp/Eugene Water & Electric Board	69	near Medicine Bow	41.4 MW	148 [92]	ESE
Caithness	3	near Medicine Bow	1.8 MW	147 [92]	ESE
Caithness	33	near Medicine Bow	24.75 MW	148 [92]	ESE
Platte River Power Authority	5	Medicine Bow	3.3 MW	137 [85]	ESE
Platte River Power Authority	2	Medicine Bow	1.2 MW	137 [85]	ESE
PacificCorp	66	near Medicine Bow	99 MW	122 [76]	ESE
PacificCorp	66	near Medicine Bow	99 MW	161 [100]	ESE
Anschutz Corp.	675	near Rawlins	1350 MW	72 [44]	SSE
Anschutz Corp.	325	near Rawlins	640 MW	80 [50]	SSE
Wasatch Wind Inc.	50	Natrona County	109 MW	88 [55]	NNE†

*Located in the Wyoming West Uranium Milling Region.
†Information on wind energy operations is from American Wind Energy Association (data through June 27, 2009). U.S. Wind Energy Projects—Wyoming. <http://www.awea.org/projects/Projects.aspx?s=Wyoming> (15 September 2009).

5.1.2 Methodology

In determining potential cumulative impacts, the following methodology was developed, based on CEQ guidance (CEQ, 1997):

- Identify for each resource area, the potential environmental impacts that would be of concern from a cumulative impacts perspective. These impacts are described and analyzed in Chapter 4.

- Identify the geographic scope for the analysis for each resource area. This scope is expected to vary from resource area to resource area, depending on the geographic extent to which the potential impacts could be at issue.

- Identify the timeframe over which cumulative impacts would be assessed. The timeframe selected begins in 2008 when the applicant submitted a license application to NRC for a new source material license for the proposed Lost Creek ISR Project. The cumulative impact analysis timeframe would terminate in 2020, which represents the license termination at the end of the decommissioning period. Identify existing and anticipated future projects and activities in and surrounding the project site. These projects and activities are identified in this chapter.

- Assess the cumulative impacts for each resource area from the proposed action and reasonable alternatives and other past, present, and reasonably foreseeable future actions. This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

The following terminology was used to define the level of cumulative impact:

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

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

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

In conducting this assessment, NRC staff recognized that for many aspects of the activities associated with the proposed Lost Creek ISR Project, there would be SMALL impacts on affected resources. It is possible, however, that an impact that may be SMALL by itself, but could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a small individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined an appropriate level of analysis that was merited for each resource area potentially affected by the proposed action and alternatives. The level of detailed analysis was determined by considering the impact level to that resource, as described in Chapter 4, as well as the likelihood that the quality, quantity, or stability of the given resource could be affected.

Table 5-4 illustrates the cumulative impacts from the proposed Lost Creek ISR project on environmental resources based on analyses the NRC staff conducted and considering the other past, present, and reasonably foreseeable activities identified in Section 5.1.1.

Table 5-4. Cumulative Impacts on Environmental Resources

Resource Category	Cumulative Impacts	Comment
Land Use	MODERATE	The proposed project is projected to have a SMALL incremental effect when added to the MODERATE cumulative impacts to land use.
Transportation	MODERATE	The proposed project is likely to have a SMALL incremental effect when added to the MODERATE cumulative impacts to transportation.
Geology and Soils	SMALL	The proposed project would have a SMALL incremental effect when added to the SMALL cumulative impacts to geology and soils.
Surface Waters and Wetlands	SMALL	The proposed project may have a SMALL incremental impact when added to the SMALL cumulative impacts to surface waters and wetlands.
Groundwater	SMALL to MODERATE	The proposed project may have a SMALL incremental impact when added to the SMALL to MODERATE cumulative impacts on groundwater resources.
Terrestrial Ecology	MODERATE	The proposed project may have a SMALL incremental impact when added to the MODERATE cumulative impacts on terrestrial ecological resources.
Aquatic Ecology	SMALL to MODERATE	The proposed project would have a SMALL incremental impact when added to the SMALL to MODERATE cumulative impacts on aquatic ecological resources.
Protected Species	SMALL to MODERATE (with mitigation)	Depending on The proposed project would have a SMALL to MODERATE incremental impact on threatened and endangered species when added to the SMALL to MODERATE (with mitigation) cumulative impacts.
Air Quality	MODERATE	The proposed project would have a SMALL impact on air quality when added to the MODERATE cumulative impacts.

Table 5-4. Cumulative Impacts on Environmental Resources (continued)

Resource Category	Cumulative Impacts	Comment
Noise	SMALL to MODERATE	The proposed project would have a SMALL to MODERATE incremental impact on noise when added to the SMALL to MODERATE cumulative impacts.
Historical and Cultural Resources	MODERATE	The proposed project would have a MODERATE incremental impact on historical and cultural resources when added to the MODERATE cumulative impacts.
Visual and Scenic Resources	SMALL to MODERATE	The proposed project would have a SMALL to MODERATE incremental impact on visual and scenic resources when added to the SMALL to MODERATE cumulative impacts to the view shed.
Socioeconomics	SMALL to MODERATE	The proposed project would have a SMALL to MODERATE incremental impact on socioeconomic resources when added to the SMALL to MODERATE cumulative impacts.
Environmental Justice	SMALL	The proposed project would have a SMALL incremental impact on environmental justice when added to the SMALL cumulative impacts.
Public and Occupational Health and Safety	SMALL	The proposed project would have a SMALL incremental impact on public and occupational health and safety when added to the SMALL cumulative impacts.
Waste Management	SMALL	The proposed project would have a SMALL incremental impact on waste management when added to the SMALL cumulative impacts.

5.2 Land Use

The cumulative impact on land use was assessed within the Great Divide Basin which in part includes land administered by the BLM Rawlins Field Office (referred to herein as the eastern land use study area) as shown in Figure 5-3. The area shown in Figure 5-3 shows the geographic boundary for the analysis of the cumulative impact on land use and is referred to herein as the “land use study area.” The Great Divide Basin contains numerous energy development projects that either have or are likely to affect land use. The Rawlins Resource Management Plan (RMP) provided information on land use within the eastern land use study area (BLM, 2008b). BLM has also developed land use data which was considered as part of the cumulative analysis. Within the land use study area, oil, gas, CBM, and coal development

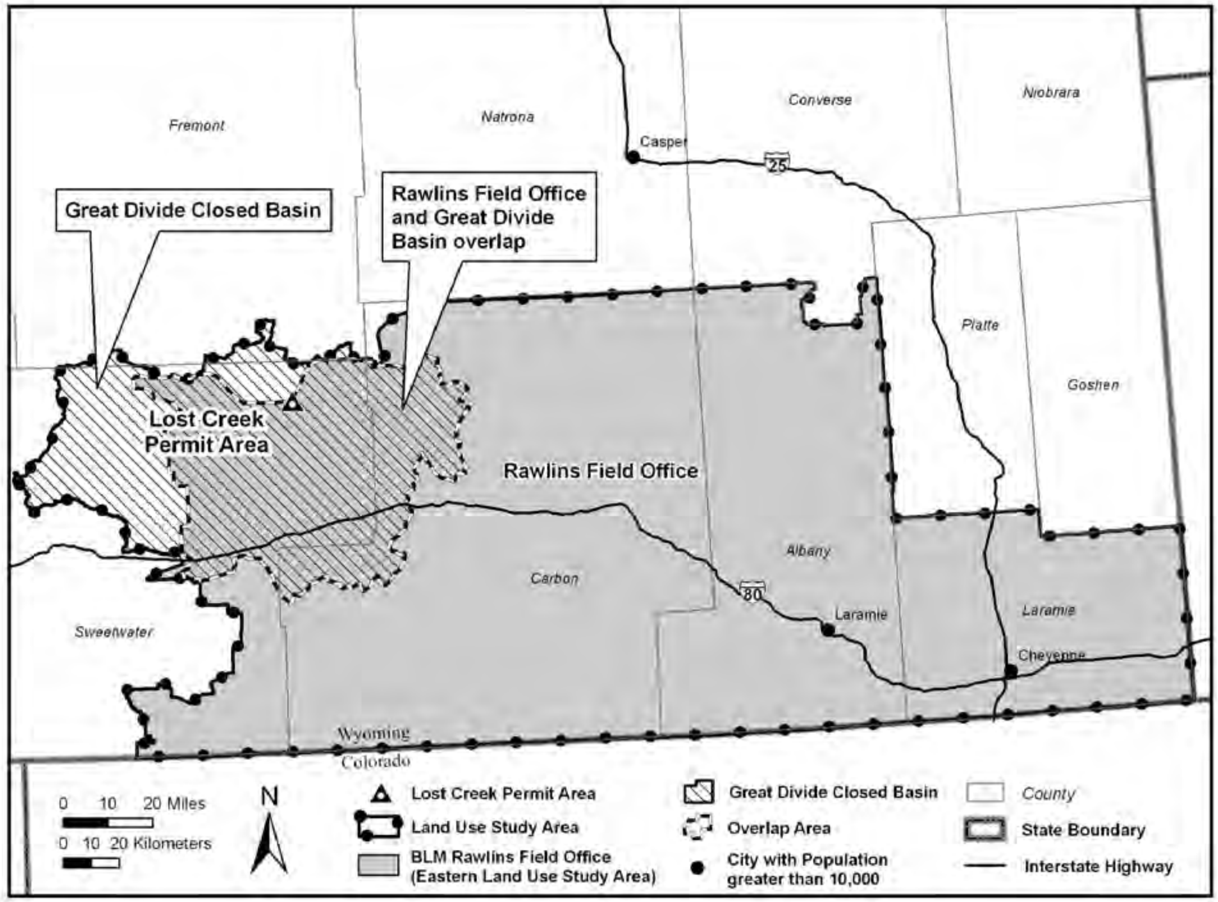

Figure 5-3. Location Map Showing the Location of the Great Divide Basin and the Eastern Land Use Study Area. Source: "BLM Field Office Boundaries." 2011. <http://www.blm.gov/wy/st/en/resources/public_room/gis/datagis/state/office.html> (7 February 2011).

on both public and private lands, are ongoing and projected to expand in the future. SEIS Section 3.2 describes land use activities in the proposed project area.

Land use impacts result from interruption to, reduction or impedance of livestock grazing areas, open wildlife areas, and land access. The timeframe for the analysis of cumulative effects begins in 2008 and terminates in 2020 as described in Section 5.1.2. The applicant submitted a license application to NRC for a new source material license for the proposed Lost Creek ISR Project in 2008; the year 2020 is the projected year that the NRC staff anticipates the license would be terminated after the decommissioning phase of the ISR project.

The land use study area covers approximately 48,782 km^2 [18,835 mi^2] of land and includes a portion of Sweetwater County, Carbon County, Albany County, Laramie County, and a small portion of Fremont County as shown in Figure 5-3. Land use within the land use study area is diversified and cooperative and characterized by grazing, and increasing trends in oil and gas production and urban development that would likely result in land use impacts (BLM, 2008b).

Livestock grazing is a primary land use and accounts for 31 percent of all land use in the eastern land use study area. The 582 grazing allotments within the eastern land use study area cover 1,413,463 ha [3,492,744 ac] of public land (52.9 percent), other federal land (0.8 percent), state land (5.3 percent), and private land (40.9 percent). Allotments range in size from 8 ha [20 ac] to 118,149 ha [291,954 ac]. Of the 582 allotments, 87 percent are used only for cattle, 9 percent are used for cattle and sheep, and 1.4 percent are used for sheep (see Figure 5-4). (BLM, 2008b)

Short-term cumulative impacts from the loss of rangeland include a decrease in the area for foraging, temporary loss of animal unit months (AUMs), and temporary loss of water-related range improvements (e.g., improved springs, water pipelines, stock ponds). These impacts would be reduced after an area had been reclaimed. Long-term cumulative impacts result from the permanent loss of forage and forage/cropland productivity in unreclaimed areas. Other impacts could include dispersal of noxious and invasive weed species both within and beyond areas where the surface had been disturbed, which reduces the area of desirable forage by livestock. The proposed Lost Creek facility would disturb115 ha (285 ac) which is a very small fraction (8×10^{-5}) of available grazing land within the eastern land use study area. About 99 ha [244 ac] of the land underlying the proposed project would be fenced from grazing at different times over the life of the project.

Oil and gas drilling has rapidly increased in the eastern land use study area over the last decade. Before 1910 only one well had been drilled. As of 2003, this area contained 5,962 wells, about half of which were active. Oil and gas drilling eastern land use study area has been concentrated in three regions. The first, and most heavily drilled, region is in the eastern Greater Green River Basin which includes part of the Great Divide Basin, the Wamsutter Arch, and the Washakie Basin, located in the western part of the eastern land use study area (see Figure 5-3). The other two regions of concentrated oil and gas drilling activity lie in the eastern and central portion of the astern land use study area. (BLM, 2008b)

BLM estimated reasonable future oil and gas development to predict the number of wells that would be drilled in the astern land use study area between the years 2001 and 2020 (BLM, 2004). The projections were based on four scenarios depicting varying levels of energy development restriction regarding land management strategies. The scenario allowing the least development predicted an additional 4,168 conventional wells and 4,464 CBM wells for a total of 8,632 new wells by 2020 and a total (old and new) of 11,322 wells. This scenario would result

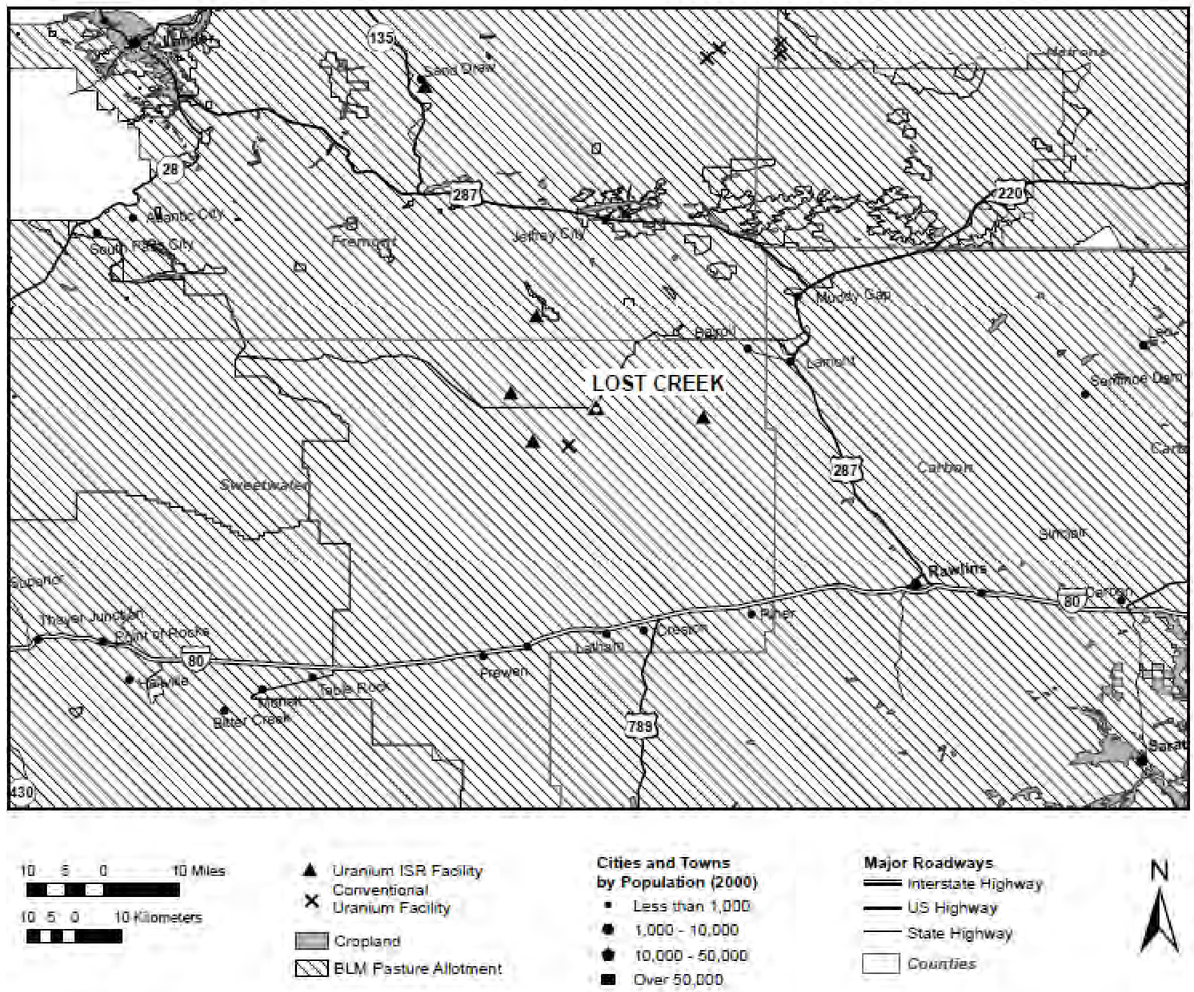

Figure 5-4. Conventional and ISR Uranium Recovery Facilities, BLM Pasture Allotments, and Croplands Near the Proposed Lost Creek ISR Project Site.
Source: Wyoming GISC (GeoLibrary Site, Which Linked to the Wyoming BLM <http://www.uwyo.edu/wygisc/>.

in the disturbance of 22,866 ac [56,505 ac] to develop new wells and a total of 37,061 ha [91,581 ac] from both old and new well development (including road and pipeline activity). The scenario which permitted the most development projected 4,779 conventional wells and 4,419 CBM wells for a total of 9,198 new wells by 2020 with a grand total of 11,888 wells. New well development was projected to disturb 25,763 ha [63,663 ac] and the development of both old and new wells was projected to disturb 40,262 ha [99,492 ac] of land. BLM stated a more realistic estimate was to subtract the area disturbed by the abandonment of newly drilled and old wells from the net disturbance from new well construction (this calculation assumes abandoned wells would be reclaimed). Under the least development scenario, 5,588 ha [13,809 ac] of land would be disturbed compared to 6,205 ha [15,333 ac] under the most development scenario. Applying the BLM most permissive well development scenario, oil, gas and CBM development was projected to impact approximately 0.1 percent of the land in the eastern land use study area. (BLM, 2004)

Coal production within the land use study area is described in SEIS Sections 3.2.3 and 5.1.1.2. There are six coalfields within the eastern land use study area. Approximately 27 million tons of federal coal have been recovered by the use of strip mining at the Hanna Field, located approximately 129 km [80 mi] east of the proposed Lost Creek ISR Project. An additional 16 million tons of federal coal have been extracted using underground mining methods. As of 2009, only one company was operating a single mine, the Elk Mountain Mine, located 136 km [85 mi] east of the proposed Lost Creek ISR Project which has disturbed 5,386 ac [13,309 ac] of land (Buchanan, 2011). The facility has produced 237,740 tons of coal, which is a small fraction of the 392 million t [432 million T] produced across the state (Wyoming Mining Association, 2010).

The Great Divide Basin contains two surface coal mining operations located southwest of the proposed project area. The Bridger Coal mine and the Black Butte Coal mine are located 82 km [51 m] and 84 km [52 mi], respectively, from the proposed Lost Creek ISR Project. The mines have disturbed 4,069 ha [10,054 ac] and 4,647 ha [11,483 ac] of land, respectively (Moxley, 2011). Production for the two mines in 2009 was approximately 5.5 million t [6.1 million T] for Bridger Coal and 3.4 million t [3.8 million T] for Black Butte (Wyoming Mining Association, 2010). Coal mining in this area may grow in response to demand as demonstrated by the Jim Bridger Coal Mine 2010 announcement that it plans to expand its mining operations by 810 ha [2,000 ac] on both public and private lands (Gearino, 2010). The total land disturbance associated with these three mining operations and the projected expansion is 14,912 ha [36,846 ac], equivalent to approximately 0.3 percent of the total land use study area.

As described in SEIS Section 5.1.1.1, uranium mining in the land use study area extends back several decades. SEIS Section 5.1.1.1 also provides information on potential and currently operating sites as well as those that are being decommissioned. Figure 5-2 shows the location of uranium recovery facilities as well as other energy development projects in the area (BLM 2003). Not including sites with terminated licenses or those undergoing decommissioning, there are 13 uranium recovery sites in the land use study that either exist or are classified as potential sites (Table 5-1), including

- A site licensed by NRC but on standby status
- An ISR application under review by NRC, but with the review delayed at the applicant's request

- Sites where a company has submitted a letter to NRC announcing its intent to submit a license application

- Sites subject to future exploration with the intent to extract commercially should they prove to be economically viable

In addition, the applicant has stated that four potential sites near the proposed Lost Creek ISR facility could be developed for uranium extraction. These prospects are Lost Soldier (letter of intent submitted in 2010)(Ur-Energy, 2010), Lost Creek South, Lost Creek North, and the deeper KM Horizon (NRC, 2011a).

To assess the projected land area that would be affected by the development of these prospects, the NRC staff assumed that approximately the same area affected by the proposed action {115 ha [285 ac]} would also apply to these other potential ISR activities. This area of land disturbance was applied as an average for all potential sites in the land use study area. There are a total of 13 existing or potential ISR sites within the land use study area, including the proposed Lost Creek ISR facility. Assuming all the sites covered approximately the same area and were developed, then 1,495 ha [3,705 ac] of land would be disturbed from uranium milling via ISR extraction and an additional 592 ha [1,462 ac] from the existing Kennecott Sweetwater conventional mine and mill in the land use study area. This value represents 0.04 percent of the total land use study area.

Construction and operational improvements and activities such as roads and infrastructure systems associated with multiple ISR facilities potentially present a long-term impact, if they exist throughout the proposed Lost Creek ISR Project lifespan and remain beyond license termination. Disturbance associated with oil, gas and coal energy projects would be reclaimed in accordance with applicable BLM and WDEQ Land Quality Division requirements after a given site ceases operation. However, reclamation of currently operating and future wellfields and coal mines might not occur until after the cumulative effects timeframe ended in 2020 meaning that the land would be used for these other actions during this time.

The NRC staff determined that the cumulative impact on land use within the land use study area resulting from past, present, and reasonably foreseeable future actions would be MODERATE. Based upon the BLM reports referenced in this section, the actions leading to this MODERATE finding are energy development activities, namely (i) oil and gas production, with 2,960 active wells in operation in the area managed by the Rawlins Field Office with an additional 8,632 to 9,198 wells projected to be drilled between through 2020 potentially affecting as much as 6,205 ha [15,333 ac] of land; (ii) coal mining which either has or is projected to affect 14,912 ha [36,846 ac] of land within the land use study area; and (iii) existing and potential uranium mining (both conventional and ISR extraction facilities) which are projected to impact 2,087 ha [5,167 ac] of land in the land use study area.

In SEIS Section 4.2, the NRC staff concluded that the proposed Lost Creek ISR Project (the proposed action) would have a SMALL potential impact on land use. The proposed action would therefore have a SMALL incremental effect when considered with other the MODERATE potential cumulative impacts from past, present, and reasonably foreseeable actions in the land use study area. This conclusion is based on the fact that the proposed action would disturb approximately 115 ha [285 ac] of land which is a small percentage (0.005 percent) of the land

that either has been or is projected to be disturbed by the identified projects within the land use study area. Furthermore, approximately 99 ha [244 ac] of the proposed Lost Creek ISR Project would be incrementally fenced over the life of the project allowing access for other use such as grazing. As wellfield production ends, fencing would be removed and the land reclaimed in accordance with applicable BLM and WDEQ Land Quality Division requirements. At the end of operations, the applicant would also decommission the site and restore the land to its previous use (with the possible exception of access roads that land owners may request to remain) in accordance with an NRC-approved decommissioning plan (see SEIS Section 2.1.1.1.5).

Under Alternative 3 (Vacuum Dryer), NRC staff concluded that cumulative impact on land use would be similar to that described for the proposed action since the same area would be disturbed. Only the transportation route would differ, since dry yellowcake would be shipped directly to a final processing center rather than the slurry being shipped to an intermediate processing center. Therefore, Alternative 3 would have a SMALL incremental effect on land use when added to the MODERATE cumulative impact on land use from other past, present, and reasonably foreseeable future actions within the land use study area.

5.3 Transportation

Potential cumulative impacts on transportation were assessed that could result from past, present, and reasonably foreseeable development activities. Sweetwater, Freemont, Natrona, and Carbon Counties served as the geographic boundary area (hereinafter referred to as the cumulative effects study area). This geographic area was selected because major transportation routes within the region (including Interstates and/or U.S. Highways) occur within these four counties. The cumulative effects analysis timeframe begins in 2008 and terminates in 2020, as discussed in Section 5.1.2. The year 2008 is when the applicant submitted a license application to NRC for a new source material license for the proposed Lost Creek ISR Project. Upon completion of decommissioning activities and license termination anticipated to occur in 2020, no additional transportation impacts associated with the proposed Lost Creek ISR project would be expected.

Potential environmental impacts from transportation associated with the proposed Lost Creek ISR Project are described in SEIS Section 4.3. Impacts would be from worker commuting to and from the site and from the shipment of materials and chemicals on and off the site. Impacts could occur from fugitive dust, noise, incidental wildlife or livestock kills, increased traffic on local roads, and accidents. The construction phase is proposed to have the highest number of workers that would commute to the site. A range of annual average daily traffic for the proposed commuting workforce was estimated by NRC staff based on the applicant’s assumed level of carpooling (35 vehicles, 70 one way trips) and no carpooling (94 vehicles, 188 one-way trips). This range of estimated traffic would increase existing traffic on County Road 22 and State Route 73 by 30 to 81 percent, on U.S. 287 from 3.7 to 10 percent, and I-80 from 0.5 to 1.4 percent. Based on the low level of existing traffic on County Road 22 and State Route 73, the NRC staff concluded the increase in traffic would not overtax the road capacity, however, the increased traffic would increase wear and tear on the road surface and would generate fugitive road dust (Section 4.7.1.1). The NRC staff concluded the small ratio of proposed to existing traffic on the other regional roads would not significantly affect existing capacity and traffic impacts would be SMALL. Based on the potential increases in road dust on the untreated portions of unpaved roads the NRC staff concluded impacts from transportation could be MODERATE along certain transportation routes. However, because of the low volume of project-related traffic, the NRC staff concluded the balance of estimated transportation impacts during the construction phase of the proposed Lost Creek ISR Project would be SMALL. Based

on the lower proposed traffic for operations, aquifer restoration, and decommissioning phases relative to the construction phase, the low radiological risks from transportation accidents, and the implementation of the applicant's additional safety practices as discussed in Section 4.3.1.2, the NRC staff concluded the potential impacts from traffic and accidents during these phases would be SMALL.

Fugitive dust emissions are also evaluated as air quality impacts in Section 5.7, noise impacts are evaluated in Section 5.8, and the impact from wildlife kills is considered in ecological impacts in Section 5.6 in this SEIS.

As noted in Section 5.1.1 of the SEIS, there are other ongoing or planned activities occurring within the Great Divide Basin and within the vicinity of the proposed Lost Creek ISR Project that contribute to the analysis of cumulative impacts. These activities include oil and gas extraction activities, CBM development, and surface mining operations that have associated transportation impacts. The Atlantic Rim coal bed methane and natural gas development project in the Great Divide Basin is approximately 86 km [45 mi] south of the proposed Lost Creek Project and was previously evaluated for environmental impacts (BLM, 2006). This project proposed drilling 1,800 coal bed methane wells and 200 natural gas wells that could generate estimated peak AADT range of 350 to 430 vehicles per day for approximately 20 years beginning in 2005. The BLM study (BLM, 2006) concluded potential impacts to roads and highways would include increased vehicular traffic and a statistical increase in risk of traffic accidents. Because the Atlantic Rim Project is located south of I-81 from the proposed site, I-81 is the only route evaluated by the BLM that overlaps with the routes expected to be used by the proposed Lost Creek Project.

In addition to the aforementioned ongoing or planned activities, there are eight other ISR sites or potential expansions either operating or planned within an 80-km [50-mi] radius of the proposed Lost Creek ISR Project (Table 5-1), each with transportation requirements that are assumed to be comparable to or bounded by the Lost Creek ISR Project. Considering the trip frequency information evaluated in Section 4.3 of this SEIS, the additional number of daily vehicle trips for commuting workers at 9 ISR sites would range from approximately 720 to 1,782 (35 to 94 additional commuting vehicles plus 5 trucks per day for 9 facilities) depending on the degree of carpooling. During the 10 year license period, the population of the region is projected to increase approximately 8 percent, based on the highest projected growth rates of the four counties in the study area (WYDOT, 2010). When the NRC staff apply this growth rate to the existing traffic on U.S. 287, the projected AADT increases to 2,020 vehicles per day. The increases in projected traffic from the operating or planned ISR facilities combined with the other ongoing or planned activities in the region, and projected increases in population over time, could contribute to potential traffic delay impacts in urban areas such as Rawlins and Casper, but would be less likely to impact traffic flow on highways that have sufficient capacity to accommodate the increase in traffic. In reaching this conclusion, the staff considered, for comparison, a rural Wyoming traffic study that calculated the capacity of a rural two-lane highway to be approximately 1,375 vehicle trips per hour (both directions) based on an ideal capacity of 3,200 vehicles per hour (Kadrmas, Lee, and Jackson, Inc., 2010). Considering these levels of hourly capacity, the existing annual average daily traffic counts on the regional highway evaluated in this SEIS (1,870 vehicles per day for U.S. 287)(SEIS Section 3.3) suggest additional capacity is available that could accommodate the increases in traffic (because the daily traffic figures apply to a longer period than the hourly peak capacity). In addition to traffic impacts, past and present natural resource development and extraction activities in the vicinity of the proposed Lost Creek ISR Project have resulted in an extensive network of unpaved

access roads. Future activities (ISR and other energy-related projects) would require the construction of additional roads and other transportation-related developments. Based on the preceding analysis, the NRC staff concludes the cumulative impacts to transportation resulting from past, ongoing, and future ISR projects, CBM projects, oil and gas operations, surface coal mining activities, and other development with transportation requirements identified in Section 5.1.1 would be MODERATE.

Considering the aforementioned site-specific impacts, the proposed Lost Creek ISR Project would have a SMALL incremental effect on the MODERATE cumulative impacts to transportation resulting from past, ongoing, and future ISR projects, CBM projects, oil and gas operations, surface coal mining activities, and other development with transportation requirements identified in Section 5.1.1.

For the Dry Yellowcake Alternative (Alternative 3), the production of dry yellowcake, compared with producing the wet yellowcake slurry under the proposed action would not only change the number of shipments (trucks) leaving the Lost Creek facility, but also the roadways that would be used. Rather than traveling north and east with the wet yellowcake slurry to an intermediate processing facility, trucks would travel south with dry yellowcake to I-80 and ultimately to Metropolis, Illinois, for final processing into uranium fuel pellets. This would result in a net reduction in yellowcake transportation as more dried yellowcake can be carried per shipment compared to yellowcake slurry. Because fewer truck shipments are associated with Alternative 3 (SEIS Section 4.3.3.2) relative to the proposed action, the impact on the regional traffic would also be reduced. Under this alternative, the majority of traffic would continue to be from commuting workers and the number of commuting workers would be the same under Alternative 3 as for the proposed action. The NRC staff concludes that because the transportation activities under the Alternative 3 would be less than the proposed action (for yellowcake shipments), the environmental impacts would be less than the impacts described for proposed action in Section 5.3.1. Therefore, Alternative 3 of the Lost Creek ISR Project would have only a SMALL incremental effect on the MODERATE cumulative impacts to transportation expected from other past, present, and reasonably future actions in the Great Divide Basin.

5.4 Geology and Soils

Cumulative impacts to geology and soils were assessed within the Crooks Gap Uranium District that is located in the northeastern part of the Great Divide Basin (NRC, 2009). The Crooks Gap Uranium District is about 60 km [36 mi] across, comprising portions of northeastern Sweetwater and southeastern Fremont Counties. The Crooks Gap Uranium District was chosen as the geographic boundary for the analysis of potential cumulative impacts on geology and soils because it includes the proposed Lost Creek ISR Project, and the uranium mineralization at other deposits within this district is located in the same geologic unit (the Eocene Battle Spring Formation) as at Lost Creek. In addition, the Crooks Gap Uranium District is part of the larger closed hydrologic basin that constitutes the Great Divide Basin. As described in SEIS Section 5.1.2, the timeframe used to analyze potential cumulative impacts begins in 2008 and ends in the year 2020, based on the estimated operating life of the proposed Lost Creek ISR Project.

As described in SEIS Section 4.4, the principal potential impacts on geology and soils would occur at the surface (wind and water erosion) as the infrastructure is developed for the proposed Lost Creek ISR Project. Another potential surface effect would occur as fugitive dust emissions from increased traffic on unpaved roads settles on nearby soils. As described in SEIS Section 4.7, the annual fugitive dust emissions from the proposed Lost Creek ISR Project

would be about 151 t/yr [166 T/yr] during operations for six wellfields each consisting of about 600 wells. These types of potential impacts could result from earthmoving and drilling activities associated with constructing surface facilities and access roads, developing wellfields, and constructing and operating pipelines. Also, operations at the proposed Lost Creek ISR Project could produce spills of process fluids or chemical materials that may contaminate soils at the site. As described in SEIS Section 4.4, best management practices and required monitoring and mitigation such as spill prevention and cleanup programs would reduce these potential surface effects, and the overall impact to geology and soils would be SMALL. In addition, compression or subsidence could potentially occur as the uranium is extracted from the subsurface, or fluid injection could reactivate nearby faults. As described in SEIS Section 4.4, the potential for these subsurface impacts would be SMALL at the proposed Lost Creek ISR Project because of the relatively small net withdrawal of fluids from confined aquifers, and low pressures during operations relative to those needed to produce small earthquakes. As described in Section 4.4.3, the impacts to geology and soils under Alternative 3 (Vacuum Dryer) would be similar to those described for the proposed action. Because there would be no liquid slurry transported offsite for processing, the possibility of liquid spills during tanker loading would be eliminated.

The past, ongoing, and reasonably foreseeable future actions in the Crooks Gap Uranium District and the surrounding area include (i) nonenergy related activities such as grazing, herd management, and recreation (hunting); (ii) mineral exploration and production (predominantly uranium recovery); and (iii) extraction of energy resources such as coal, oil, natural gas, and coal bed methane. These activities are described in SEIS Section 5.1.1. Development activities associated with these ongoing and reasonably foreseeable future actions would contribute to the potential cumulative impacts on surface geology and soils. Because many of the activities (drilling, pipeline and surface infrastructure construction, developing access roads) are similar to those described in SEIS Chapter 2 and SEIS Section 4.4 for the proposed Lost Creek ISR Project, the same types of impacts to geology and soils will be associated with other mineral and energy extraction activities that occur in the Crooks Gap Uranium District. In addition, the subsurface geology can potentially be affected by the removal of a resource (e.g., oil) or by the injection of fluids to recover a resource (e.g., *in-situ* recovery of uranium).

Different land uses in the Great Divide Basin and the Crooks Gap Uranium District are described in SEIS Section 5.2. Livestock grazing is the primary non-energy related past, present, and reasonably foreseeable land use in the vicinity. The most likely way that grazing could contribute to potential cumulative impacts to geology and soils within the study area would be through the settling of fugitive dust emissions associated with increased traffic on unpaved roads. Dust emissions associated with grazing are difficult to estimate, but recent field studies of land disturbed by grazing in a semi-arid region of Utah on the Colorado Plateau estimated that for most years during a 10-year period, annual dust deposition rates ranged from 10 to 39 $g/m^2/yr$ [0.03 to 0.13 $oz/ft^2/yr$] (Belnap, et al., 2009). For a region the size of the Crooks Gap Uranium District {about 2,000 km^2 [760 mi^2]}, and assuming that about 30 percent is used for grazing (based on proportions of total area and grazing area described in SEIS Section 5.2), the results of Belnap et al. (2009) indicate that the total amount of dust from grazing deposited each year over the study area would be about 6,000 to 23,400 t/yr [6,610 to 25,790 T/yr]. These estimates are uncertain, but taking into consideration the large area of the Crooks Gap Uranium District, the potential cumulative impact of fugitive dust settling on soil from other past, present, and reasonably foreseeable future actions would be SMALL. The incremental impacts to soil from the deposition of fugitive dust emissions associated with the proposed Lost Creek ISR Project {151 t/yr [166 T/yr]} would be SMALL when compared with dust deposited in the area

used for rangeland grazing. The potential cumulative impacts of fugitive dust emissions on air quality are analyzed in SEIS Section 5.7.

As presented in Table 5-1, there are a number of uranium properties and facilities in various stages of exploration, development, and decommissioning in the Crooks Gap Uranium District of the Great Divide Basin. There are also other uranium properties in the Gas Hills region further to the north, Bison Basin to the west, and Shirley Basin to the east, but these properties are in different geologic basins and the uranium is located in different geologic units. For these reasons, they are not considered in the analysis of potential cumulative impacts on geology and soils for the proposed Lost Creek ISR Project. The only currently licensed facility in the Crooks Gap Uranium District is the Sweetwater Conventional Uranium Mill about 9 km [6 mi] south southwest of the proposed project. It is on standby status now, and other than dust emissions from routine traffic does not contribute to the potential cumulative impacts on geology and soils.

Reasonably foreseeable future actions with respect to uranium production in the Crooks Gap Uranium District also include four properties (Lost Creek North, Lost Creek South, the deeper KM horizon, and Lost Soldier) that are currently being explored by the applicant (NRC, 2011a). Of these properties, NRC has received a letter of intent to apply for a license for the Lost Soldier property in March 2012 (Ur-Energy, 2010). The applicant indicates that, if developed, these properties would use the surface facilities at the proposed Lost Creek ISR Project rather than satellite facilities or new processing plants (NRC, 2011a). For the purposes of analyzing potential cumulative impacts to geology and soils, the NRC staff assumes that additional pipelines and wellfields (about 600 wells each) for these properties would be similar to the proposed Lost Creek ISR project, with similar potential for surface impacts to geology and soils. The construction and operation of the infrastructure for these properties, however, would be subject to the same monitoring, mitigation, and response programs required to limit potential surface impacts (erosion and contamination from spills) at the proposed Lost Creek ISR Project. With respect to compaction and surface subsidence, the groundwater would be from the same confined aquifers at depths of approximately 92 m [300 ft] or more, with a small net withdrawal for each of the properties. Because the applicant would use the proposed Lost Creek processing plant for these other uranium properties, the uranium production would be developed in sequence to ensure compliance with NRC license requirements for the proposed Lost Creek ISR Project. NRC has received a letter of intent to develop a conventional mine and heap leach operation to produce the Sheep Mountain deposit located about 29 km [18 mi] northwest of Lost Creek (Titan Uranium USA, 2010; Beahm et al., 2010). NRC has also received an application for a license to develop the Jab & Antelope ISR Project (UraniumOne, 2008) located about 21 km [13 mi] north northwest of Lost Creek, but the NRC review has been suspended at the request of the applicant. Because uranium mineralization at the Jab and Antelope ISR Project also occurs in the Battle Spring Formation at depths similar to the proposed Lost Creek ISR Project, the project would be expected to have similar surface impacts to geology and soil. The Sheep Mountain project, however, would be a conventional mine and heap leach operation, with a larger footprint, waste rock disposal, heap leach piles, tailings impoundments, and other features that would result in greater surface impacts to geology and soil resources than those anticipated from the proposed Lost Creek ISR Project (NRC, 2009, Appendix C).

The bulk of the coal resources in Wyoming are located in the Powder River Basin, more than 160 km [100 mi] northeast of the Crooks Gap Uranium District (De Bruin et al., 2004; Jones and Cottingham, 2009). Although there are closer coal resources at the Jim Bridger and Black Butte Mines in the Green River {81 to 82 km [51 to 52 mi] to the southwest} and Hanna {130 km [80 mi] east} coalfields, there are no active or inactive coal mines within the Crooks Gap

Uranium District. For this reason, coal mining would not contribute to the potential cumulative impacts on geology and soils within the geographic study area.

Oil and gas exploration wells have been drilled in the Crooks Gap Uranium District, but with the exception of the Lost Soldier and Wertz fields near Bairoil, there has been limited production, and no oil and gas production units are identified within the study area (BLM, 2004). The closest oil and gas units are the Washakie Basin, the Jack Morrow Hills, Wamsutter Arch, and the Atlantic Rim, all of which are at least 65 km [40 mi] from the proposed Lost Creek ISR project (BLM., 2004; USGS, 2002). The closer Lost Soldier and Wertz fields were early oil and gas producers in the region, and have been undergoing CO_2 flooding to enhance oil recovery. The fields have also been considered for CO_2 sequestration, and there is a CO_2 pipeline that runs from a gas metering facility in Bairoil southwest to the ExxonMobil Shute Creek gas plant near LaBarge (DeBruin, 2001; Ruby Canyon Engineering, 2008). The subsurface geologic formations that are targeted in these oil and gas units are the Lance and Fort Union Formations, typically deeper {more than 1,800 m [5,900 ft]} compared to the uranium mineralization in the Battle Spring Formation {92–215 m [300–700 ft]}; the distance of oil and gas units from the Crooks Gap Uranium District, and the greater depth to the target formations make it unlikely to that oil and gas production would contribute to potential cumulative impacts on surface geology and soils or on subsurface geology in the vicinity of the proposed Lost Creek ISR Project.

Coal bed methane is located where there are abundant coal resources. For this reason, the majority of coal bed methane production in Wyoming occurs in the Powder River Basin, more than 160 km [100 mi] northeast of the Crooks Gap Uranium District (De Bruin et al., 2004; Jones and Cottingham, 2009). As described previously, there are only limited coal resources within the Crooks Gap Uranium District, and the amount of associated coal bed methane would therefore also be limited. Even taking into account the more distant Green River and Hanna coalfields, the total amount of estimated recoverable coal bed methane resources represents about 421 billion m^3 [4.5 trillion ft^3] or about 14 percent of the total for Wyoming. This lack of coal resources within the Crooks Gap Uranium District make it unlikely that coal bed methane production would contribute to potential cumulative impacts on surface geology and soils or on subsurface geology within the study area.

The production of coal, oil, natural gas, and coal-bed methane is limited in the Crooks Gap Uranium District based on an evaluation of past, present, and reasonably foreseeable future actions over the time period of the evaluation (2008 through 2020). Because of their distance from the study area, the potential cumulative impacts on geology and soils from these energy-related activities would be SMALL. The most likely potential contributor to cumulative impacts on geology and soils would be development of other uranium deposits within the Crooks Gap Uranium District. With the exception of the Sweetwater Conventional Uranium Mine and Mill (NRC licensed, but in standby mode), Jab and Antelope ISR (application submitted, but licensing review on hold), and the Lost Soldier (ISR) and Sheep Mountain (heap leach) deposits (letters of intent for submitting a license application in 2012 and 2011, respectively), most of the uranium properties are in the early stages of development (NRC, 2011a; Titan Uranium USA, 2011; Ur-Energy, 2010; 2011a,b; Uranium One, 2008).
If developed, these projects would be regulated by NRC and the Wyoming Department of Environmental Quality (WDEQ), with required environmental reviews, monitoring, mitigation, and response plans to reduce potential impacts to geology and soils from spills and dust deposition. In addition, the uranium mineralization is deep enough and the net withdrawal of water small enough that potential impacts related to subsidence would SMALL. For these reasons, the NRC staff has concluded that the proposed Lost Creek ISR Project would have a

SMALL incremental effect on geology and soils when added to the SMALL cumulative impacts from other past, present, and reasonably foreseeable future actions.

Under Alternative 3 (Vacuum Dryer), the NRC staff concluded that cumulative impacts on geology and soils would be similar to, or less than those described for the proposed action, since the footprint of the facility is the same. Only the transportation route would differ, since dry yellowcake would be shipped directly to a final processing center rather than slurry being shipped to an intermediate processing center. The handling of dry yellowcake would reduce the potential for liquid spills during loading slurry, although the concentration of uranium in each shipment would be greater. Therefore, Alternative 3 would have a SMALL incremental impact on geology and soils when added to the SMALL cumulative impacts associated with other past, present, and reasonably foreseeable future actions.

5.5 Water Resources

5.5.1 Surface Waters and Wetlands

The cumulative impact to surface water resources was evaluated for the area within an 80-km [50-mi] radius surrounding the proposed Lost Creek ISR Project (Figure 5-2). This area encompasses most of the Great Divide Basin, a closed hydrologic basin, with no surface water outflow to the surrounding areas.

As described in SEIS Section 4.5.1, the proposed Lost Creek ISR Project located in the northeastern drainage of the closed Great Divide Basin. Surface water within the Great Divide Basin drains to the basin center to feed seasonal playa lakes. The proposed Lost Creek ISR Project permit boundary traverses the watersheds of the Battle Spring Draw and two other unnamed tributary streams, all of which are ephemeral streams that remain dry for most of the year. Flow in these ephemeral streams occurs only from heavy snow melt and large rain storms. No surface water discharge would occur as part of the Lost Creek ISR facility operations, and the potential impact to onsite drainage would only be from increased surface water runoff, primarily during the construction and decommissioning phases of the proposed project. The U.S. Army Corps of Engineers (USACE) has determined there are no jurisdictional wetlands in the vicinity of the proposed Lost Creek ISR Project (USACE, 2010). Prior to ISR operations, the applicant is required to obtain construction and industrial stormwater National Pollutant Discharge Elimination System (NPDES) permits from the Wyoming Department of Environmental Quality (WDEQ). Impacts would be mitigated through State-approved industrial and construction NPDES permits, which would include plans and programs for spill prevention and cleanup, erosion mitigation, and runoff control plans. As described in SEIS Section 4.5.1, the impact on surface water quality and on downstream surface waters and wetlands from the proposed action would be SMALL.

Nearly all streams within the Great Divide Basin are ephemeral and are losing streams {i.e., surface water is lost to groundwater (Clarey et al., 2010)}. Several springs or seeps which represent discharges of groundwater to the ground surface have been mapped in the basin (Clarey, et al., 2010). The seeps are located along the margin of the Great Divide Basin at least 16 km [10 mi] upgradient from the proposed project area, and attributed to groundwater flow from the underlying Fort Union and older formations. The seep discharge rates are typically low, less than 2 gpm but may be up to 30 gpm, and often difficult to accurately measure in the field Clarey, et al., 2010). The springs occur at various elevations within the basin indicating the groundwater likely represents perched water table conditions which would not be affected by the

proposed action. Therefore, the cumulative impact on surface water flow from a basin-wide lowering of groundwater levels would be SMALL.

Surface water quality could potentially be impacted by spills or leaks that migrate to the ephemeral channels. However, since the channels are ephemeral and the WDEQ would require mitigation, monitoring, and corrective actions if a spill were to occur, the NRC staff conclude the impact on surface water quality would be SMALL.

Other activities occurring within the proposed license area, as well as within 80 km [50 mi] of the proposed Lost Creek ISR Project, also have the potential to impact surface waters. These activities include coal bed methane (CBM) production, oil and gas development, minerals extraction, other ISR and conventional uranium milling, and rangeland grazing. As described in Section 5.1.1, there are CBM production, oil and gas development, and mineral extraction activities within that occur within an 80 km [50 mi] radius of the proposed Lost Creek ISR Project (Figure 5-2). These activities are likely to occur in the future, however, with prudent resource development and proper use of mitigation measures potential impacts could be reduced. (BLM, 2009a)

As described in SEIS Section 5.1.1, proposed ISR projects located in the vicinity of the proposed Lost Creek ISR Project (Figure 5-1) include Jab and Antelope ISR (application placed on hold), West Alkali Creek, Lost Soldier, and Sweetwater. These projects have the potential to degrade water quality in the area and cause erosion and subsequent siltation of streambeds by the construction of new roads, power lines, underground piping, and well drilling, all of which could have negative impacts on surface waters and wetlands. However, applicants must obtain industrial, construction, and NPDES permits from WDEQ, in addition to USACE permits for jurisdictional surface waters that exist within their proposed ISR permit boundaries. These permits would require that potential surface water impacts be mitigated. Therefore, NRC staff concludes that the potential cumulative impacts from ISR-related activities on surface waters and wetlands water quality at these additional ISR Project sites would be SMALL. As described in SEIS Section 5.5.2, because the ephemeral surface streams in the study area are already losing streams (i.e., surface water is lost to groundwater) (Clarey, et al., 2010), there would be SMALL impacts to surface water resources that result from water table fluctuations associated with uranium production at these facilities.

The Lucky Mc, Split Rock, Sweetwater, and Gas Hills conventional milling facilities are located within 80 km [50 mi] of the proposed Lost Creek ISR project site. These facilities are being decommissioned and, therefore, any potential cumulative impacts on surface water features would be SMALL.

Based on the previous analysis and due to the ephemeral nature of the streams in the Great Divide Basin, the cumulative impact on surface water from other activities within the basin would be SMALL. The proposed Lost Creek ISR Project would have a SMALL incremental impact on surface water resources when added to the SMALL cumulative impacts anticipated from other past, present, and reasonably foreseeable future actions in the study area.

5.5.1.1 Alternative 3 (Dry Yellowcake)

Cumulative impacts to surface waters from the implementation of Alternative 3 (Dry Yellowcake) would be the same as assessed for the proposed action. The overall facility size, shape, and amount of disturbance would not change and surface runoff would be the same as for the

proposed action. Therefore, the Dry Yellowcake Alternative 3 would have a SMALL incremental impact on the ephemeral, non-jurisdictional surface waters of the Great Divide Basin, when added to the SMALL cumulative impacts anticipated from other past, present, and reasonably future actions.

5.5.2 Groundwater

5.5.2.1 Proposed Action

To assess cumulative impacts to groundwater resources, NRC typically evaluates ongoing or planned activities within a radius of approximately 80 km [50 mi]. However, for the analysis of the Lost Creek ISR project on the groundwater quantity and quality, the potentially impacted water resource is defined as surface waters and the Lower Tertiary aquifer, specifically the aquifer within the Battle Spring Formation within the Great Divide Basin. For reasons discussed below, this definition is more applicable to the setting. Consequently, the cumulative impact analysis consists of the proposed ISR operation in concert with other past, present and reasonably foreseeable actions within the Lower Tertiary Aquifer of the Great Divide Basin during the life of the project from 2008 to 2020, as discussed in Section 5.1.2. The following discussion of cumulative impacts focus first on quantity impacts to groundwater resources due to consumptive use, then consumptive quality impacts to groundwater resources and then quantity and quality impacts on surface waters within the Great Divide Basin.

The Great Divide Basin is a hydrologically closed basin approximately 8,960 km^2 [3,500 mi^2] in extent. The Lower Tertiary Aquifer within the Great Divide Basin consists of the Battle Spring Formation, Wasatch Formation and Fort Union Formation. The Battle Spring Formation has been mapped at ground surface throughout the eastern half of the Great Divide Basin. In the western half of the basin, the Wasatch Formation has been mapped at ground surface. The Battle Spring Formation grades into and is time equivalent to Wasatch Formation though subtle differences exist in the lithologies of those respective formation reflecting differences in depositional environments (i.e., distance from the source areas for the detrital material). However, both formations can be considered as a single hydrogeologic entity. For this analysis, references to the Battle Spring Aquifer include groundwater in the Wasatch Formation as well.

Thickness of the Battle Spring/Wasatch Formation within the basin is estimated to be less than 305 to 1,372 m [1,000 to 4,500 ft] (Welder and McGeevy, 1966) but typically 610 to 1,220 m [2,000 to 4,000 ft] (Grover, 1998). The variation is due in part to erosion as both formations have been exposed at ground surface. In the northeastern and southwestern margins of the Great Divide Basin, the formations have been completed eroded with older geologic formations being exposed.

The potentiometric surface for the Battle Spring Formation mirrors the topography. Playa lake beds are found in the central area of the basin which serve as a groundwater sink through evaporation. The potentiometric surface at various elevations within the Battle Spring Formation indicates both unconfined (near surface) and confined conditions (at depth).

The Fort Union Formation underlies the Battle Spring/Wasatch formations as the lowermost portion of the Lower Tertiary Aquifer. Thickness of the Fort Union Formation with the Great Divide Basin is 214 to 1,372 m [700 to 4,500 ft] (Welder and McGeevy, 1966), but is typically 914 to 1,220 m [3,000 to 4,000 ft] (Grover, 1998). The potentiometric surface for the Fort Union Aquifer within the Great Divide Basin differs from that for the Battle Spring Aqiuifer. The potentiometric surface is 91 to 122 m [300 to 400 ft] higher; the playa lake within the basin is not

a groundwater sink, the highland area to the northeast which is a recharge area for the Battle Spring Aquifer is a sink for the Fort Union aquifer, and the potential is greater for southerly flow out of the Great Divide Basin.

Water wells within the Great Divide Basin are required to be permitted by the Wyoming State Engineer's Office (SEO) within the Great Divide Basin and are generally limited to the Lower Tertiary aquifers, i.e., the Battle Spring/Wasatch and Fort Union aquifers. In the Great Divide Basin, an intervening aquitard between the Lower Tertiary formations is not found and some geologists have combined both formations into a single designated Lower Tertiary Aquifer System (Clarey, et al., 2010). However, subtle differences exist in the potentiometric surfaces for the Lower Tertiary Aquifers and the water quality of the Fort Union Formation is slightly more saline than that of the Battle Spring Formation suggesting that communication between the Lower Tertiary Aquifers may be inhibited. The upper sections of the Fort Union Formation reportedly contain siltstones and claystones (Welder and McGeevy, 1966), which may inhibit hydraulic communication between formations. Based on Lost Creek's deep disposal well UIC permit application, the uppermost portion of the Fort Union Formation is comprised of a 300-foot thick shale bed which effectively isolates groundwater in the Battle Spring Formation from that in the Fort Union Formation. Therefore, impacts to the Battle Spring Formation are isolated from those to the Fort Union Formation (and vice versa) though both are included in the Lower Tertiary Aquifer.

Underlying the Fort Union Formation in the Great Divide Basin is the Late Cretaceous Lance Formation. The Lance Formation is predominantly a carbonaceous shale containing numerous coal beds. Thickness of the Lance Formation in the Great Divide Basin is 0 to 1,37s m [0 to 4,500 ft] (Welder and McGeevy, 1966). The low permeability of the Lance Formation does not completely isolate the lower Tertiary Aquifer from the underlying Upper Cretaceous aquifers, (e.g., Mesaverde), and some hydraulic communication exists between the Lower Tertiary and Upper Cretaceous Aquifer systems (Clarey, et al., 2010, Grover, 1998). The Lance Formation has been described as a minor aquitard (Clarey, et al., 2010).

The Lost Creek proposed production aquifer is designated as the HJ Horizon of the Battle Spring Formation (LCI, 2008a). Lost Creek suggested that future potential production may consist of production from the KM Horizon, which is also found within the Battle Spring Formation. The HJ and KM Horizons are found at depths 400 and 800 feet below grade at the proposed Lost Creek ISR Project (LCI, 2008a). For a conservative analysis, the groundwater resource impact analysis from proposed facility assumed that the HJ (or KM) Horizon was a distinct aquifer in the area immediately surrounding the proposed facility. However, it is anticipated that the HJ or KM Horizons are not distinct aquifers throughout the Great Divide Basin and, it would be impossible to adequately evaluate cumulative impacts. Therefore, for this analysis, the proposed activities are assessed on the cumulative impacts on water resources within the Battle Spring Formation within the Great Divide Basin.

Potential environmental impacts on groundwater resources from the proposed Lost Creek ISR Project would occur primarily during the operation and aquifer restoration phases of the ISR facility lifecycle. The analysis of consumptive use impacts to groundwater quantity from the proposed Lost Creek ISR Project as described in SEIS Section 4.5.2 determined that the water yields at several private wells located outside of the proposed project area and completed in the ore zone aquifer could potentially be affected by the facility's operation. Specifically, the NRC staff concluded the proposed operation would lower groundwater levels within the production aquifer (HJ Horizon) in the immediate area (five miles) surrounding the proposed license area.

The predicted drawdown from the Lost Creek ISR Project represents a small fraction of the available water at most private wells surrounding the proposed license area; however, the predicted drawdown at a few wells may represent a significant portion of the available water for that well's use. The applicant committed to monitoring water levels in the adjacent areas and replacing any impacted well (LCI, 2010b). Therefore, the NRC staff has determined that impacts to the quantity of the groundwater resources would be MODERATE during the life of the project.

For an analysis of cumulative impacts on water resources, staff reviewed the Wyoming State Engineer's Office database which was used by Clarey et al. (2010) for the water resource analysis of the Green River Basin, which included the Great Divide Basin. In that study, 1,424 water wells have been permitted within the Great Divide Basin. Of that total, 1,194 wells are located within the area bounded by the areal extent of the Battle Spring and Wasatch formations. Of the 1,194 wells, the status of 833 wells is listed as either adjudicated, good standing, good standing with qualifiers, or left blank. The 833 wells are considered as representative of the current use of the water resources due to the existing permits. The remaining 361 wells were not considered as representative of current use because the status for 318 wells was listed as unadjudicated or expired and the use of 43 wells was listed as coal bed methane. As discussed in SEIS Section 5.1.1.4, no coal bed methane wells are currently active in the basin and the listed wells are attributed to exploratory wells.

The 833 representative wells are used mostly for stock watering wells, monitoring wells or miscellaneous uses. Based on the database, the total estimated usage is 34,075 L/min [9,002 gal/min]; albeit the database did not list yields for 163 wells. Of the categories list, the usage associated with the miscellaneous use category is least well defined. Of the 145 wells listed with a miscellaneous use, 69 wells did not have a listed usage, and the usage rates that were listed were quite variable, from 11 to 568 L/min [3 to 150 gal/min]. The higher rates are typically associated with water supplies for well drilling operations for oil well drilling activity and water injection for tertiary oil recovery systems. Those wells are typically screened deep, possibly in the Fort Union rather than the Battle Spring/Wasatch Aquifer.

The total usage for wells that are currently unadjudicated or have expired was approximately 37,850 L/min [10,000 gal/min]. Of those wells, Kennecott was listed as the applicant for a total usage of approximately 30,285 L/min [8,000 gal/min]. Kennecott is currently a NRC-licensed conventional mill in standby condition. Based on the 1978 Environmental Statement, Kennecott was permitted to withdrawal groundwater up to 25,740 L/min [6,800 gal/min] for dewatering of the surface mine and another 1,893 L/min [500 gal/min] for operations of 8,070 tons [8,897 T] tons of ore for the 16-year life expectancy of the facility (NRC, 1978). The facility only operated 2 years, 1981 through 1983, during which dewatering activities were performed at a 24-ha [60-ac] open pit mine. A 1994 Environmental Report estimated groundwater flow through the floor of the pit at approximately 379 L/min [100 gal/min] for an area approximately 0.2 ha [0.5 ac] (Miller, 1994).

For the purposes of estimating potential cumulative impacts to groundwater use, it was assumed that other ISR projects in the geographic study area (see SEIS Section 5.1.1.1) would have about the same consumptive groundwater use of 659 L/min [174 gal/min] for 12 years (2008 to 2020) estimated for the proposed Lost Creek ISR Project. For example, Ur-Energy has submitted a letter of intent to submit a license application for the Lost Soldier ISR Project in 2012 (Ur-Energy, 2010). Assuming similar operations to the proposed Lost Creek ISR Project, i.e., groundwater consumptive use of 659 L/min [174 gal/min] for a 12 year lifecycle. For this analysis, it is assumed that the plant will operated between years 2014 and 2025.

Lost Creek North and South are in earlier stages of development than Lost Soldier (NRC, 2011a), and if licensed, would only be anticipated operate during the latter part of the cumulative impact assessment timeframe of 2008 to 2020. Based on conversations with Ur-Energy, these deposits would be developed as an expansion of the proposed Lost Creek ISR Project.

In addition, NRC has received an application for the proposed Jab and Antelope ISR Project (Uranium One, 2008), although the licensing review is currently on hold. This would be a separate facility, but would be assumed to have an annual consumptive groundwater use similar to the proposed Lost Creek ISR Project.

Kennecott's Sweetwater Uranium Mill has been in standby operating condition since 1983 (NRC, 2008). Future actions could include restart of the mill for milling operations or toll milling operations by the current or future owner. Based on the design of the plant, a consumptive use of 1,893 L/min [500 gal/min] is need for future operations. It is assumed that if the mill were to resume operations, it would operate for 18 years.

The cumulative impacts from the proposed action with the above assumed reasonable foreseeable actions will create an additional annual demand of as much as 5,186 L/min [1,370 gal/min] on the water resources above the current estimated demand of 34,075 L/min [9,002 gal/min]. The effect of that impact depends upon the sustainable yields and thus recharge to the aquifer. Although the Great Divide Basin is a closed basin, recharge to the aquifers is difficult to estimate with certainty. The recharge is difficult due to the setting, in which annual precipitation is low {15 to 30 cm/yr [6 to 10 in/yr]} and evapotranspiration is quite high, estimated at 109 cm/yr [43 in/yr] (Wyoming State Climate Office, 2004), and all the surface water is ephemeral. A minimum annual recharge of 1,340 ha-m/yr [10,860 acre-feet/yr] was reported for the Great Divide and the Washakie basins (Clarey et al., 2010). Clarey, et al. (2010) concluded that the Green River Basin had a water deficit; however, the editor qualified the report's conclusions by stating the existing data do not support this conclusion. In the editor's opinion, the actual water balance was negative but the deficit was masked by natural variability in groundwater levels. Based on this uncertainty, the current use as well as cumulative impacts on the groundwater quantity for other past, present and reasonably foreseeable future actions would be MODERATE.

Because the Battle Spring Aquifer is both confined and unconfined, infiltration of surface water through the basin may provide an estimate of its recharge. In a report by BLM for the Pinedale area of the Green River basin, BLM used a recharge to the near surface aquifer of 0.64 to 1.5 cm/yr [0.25 to 0.6 in/yr] (BLM, 2008f). In that setting, the precipitation was approximately 20 inches per year which is double that for the Great Divide Basin. Nevertheless, assuming the low end of the range of 0.64 cm [0.25 in] per year can be used for the recharge to the Battle Spring Formation in the Great Divide Basin, the recharge is calculated at 109,780 L/min [29,000 gal/min]. Using this value for the current consumptive use, the SMALL incremental effects from the proposed Lost Creek ISR Project and cumulative impacts to the Battle Spring Formation (and Lower Tertiary Aquifer) within the Great Divide Basin from other past, present and reasonably foreseeable future actions will be SMALL.

The best estimated of the available capacity of the groundwater resource is the recovery of water levels at the Kennecott Sweetwater Mill facility. During the 2-year operation at the open pit mine, groundwater was drawdown by approximately 305 m [1,000 ft]. After the dewatering activities ceased water levels took approximately 10 years (until 1994) to recover 34 m [111 ft].

In 2011, the water levels have recovered an additional 1.1 m [3.5 ft] and are currently 1.8 m [6 ft] below the expected levels based on groundwater elevations in the aquifer prior to dewatering activities. The pumping only occurred during a short period but at a high rate. The total consumptive use of water from the aquifer during the dewatering activities is similar to that estimated for the proposed and reasonably foreseeable actions during the 22-year period. Because the dewatering was a concentrated action, the proposed and reasonable foreseeable actions under analysis would have lower impact. Therefore, the NRC staff has determined that the when the SMALL impact from the proposed Lost Creek ISR Project is added to anticipated consumptive groundwater use from other past, present, and reasonably foreseeable future actions the potential cumulative impact on groundwater resources within the Lower Tertiary Aquifer in the Great Divide Basin would be MODERATE.

The analysis of quality impacts to the groundwater resources from the proposed Lost Creek ISR Project, as discussed in SEIS Sections 4.5.2 and 6.3.1, demonstrated that the required monitoring network will provide early detection, control, and reversal of potential horizontal and vertical excursions, and thus the potential groundwater quality impacts to the groundwater resource in the vicinity of the project would be expected to be SMALL. After the proposed life of the project is complete and groundwater withdrawals are terminated, groundwater levels at the project area would recover with time. As discussed in SEIS Section 4.5.2, the potential impact on groundwater quality resources after operations at the proposed Lost Creek ISR Project are terminated would be SMALL. There are no other uses of groundwater for which the quality would be affected by the proposed operations within the Great Divide Basin. Therefore, staff concludes that the incremental effects on the groundwater quality from the proposed Lost Creek ISR Project would be SMALL and the cumulative impact on the groundwater quality in the Battle Spring Formation (and Lower Tertiary Aquifer) within the Great Divide Basin from other past, present and reasonably foreseeable future actions would be SMALL.

5.5.2.2 Alternative 3 (Dry Yellowcake)

The Dry Yellowcake Alternative would have the same impact on groundwater as the proposed action. Like the proposed action there is the potential for leaks and spills from the lixiviant that would be used to recover the uranium. Similarly, the protection features that are proposed for the proposed action would be employed for the Dry Yellowcake Alternative. The same approvals, plans and other regulatory requirements that apply to the proposed action, would also apply to Alternative 3. Therefore, the implementation of Alternative 3 would have only a SMALL incremental impact on the groundwater resources of the Great Divide Basin when added to the MODERATE cumulative impacts anticipated from other past, present, and reasonably foreseeable future actions.

5.6 Ecological Resources

The potential cumulative impacts to ecological resources from the proposed Lost Creek ISR Project were considered for the geographic region comprised of the Great Divide Basin. The proposed facility is located within the Great Divide Basin which is closed drainage basin characterized by big sagebrush shrubland habitats similar to those existing at the proposed Lost Creek ISR Project site. The basin is 8,960 km^2 [3,500 mi^2] in size and is currently experiencing growth due to various types of energy development activities. This trend is projected to continue in the future. As such, ecological communities and assorted species within the basin are subject to varying levels of incremental impacts associated with this development. The timeframe for the analysis of cumulative effects begins in 2008 and terminates in 2020 as described in Section 5.1.2. The year 2008 is when the applicant submitted a license

application to NRC for a new source material license for the proposed Lost Creek Project while 2020 is the projected year that NRC estimated the license would be terminated after the decommissioning phase.

As described in SEIS Section 5.2, the total area of current and future disturbed land within the Great Basin Divide is projected to be about 23,204 ha [57,346 ac]. This represents approximately 2.6 percent of the Great Divide Basin's total land area. This figure was arrived at by combining current and potential future land disturbance areas associated with oil and gas operations, coal mining, and uranium extraction operations, including development of four uranium properties within 8 km [5-mi] that the applicant is exploring as is described in SEIS Section 5.1.1 (see Table 5-1). This scenario assumes that oil and gas wells will occur in the basin at the same density as been projected for the entire area managed by the BLM Rawlins Field Office. Under this assumption there would be between 2,476 and 2,600 existing and potential future wells in the basin by 2020. This assumption is plausible as 67 percent of the Great Divide Basin is comprised of land managed by the BLM Field Office.

5.6.1 Terrestrial Ecology

Activities occurring in the basin include grazing and herd management, hunting, other recreational activities, and mineral exploration. Potential cumulative impacts from these activities to ecological resources may occur and include (i) reduction in wildlife habitat and forage productivity, (ii) the modification of existing vegetative communities, and (iii) the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve (i) loss, alteration, and/or incremental fragmentation of habitat; (ii) displacement of, and stresses on, wildlife; and (iii) direct and/or indirect mortalities.

The Great Divide Basin is characterized by upland big sagebrush shrublands, lowland big sagebrush shrublands, grasses and dunes. Sagebrush shrublands area found at the proposed Lost Creek ISR Project site. Plant communities would be affected by development activities in the ecological resources study area. Impacts to vegetation include the loss and degradation of native sagebrush shrubland habitats which are imperiled across much of their range. Section 4.6.1 described impacts to vegetation ranging from the proposed Lost Creek ISR Project facility as ranging from SMALL to MODERATE depending on the life cycle phase of the facility. Much of the sagebrush lands have been changed due to livestock grazing, agriculture, or resource extraction. Given the considerable amount of CBM, oil and gas development presently occurring and predicted to occur in the future, vegetative impacts across the Great Divide Basin would be expected to increase. Reestablishment of sagebrush habitat postdisturbance has proven to be challenging, especially in arid environments such as those existing in the Great Divide Basin.

NRC staff concluded that the proposed action's impacts to wildlife species were SMALL (Section 4.6.1.) The analysis included looking at big game species including pronghorn antelope, mule deer and elk are found in the Great Divide Basin, upland game birds, raptors, waterfowl and shorebirds, migratory and nongame birds and other mammals, reptiles and amphibians.

Cumulative impacts to populations of small mammals, reptiles, and amphibians would be limited. While some mortality may occur during construction phases of assorted projects, many species would likely relocate away from disturbance areas. There could be impacts to nongame/migratory birds in the ecological resources study area. While birds are highly mobile

and usually able to disperse into adjacent or distant available habitat areas, human activities may displace bird species into an area that is larger than the physical habitat that is being disturbed a specific project. For example, it has been demonstrated that drilling and construction noise interfere with the male songbirds' ability to attract mates and defend territory as well as the ability to recognize calls from other birds that could pose a threat. Additionally, the 24,664 ha [60,946 ac] Chain Lakes Wildlife Management Area is located in the southeastern part of the basin and serves as an important resting area for migrating waterfowl and shorebirds (WGFD 2008). The management area is open to mineral, oil and gas leasing but these activities would occur under intensive management of surface disturbing and disruptive activities (BLM 2008d). Even under strict management, however, some impacts to nongame/migratory birds are likely to occur.

The NRC staff has determined that the cumulative impact on terrestrial ecology within the ecological resources study area resulting from other past, present, and reasonably foreseeable future actions is MODERATE. The projected amount of land disturbance from these activities would negatively affect habitat and vegetation by promoting spread of noxious weeds and fragmenting vegetative communities. Species of nongame/migratory birds, raptors, and sage grouse would experience impacts due to loss, alteration, or incremental fragmentation of habitat; various stresses associated with human disturbance; and direct or indirect mortalities.

The NRC staff has concluded that the proposed Lost Creek ISR Project would have a SMALL incremental effect on terrestrial ecology when considered with MODERATE impact from other past, present, and reasonably foreseeable actions in the terrestrial ecology study area. This conclusion is based on the fact that proposed action would only disturb approximately 115 ha [285 ac] of habitat out of up to 18685 ha [46,172 ac] of disturbed land projected to occur by 2020. The proposed Lost Creek ISR Project would therefore account for approximately 0.25 percent of disturbed habitat in the ecololical resources study area.

Under Alternative 3 (Vacuum Dryer), NRC staff concluded that cumulative impact on terrestrial ecology would be similar to that described for the proposed action since the same area would be disturbed. Only the transportation route would differ, since dry yellowcake would be shipped directly to a final processing center rather than the slurry being shipped to an intermediate processing center. Therefore, Alternative 3 would have a SMALL incremental effect on terrestrial ecology when added to the MODERATE cumulative impacts from other past, present, and reasonably foreseeable future actions.

5.6.2 Aquatic Ecology

The Great Divide Basin is a closed drainage system characterized by an extremely arid environment that receives an average of 16.5 cm [6.5 in] of precipitation per year. No drainages leave the basin as all seasonal creeks drain towards its interior. There are a series of unique, fragile and rare alkaline deserts lakes and wetland systems in the Great Divide Basin, the largest concentration of which is contained in the Chain Lakes Wildlife Habitat Management Area. The Chain Lakes wetlands span a range of conditions from temporary to semi-permanent conditions and there are no deepwater (lacustrine) systems in this landscape. The exact nature of the hydrogeological regime is not well understood at this time but artesian water flows appear to contribute greatly to the hydrological complexity of the landscape (Heidel, 2008).

The Chain Lakes Wildlife Management Area is open to mineral and oil and gas leasing activities though all surface disturbing activities are required to be intensively managed (BLM 2008d). CBM operations are known to require and release large quantities of water. Depending on the

location of specific CBM operations, surface releases could negatively impact nearby aquatic habitat, including wetlands.

The NRC staff has determined that the cumulative impact on aquatic ecology within the ecological resources study area resulting from other past, present, and reasonably foreseeable future actions is SMALL to MODERATE. While much of the Great Divide Basin is characterized by ephemeral or seasonal surface water feature with offering no or limited aquatic habitat, there is the potential for development-related negative impacts to affect aquatic habitat associated with the unique alkaline desert lake systems within the Chain Lakes Wildlife Management Area.

In SEIS section 4.6.1.1.3, the NRC staff concluded that the proposed action would have a SMALL impact on aquatic species because the surface water that may be present for a short time in the ephemeral streams does not support an aquatic population of wildlife or wetland species. Based on the previous finding, the NRC staff has concluded that the proposed Lost Creek ISR Project would have a SMALL incremental effect on aquatic habitat when added to the SMALL to MODERATE cumulative impact on aquatic ecology from other past, present, and reasonably foreseeable future actions within the ecological resources study area.

Under Alternative 3 (Vacuum Dryer), NRC staff concluded that cumulative impact on aquatic ecology would be similar to that described for the proposed action since the same area would be disturbed. Therefore, Alternative 3 would have a SMALL incremental effect on aquatic habitat when added to the SMALL to MODERATE cumulative impact on aquatic ecology from other past, present, and reasonably foreseeable future actions within the ecological resources study area.

5.6.3 Protected Species

No federally-listed species occur within the proposed license area. Potential suitable habitat for the black-footed ferret exists in the form of black-tailed prairie dog complexes which are known to occur in the ecological resources study area. Presently, these complexes are far less common compared to historical populations. Populations of black-footed ferrets would be unlikely to move into any new areas without being purposefully reintroduced by the FWS. Given the present and anticipated development in the ecological resources study area, it is highly unlikely that the FWS would promote such action. Surveys conducted by the applicant identified no active black or white-tailed ferret colonies within the proposed Lost Creek ISR Project area, and the nearest active prairie dog colonies were found to be about 1.6 to 3.2 km [1 to 2 mi] south and southwest (LCI, 2008a).

The bald eagle (formerly listed as threatened, currently delisted) has been observed in the Great Divide Basin. It may frequent the basin as a sporadic migrant and may forage in basin areas featuring surface water. However, given the limited surface water features found within the Great Divide Basin, population numbers of this species would be small, and there are no known eagle nests within 8 km [5 mi] of the proposed Lost Creek ISR Project (LCI, 2008a).

The long-term, range-wide viability of the Greater sage-grouse is at risk because of population declines related to habitat loss and degradation. Sage-grouse populations have declined overall from 1965 to 2007, with the greatest decline occurring before the mid-1980s.The total range-wide population decline is estimated at 45 percent to 80 percent from historic levels (Becker, et al., 2009). Populations have been declining at rate of 2 percent per year from 1956 to 2003 (Connelly, et al., 2009). Development activities are regarded as playing a major role in

the decline of the species in the eastern portion of species' range (Becker, et al., 2009). Future development is projected to cause a 7 to 19 percent decline in sage-grouse lek population counts throughout much of the current and historic range of the sage-grouse (Connelly, et al., 2009). Forecasts of future population viability across 23 populations and 7 sage-grouse management zones (SMZ) suggest that 75 percent of the populations and 29 percent of the SMZs may decline below effective population sizes of 500 within 100 years if current conditions and trends persist. Preventing high probabilities of extinction in many populations in the long term would require concerted efforts to decrease continuing loss and degradation of habitat that may negatively affect sage-grouse at local scales (Garton, et al., 2009).

The negative impacts of energy development projects on sage-grouse have been well documented (Doherty, et al., 2008; Walker, et al., 2007; Holloran, 2005; Braun, et al., 2002,).

These investigations demonstrated that energy projects, especially CBM-related activities, can have direct impacts on the species. Examples include avoidance of human infrastructure or negative impacts on survival and reproduction. Indirect impacts include changes in habitat quality and predator communities (Naugle, et al., 2009). Energy development projects threaten to extirpate birds from otherwise suitable habitats and further isolate remaining populations (Naugle, et al., 2006). With up to an additional 2,600 mostly gas wells projected to be placed in the Great Divide Basin by 2020 (BLM, 2008b), negative impacts to sage-grouse across the ecological resources study area would be expected.

As of this writing, the U.S. Fish and Wildlife Service (FWS) has designated the Greater Sage-Grouse as a "candidate species" under the Endangered Species Act (FWS, 2010). The Agency would consider inclusion of the bird on an annual basis for listing as a threatened or endangered species. The State of Wyoming is critical for maintaining sage-grouse population because it currently contains 64 percent of known sage-grouse habitat in the U.S. and more active leks than any other state (Doherty, et al., 2009). Much of the Great Divide Basin has been classified as a sage-grouse Core Population Area as delineated by the Wyoming governor in an Executive Order (E.O. 2010-4). This means that oil and gas development will be allowed in Core Population Areas but with restrictions. These restrictions do not apply to sites already operating at the time of the signing of the executive order (August 18, 2010).

BLM and WDEQ records identify 11 Greater Sage-Grouse leks within a 6.4-km [4.0-mi] radius of the proposed Lost Creek ISR Project site (Figure 3-13). According to sage-grouse surveys conducted in 2006 and 2007, only one active sage-grouse lek is located on the proposed project site (LCI, 2008b). However, construction activities are likely to result in habitat loss and fragmentation. Furthermore, increased noise and human activity could negatively impact the sage-grouse.

The NRC staff has determined that the cumulative impact on protected species within the ecological resources study area resulting from other past, present, and reasonably foreseeable future actions ranges from SMALL to LARGE. Impacts to black footed ferrets and bald eagles would be SMALL. However, for the sage grouse which has specialized habitat requirements, future population viability would be strongly influenced by the quality and composition of any remaining habitat. With the projected development through 2020, the loss of habitat and the detrimental effect of past, present, and reasonably foreseeable future actions, cumulative impacts in this Core Population Area would be expected to be LARGE. Impacts could be reduced to MODERATE by adhering to guidelines recommended by WGFD (WGFD, 2010), BLM (BLM, 2008b), and EO 2010-4.

In SEIS Section 4.6.1.1.4, NRC staff concluded that the proposed Lost Creek ISR Project would have a MODERATE impact on protected species during the construction and decommissioning phases of the facility and SMALL impact during the operations and aquifer restoration phases. The MODERATE impact finding was based on the potential impact to the greater sage-grouse in the area. Compliance with mitigation measures could reduce this impact further. The NRC staff has concluded that the proposed Lost Creek ISR Project would have a SMALL to MODERATE incremental effect on protected species when considered with other past, present, and reasonably foreseeable actions in the ecological resources study area. This SMALL impact conclusion for the black footed ferret and bald eagle is based on the fact that few (eagle), or no (ferret), members of these protected species have been observed at the project site. Given the potential disturbances associated with the proposed project, these protected species would be unlikely to inhabit the proposed project area by 2020. However, the incremental impacts to sage grouse from the proposed Lost Creek ISR Project site would be MODERATE because the proposed project would (i) contribute to an overall decrease in sagebrush shrubland and (ii) reduce the overall amount of habitat for sage-grouse in a designated Core Population Area.

Under Alternative 3 (Vacuum Dryer), NRC staff concluded that cumulative impact on protected species would be similar to that described for the proposed action since the same area would be disturbed. Therefore, Alternative 3 would have a SMALL to MODERATE incremental effect on protected species when added impact on protected species from other past, present, and reasonably foreseeable future actions within the ecological resources study area.

5.7 Air Quality

5.7.1 Ambient Air Quality

Potential cumulative impacts on air quality were assessed that could result from past, present, and reasonably foreseeable development activities. The geographic area for the impact analysis was based on the NRC staff's consideration of other regional air modeling studies addressing larger scale emission sources applicable to oil and gas activities, CBM production, and conventional coal mining suggesting the region of influence (ROI) for air emissions could range from about 60 km [37 mi] (Stoeckenius, et al., 2006) to beyond 241 km [150 mi] (BLM, 2009c). Based on the NRC staff's general understanding of the effect of source emission strength on the magnitude and spatial extent of downwind air impacts (i.e., larger plumes transport longer distances downwind before diminishing to insignificant levels), the NRC staff expects the lower magnitude of proposed emissions, relative to the larger scale sources described previously, would have the potential to impact a smaller geographic area. Therefore, the staff selected the geographic area for source emissions as a 80 km [50 mi] radius around the proposed facility. The geographic area for evaluating the impacts of the emissions was selected more conservatively as a 161 km [100 mi] radius around the proposed facility with particular emphasis on areas that are in the path of the predominant wind direction (Section 3.7.1.2). The timeframe for the air quality cumulative impacts analyses runs to 2020, which represents the license termination at the end of the decommissioning period as described in Section 5.1.2 of this SEIS. Beyond license termination, there would be no impact on air quality from the proposed action.

Past, present, and reasonably foreseeable future activities in the vicinity of the proposed Lost Creek Project site that emit air pollutants include other uranium mining/milling activities, CBM, coal mining, and oil and gas operations (Section 5.1.1). The past and present contributions of

projects in the region that emit air pollutants are represented in the ambient air quality monitoring results described in Section 3.7.2. These monitoring results indicate the air quality is in attainment for all National Ambient Air Quality Standards (NAAQS). Emissions from projected development of future oil and gas exploration and production, including CBM have been evaluated for impacts to air in previous EISs and supporting documents for proposed developments in the Great Divide Basin (BLM, 2008b; Buys and Associates, 2001a–c; TRC Environmental Corporation, 2006). While the concurrent activities emit a variety of pollutants, the NRC staff concludes principal emissions from the oil and gas industry that would overlap to some extent with emissions from the proposed action are nitrogen oxides, volatile organic compounds, and fugitive road dust. Because the estimated emissions of volatile organic compounds from the proposed action are considerably lower than estimated nitrogen oxide emissions, the focus of the NRC staff cumulative impact analysis on air quality is on nitrogen oxides and fugitive dust emissions from the proposed Lost Creek Project, other proposed ISR facilities, and future oil and gas development in the Great Divide Basin of Wyoming.

While available information on the potential cumulative air impacts from future CBM activities, coal mining, and oil and gas exploration in the portion of the Great Divide Basin area surrounding the proposed Lost Creek Project is limited, the BLM Rawlins Field Office has published an applicable cumulative emissions inventory for base year conditions in 2003 with projections to 2008 and 2023 for BLM-managed lands in the region (BLM, 2008b). This study did not model the potential impacts to air quality from the projected emissions but does include a qualitative analysis of potential cumulative impacts. For the base year of 2003, the total number of wells reported to be drilled was 2,690, with 97 percent of these conventional gas wells and the remainder coal bed methane wells (BLM, 2008b). This number was projected by BLM to increase to 4,393 by year 2008 and then 9,615 in year 2023 (with 60 percent conventional gas wells and the remainder coal bed methane wells in 2023). NO_x emissions associated with this projected gas development were reported as 2,938 t/yr [3,232 T/yr] for year 2003 increasing by approximately a factor of 3 to 8,847 t/yr [9,732 T/yr] by year 2023. Particulate matter (PM_{10}) emissions were reported as 1,683 t/yr [1,851 T/yr] in year 2003 increasing to 2,532 t/yr [2,785 T/yr] in year 2023. Based on their emissions projections and the low ambient concentrations of all pollutants except ozone, the BLM concluded the increase in emissions of CO, NO_x, SO_2, and particulate matter (PM_{10} and $PM_{2.5}$) would not cause any of the State or Federal ambient air quality standards to be exceeded. Specific conclusions regarding ozone, atmospheric deposition, or visibility were not made citing the lack of quantitative analyses of these impacts from the estimated emissions.

Another project specific air analysis (Buys and Associates, 2001a–c) included a detailed emissions inventory and air quality modeling of current and planned activities in the same region. That analysis concluded existing and proposed area activities would meet ambient air quality standards, but could contribute to significant impacts on visibility in the Bridger, Fitzpatrick, Mount Zirkel, and Rawah wilderness areas. The analysis, however, did not make long term projections about future emissions or impacts to air quality.

These studies suggest that local and regional air quality in the Great Divide Basin and nearby areas is presently good but with increasing emissions in the future may degrade with time, primarily from NO_x and VOC emissions that are projected to increase between now and year 2023 that could contribute to potential visibility impacts to nearby prevention of significant deterioration areas. Based on this analysis, the NRC staff concludes the present cumulative air quality impacts in the region surrounding the proposed Lost Creek Project are SMALL, but could change to MODERATE in future years.

In Section 4.7 of the SEIS, the NRC staff concluded the potential impacts to air quality from the proposed Lost Creek Project are anticipated to be SMALL except for the potential for MODERATE localized air impacts from fugitive road dust emissions near the Town of Bairoil. Nonradiological air emission impacts primarily involve fugitive road dust from vehicles used throughout the facility lifecycle and combustion engine emissions from diesel equipment used predominantly during the construction and decommissioning phases. The NRC staff concluded that the air quality for the region in the vicinity of the site is in compliance with the NAAQS, and based on emissions estimates described in Section 2.1.1.1.6.1 of the SEIS, the facility would not be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs. The NRC staff analysis noted the presence of Prevention of Significant Deterioration (PSD) Class I and II areas within the region that emissions from the proposed action could potentially impact; however, based on the magnitude of emissions from the proposed action, the prevailing wind direction, and distance from the proposed facility, the NRC staff concluded impacts would be SMALL.

Within an 80-km [50-mi] radius of the proposed Lost Creek Project, there are at least eight other operating or planned ISR facilities or expansions (Table 5-1) that would generate emissions comparable to emissions projected for the proposed project. Because ISR facilities commonly use a phased approach to well drilling and wellfield construction (NRC, 2009), and all nine facilities would not undergo construction concurrently (as each proposed ISR facility must go through the average 2-year licensing process and obtain the necessary Federal, State, and local permits), the NRC staff assumes the degree of overlap in construction activities would be most likely to occur for wellfield drilling activities because each facility would construct more than one wellfield over a period of years. To estimate the potential annual contribution of the nine facilities to local air emissions, the NRC staff considered the emissions results in Appendix D of the SEIS. The contribution from the proposed Lost Creek Project, as detailed in Table D3-4, was assumed be the full development of the first wellfield and five deep disposal wells. One of the remaining eight other facilities was assumed to be simultaneously conducting the same construction activities as the proposed Lost Creek project while the remaining seven facilities were each assumed to be constructing an active wellfield and a deep well. For this scenario, the total annual contribution of ISR facility nitrogen oxide emissions in the region that would add to the emissions from other past, present, and reasonably foreseeable future actions would be approximately 151 t/yr [166 T/yr]. To calculate the cumulative fugitive road dust estimate, the NRC staff assumed road dust emissions would scale directly with each new ISR facility because emissions would occur during all phases of the facility lifecycle thereby increasing the likelihood of emissions from multiple facilities overlapping in time. The NRC staff assumed an average value of 63.5 t/yr [70 T/yr] for each additional facility, resulting in a total of 723 t/yr [798 T/yr] of fugitive road dust when added to the proposed action emissions (Section 2.1.1.1.6.1). A bounding estimate assuming no employee carpooling from the proposed action increases the total fugitive dust estimate to 1,074 t/yr [1,185 T/yr]. These facilities, and therefore their emissions, would be spatially dispersed throughout the region and therefore do not represent a single point source. Considering that a majority of PM_{10} from fugitive road dust is known to settle a short distance from the unpaved road surface (Countess et al., 2001), the NRC staff consider road dust emissions estimates to reflect conditions close to the source and therefore have not further evaluated the potential cumulative effects of these emissions on regional air quality.

The construction of proposed ISR facilities would contribute incremental increases to regional emissions including, in particular, NO_x, and therefore, could incrementally impact air quality. A number of variables affect downwind concentrations of emitted air pollutants including

ambient meteorological conditions and the magnitude of the emission rate. Based on the low magnitude of estimated emissions from the proposed action (Section 2.1.1.1.6.1 of the SEIS), good air quality in the region (Section 3.7.2 of the SEIS), and atmospheric conditions that are often favorable for dispersion (Section 3.7.1 of the SEIS), the NRC staff conclude that a detailed quantitative air analysis is not necessary to evaluate potential air impacts. Because ISR nonradiological emissions are low compared to existing and future proposed developments in the region, the NRC staff concludes the relative contribution to future air quality impacts from ISR operations would be SMALL. This conclusion is further supported by comparison of proposed emissions with emissions data and air modeling analyses for a nearby CBM and natural gas project that is described further in the following paragraph.

The Atlantic Rim coal bed methane and natural gas development project in the Great Divide Basin (TRC Environmental Corporation, 2006) is approximately 86 km [52 mi] south of the proposed Lost Creek Project and has proposed drilling 1,800 coal bed methane wells and 200 natural gas wells that could generate an estimated maximum of 1,159 t/yr [1,278 T/yr] of NO_x (TRC Environmental Corporation, 2006, Table 4.1). The estimated annual emissions for the Lost Creek Project are 35 t/yr [39 T/yr] of NO_x (Section 2.1.1.1.6.1). The aforementioned emissions from all nine proposed ISR facilities that would be within an 80-km [50-mi] radius of 151 t/yr [166 T/yr] NO_x is 24 percent of the Atlantic Rim Project emissions, respectively. The annual NO_x emissions calculated for the proposed action is 23 percent of the aforementioned nine-facility estimate. For the Atlantic Rim Project, the modeled in-field (within and nearby project area) NO_x concentrations were well below the applicable ambient air quality standards. Specifically, the in-field NO_x concentration results (including the total of project and background concentrations) were a small fraction of the NAAQS and WAAQS at 19 percent of the standards (TRC Environmental Corporation, 2006, Table F1.5.3). The far-field air modeling results for the Atlantic Rim Project concluded the applicable ambient air quality standards, prevention of significant deterioration increments, and other air quality related values such as visibility and deposition would not be exceeded by the emissions proposed for the Atlantic Rim project when those emissions were added to existing background pollutant levels and regional emissions from state permitted and reasonably foreseeable future actions (TRC Environmental Corporation, 2006, Section 4.6). Because the estimated cumulative ISR facility NO_x emissions are 24 percent of the Atlantic Rim Project emissions, and the calculated air quality impacts from Atlantic Rim Project emissions including other sources are well below the applicable standards, the NRC staff conclude the potential impacts to air quality from future ISR facility NO_x emissions would not affect compliance with air quality standards. Furthermore, because the NO_x emissions from the proposed action are a small fraction of the cumulative ISR facility estimate, the NRC staff concludes that the contribution from the proposed action to the potential MODERATE cumulative air quality impacts from existing activities and reasonably foreseeable future actions would be SMALL.

Overall, based on the preceding analysis, the NRC staff concludes the proposed Lost Creek Project would have a SMALL incremental effect on the MODERATE cumulative impacts to air quality resulting from past, ongoing, and future ISR projects, CBM projects, oil and gas operations, and other development identified in Section 5.1.1. While the proposed ISR emissions are relatively low, the actual cumulative effect of multiple new ISR facilities that could be licensed in the future would depend on (i) the ambient air quality at the time of licensing, (ii) the continued development of other emission-generating activities in the area and region, and (iii) the timing and magnitude of emission-generating activities at each proposed ISR facility. As these ISR facilities would be licensed by NRC and permitted sequentially on a first-come, first-serve basis, the emissions from each new facility would be incremental. This incremental development of uranium milling facilities in the region would allow the NRC and

Wyoming State air quality staff to evaluate each proposal and their potential impacts within the context of existing air quality.

For the Dry Yellowcake Alternative (Alternative 3) the proposed operations would be the same as Alternative 1 (the Proposed Action), except that the uranium processing of yellowcake slurry would be changed to processing dry yellowcake. This additional process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate dry processing facility. Under Alternative 3, the construction supply shipment and equipment emissions would only be slightly and insignificantly elevated at the proposed project site relative to the proposed action. This is because the construction of the processing plant would accommodate a yellowcake dryer, involving potentially different heavy equipment utilization compared to the proposed action. The nonradiological air impacts during the operations phase of Alternative 3 would be the same or less as those stated for Alternative 1 (Section 4.7.1.2 of the SEIS). Because the facility would produce dried yellowcake instead of yellowcake slurry, outgoing shipments would be relatively less frequent (SEIS Section 4.3.3.2). Fewer trips would result in potentially less fugitive dust being generated by trucks, however, because the majority of estimated fugitive dust emissions are associated with commuting worker traffic, the NRC staff concludes the effect of the reduced truck traffic on overall emissions would minor and therefore fugitive dust emissions associated with this alternative would be comparable to the proposed action. The use of vacuum dryer technology for this alternative would reduce uranium particulate emissions from operations to near zero (NRC, 2003). The impacts during the aquifer restoration phase for Alternative 3 would be the same as those stated in the preceding Section 4.7.3.2, though perhaps limited even further by the fact that fewer shipments of process chemicals would be required during the aquifer restoration phase. The impacts during the decommissioning phase of Alternative 3 would be the same as for the proposed action (Section 4.7.1.4), though perhaps increased slightly to account for decommissioning the additional dryer components. Though offsite haulage may increase relative to the proposed action to account for the disposal of additional infrastructure and equipment, the difference in the level of traffic and the resulting change in dust emissions is not expected to be significantly different for Alternative 3 compared to the proposed action. The remainder of decommissioning activities would be the same as evaluated for the proposed action and therefore would have similar impacts to air quality. Based on this analysis, Alternative 3 would have a SMALL incremental effect on air quality when added to the MODERATE cumulative impact on air quality from other past, present, and reasonably foreseeable future actions within the air quality study area.

5.7.2 Global Climate Change and Greenhouse Gas Emissions

Greenhouse gas emissions are described in SEIS Section 3.7.1.5. Table 5-5 shows a comparison of annual carbon dioxide emissions by source. Evaluating the cumulative impacts of greenhouse gas emissions is challenging, and requires the use of a global climate model. The GCRP report (2009) provides a synthesis of the results of numerous climate modeling studies. NRC staff concluded that the cumulative impacts of greenhouse emissions around the world, as presented in the report, are the appropriate basis for its evaluation of cumulative impacts. Based on the impacts identified in the GCRP report, NRC staff concludes that the national and worldwide cumulative impacts of greenhouse gas emissions are noticeable but not destabilizing. NRC staff further concluded that the cumulative impacts would also be noticeable but, again, not destabilizing, with or without the greenhouse gas emission of the proposed project.

Table 5-5. Comparison of Annual Mass of Carbon Dioxide Emissions by Source

Source	CO_2 Emission
Global Emissions	28,000,000,000 t [30,884,000,000 T]*
United States	6,000,000,000 t [6,618,000,000 T]*
Single ISR Facility (Lost Creek)	1,904 t [2,100 T]
Current/Proposed ISR Facilities	7,380 t [8,140 T]
Average U.S. Passenger Vehicle	4.5 t [5 T]†
*EPA, 2009 †FHWA, 2006	

Consequently, NRC staff has determined that a meaningful approach to address the cumulative impacts of greenhouse gas emissions, including carbon dioxide, is to recognize that such emissions contribute to climate change and that the carbon footprint is a relevant factor in evaluating potential impacts of an alternative.

5.7.2.1 Greenhouse Gas (GHG) Emissions in the Region

The Center for Climate Strategies (CCS) prepared a report for the WDEQ that provides an inventory and forecast of Wyoming's GHG emissions (CCS, 2007). These emissions data were based on projections from electricity generation, fuel use, and other GHG-emitting activities. Emissions are reported as CO_2 equivalents (CO_2e) a conversion to put any of the various gases emitted (i.e., methane or nitrous oxides), into the equivalent greenhouse effect compared to CO_2 (BLM, 2008b). Gross CO_2e emissions in 2005 for Wyoming were 56 million metric tons [61.7 million short tons], and accounts for less than 1 percent (0.8 percent) of the total U.S. gross GHG emissions. This total is reduced to 20 million metric tons [22 million short tons] CO_2e as a result of annual sequestration (removal) due to forestry and other land uses (CCS, 2007).

Wyoming has a higher per capita emission rate than the national average (>4 times), due primarily to (i) the State's fossil fuel production industry, (ii) industries that consume high amounts of fossil fuels; (iii) a large agricultural industry, (iv) large distances between cities, and (v) a small population (CCS, 2007). The CCS report shows that the Wyoming GHG emissions would continue to grow as demand for electricity is projected to increase, followed by emissions associated with transportation. These projections are reflected in Table 5-6.

According to the Wyoming Oil and Gas Conservation Commission, the State of Wyoming contains over 33,000 active gas and oil wells, 45 operational gas processing plants, 5 oil refineries, and over 14,484 km [9,000 mi] of gas pipelines (CCS, 2007). Because there is no

Table 5-6. Wyoming Historical and Reference Case GHG Emissions in Million Metric Tons [Million Short Tons] CO_2e*

Year	1990	2000	2005	2010	2020
Energy Sector	38.0 [41.9]	43.6 [48.1]	47.5 [52.4]	51.6 [56.9]	59.6 [65.7]
Electricity Production Based	39.8 [43.9]	43.3 [47.8]	44.2 [48.7]	47.8 [52.7]	54.2 [59.8]
Coal	39.8 [43.9]	43.2 [47.8]	44.1 [48.7]	47.7 [52.6]	53.9 [59.4]
Natural Gas	0.0 [0.0]	0.1 [0.1]	0.1 [0.1]	0.1 [0.1]	0.2 [0.2]
Petroleum	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]
Geothermal, Biomass and Waste (CO_2, CH_4, and N_2O)	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]	0.0 [0.0]
*Source: CCS, 2007					

regulatory requirement to track carbon dioxide or methane emissions, there is a high degree of uncertainty associated with the Wyoming GHG emissions from this industry. However, the CCS (2007) estimated that approximately 13.5 million metric tons [14.9 million short tons] of CO_2e was emitted by fossil fuel industries. Of this amount, 80 percent was due to the natural gas industry. This amount is expected to grow an additional 8 to 10 percent in the next decade (CCS, 2007). No data currently exists for the nonfossil fuel industries, including uranium.

5.7.2.2 GHG Emissions from the Proposed Lost Creek ISR Project

In response to current concerns related to GHG emissions, NRC staff has focused on evaluating CO_2 emissions for the lifecycle of the proposed facility, and comparing them with other forms of extraction. The primary source of CO_2 emissions from ISR facilities is combustion engine emissions from construction equipment (including drill rigs). Construction equipment is used most during initial wellfield and facility construction, but also later during the decommissioning phase to remove buildings and equipment and reclaim land surfaces.

Annual and cumulative CO_2 emissions from the proposed Lost Creek ISR Project for construction and decommissioning activities were estimated by the NRC staff and documented in SEIS Appendix D. Combustion engine exhaust calculations performed for the proposed Lost Creek ISR Project were based on a combination of proposal-specific and representative information appropriate to support a conservative emissions screening analysis (Appendix D). Only nonroad combustion emissions were considered. Diesel emissions from construction equipment, including drilling rigs, were estimated using emission factors the EPA provided using different engine classes, based upon power output and operating time (Appendix D). The applicant proposes to drill six wellfields (approximately 600 wells), including injection and production wells (for the ISR process) as well as monitoring wells. In addition, the applicant has a permit for five UIC Class I wells [for deep well injection of byproduct material (liquid efficient)]. Analyses from Appendix D show that well-drilling rigs and other construction equipment used during the construction phase have the highest annual emissions of CO_2 for the proposed action. This amounts to 1,904 t [2,100 T] of CO_2 per year. The cumulative (calculated) CO_2 emissions, including drilling and construction of all wellfields, as well as decommissioning all wellfields and associated facilities is 6,165 t [6,800 T]. The majority of estimated annual CO_2 emissions would be from drilling, with nearly 80 percent of the CO_2 emissions attributed to deep disposal well-drilling activities. As shown in Figure 2-1, well drilling activities would occur over a period of several years. The estimate, also, did not include sequestration (removal) due to vegetation, forestry, or other agricultural activities (EPA, 1996).

5.7.2.3 Lost Creek ISR Project GHG Emissions Impact

As described in Section 5.7.1.3, the total amount of GHGs produced in Wyoming in 2005 was 56 gross million metric tons [61.7 million short tons], not taking into account sequestration (CCS, 2007). If, by taking into account 36 gross million metric tons [39.7 million short tons] for sequestration of GHGs, as estimated in the Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990–2020 (CCS, 2007), the net total of GHGs produced annually in Wyoming is 20 Mt [22 MT]. The proposed Lost Creek ISR Project conservatively would produce a maximum annual total 1904 t [2100 T] of GHGs (as carbon dioxide). This equates to approximately 0.0034 percent of the net total GHGs produced in Wyoming in 2005. If there has been an increase in GHG emissions, or a decrease in sequestration since 2005, the effect of the proposed Lost Creek ISR Project would be even less. Therefore, the potential impact of GHGs from the proposed Lost Creek ISR Project would be SMALL.

5.7.2.4 Effect of Climate Change on the Lost Creek ISR Project Facility

While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains in the magnitude and direction of some of the changes, especially predicting trends in a specific geographic location. To predict the effect of climate change on the proposed Lost Creek ISR Project facility, temperature and precipitation data from three National Weather Service (NWS) stations located in, and around the Great Divide Basin: (i) the Town of Wamsutter {located 52 km [31 mi]}; (ii) Muddy Gap {located 40 km [24 mi] northeast}; and (iii) Jeffrey City {located 40 km [25 mi] north-northwest} from the proposed site (NCDC, 2010a). The data, including daily records for both temperature and precipitation, from these stations had the most comprehensive historical records for NWS for the Great Divide Basin covering the period of May 1897 to April 2009. Aside from the year-to-year fluctuations, there was no observable overall increase or decrease in either temperature or precipitation during the periods of record for the three NWS stations (NCDC, 2010a). In reviewing at annual temperature data from the National Climatic Data Center (NCDC) for the State of Wyoming from 1895 to 2009, a slight upward trend temperature {0.09 °C [0.16 °F] per decade} was noted (NCDC, 2010b). In the report, Global Climate Change Impacts in the United States (GCRP, 2009), the U.S. Global Change Research Team indicated that the temperatures in the past 15 years have risen even faster {1.1 to 1.7 °C [2 to 3°F] for the Great Divide Basin}, most of which is attributed to warmer winters. This trend is expected to continue into the next decade, and by the end of this century, average annual temperatures in the Great Divide Basin could rise as much as 2.2 to 3.8 °C [4 to 7°F] (GCRP, 2009).

In the 50-year period from 1958 to 2008 for the thus NWS stations that were observed, there was also no obviously observable change in annual precipitation. However, the NCDC, in a separate study in a similar evaluation of 105 years of climatological data for the entire State of Wyoming, revealed a slight downward trend in precipitation {0.33 cm [0.13 inches] per decade} (NCDC, 2010b). Nevertheless, the U.S. Global Change Research Team is predicting that the Northern Great Plains Region (which includes the Great Divide Basin) would receive increased precipitation in future decades. Most of the precipitation is expected to fall in the colder months (winter and spring), and the summer and fall are to become drier. In addition, with the colder months expected to warm over the next several decades, more precipitation would fall in liquid form, resulting in less snow pack in the higher elevations (GCRP, 2009). Based on the above analysis, the overall effect of projected climate change on the proposed Lost Creek ISR Project facility is SMALL. The small predicted increases in temperatures and precipitation over the next decade would have no effect on any of the phases of the project. Because the major functioning of the facility would be below ground, the effects of the surficial and atmospheric environments are not expected to impact the proposed operation. There could be an increase in recharge to the aquifer in future years, resulting from the predicted increased precipitation (and consequent infiltration into the groundwater). This could affect the proposed project by increasing the volume of groundwater in the ore body and improving the effectiveness of the aquifer restoration process. Similarly, while potential changes to the site environment and resources such as ecology are plausible, the NRC staff considered the small magnitude of the predicted climate changes during the period when the proposed activities would be conducted to not be sufficient to alter the environmental conditions at the site in a manner that would significantly change the environmental impacts from what has already been evaluated in this SEIS.

5.7.2.5 GHG Mitigation Measures

Best management practices (BMPs) and mitigation measures could be used to minimize the emission of GHGs at the proposed Lost Creek facility. These include, but are not limited to:

- Use of fossil-fuel vehicles that meet latest emission standards
- Ensure that diesel-powered construction equipment and drill rigs are properly tuned and maintained
- Use low-sulfur diesel fuel
- Use newer, cleaner-running equipment
- Avoid leaving equipment idling or running unnecessarily and
- Minimize the number of trips to well pads.

Alternative 3 (Dry Yellowcake) would not add to the greenhouse gas emissions estimated for the proposed action. There would be no additional combustion sources as a result of the development of the alternative. Installation of the vacuum dryer, the only difference between the proposed action and Alternative 3, while not expected to emit pollutants, could potentially release radioactive particulates if a containment failure was to occur. Nevertheless, the incremental impact of the Lost Creek Dry Yellowcake Alternative on the air quality of the Great Divide Basin, as well as on climate change would be SMALL when added to the SMALL to sometimes MODERATE cumulative impacts anticipated from past, present, and reasonably foreseeable future actions.

5.8 Noise

Cumulative impacts from noise were assessed within an 8-km [5-mi] radius of the proposed Lost Creek ISR Project. This area served as the cumulative assessment geographic boundary and was chosen because noise attenuates quickly with distance from the source. GEIS Section 4.3.7 stated that sound levels as high as 132 dBA will taper to the lower limit of human hearing (20 dBA) at a distance of 6 km [3.7 mi] in this region, so a larger 8-km [5-mi] study area would be appropriate to evaluate potential cumulative impacts on noise. The geographic study area also, however, includes consideration of potential cumulative impacts on noise from traffic at the nearest receptor (residence) in Bairoil, about 24 km [15 mi] northeast of the Lost Creek site. As described in Section 5.1.2, the timeframe considered in evaluating potential cumulative impacts runs from 2008 when the application was initially submitted for the proposed Lost Creek ISR Project until 2020, when a license would be terminated at the end of the decommissioning phase of the proposed project.

As described in detail in SEIS Section 4.8.1, Noise associated with construction of the proposed Lost Creek ISR Project facilities is anticipated to be greater than other phases. However, because some noise can be detected beyond the project boundary, a radius of 8 km [5 mi] was considered a conservative radius for the assessment of cumulative noise impacts. Noise impacts from the proposed Lost Creek ISR Project would be SMALL during all phases (construction, operations, aquifer restoration, and decommissioning) of the proposed project,

largely due to the distance of the site from the nearest receptor (residence) at Bairoil (24 km [15 mi] to the northeast). However, there could be a temporary MODERATE noise impacts would occur as a result of increased traffic on lightly travelled roads through smaller communities such as Bairoil and Jeffrey City.

As described in SEIS Section 5.1.1, past, present, and reasonably foreseeable future noise-generating activities in the vicinity of the proposed Lost Creek ISR Project are primarily operating heavy equipment and traffic noise associated with energy extraction (for example, oil and gas) operation, and mineral (uranium exploration and production. Oil, gas, coal, and coal bed methane operations generate noise during construction, well drilling and operation of compressor stations. However, noise levels at these activities are reduced to ambient levels at distances of approximately 488 m [1,600 ft] (BLM, 2003). Noise related impacts are generally limited to the 610 m [2,000 ft] immediately surrounding each discrete source (e.g., drill rig, compressor station). At present, both Carbon County and Sweetwater County (where the proposed Lost Creek ISR Project is located) are experiencing considerable natural resource development, much of which is related to oil and gas exploration and production, but there are no oil and gas wells or coal mines within the 8-km [5-mi] radius that could potentially contribute to cumulative impacts related to noise (see Figure 5-2).

The Sweetwater conventional uranium mine and mill is located about 9-km [6 mi] to the south southwest of the proposed Lost Creek ISR project. The Sweetwater facility has an active NRC license, but it is currently in standby mode (NRC, 2008). It is currently used as a licensed byproduct disposal site and there is an ongoing groundwater corrective action plan in place that includes nine pumpback wells to extract contaminated groundwater for discharge into the tailings impoundment (NRC, 2008). Noise impacts associated with the Sweetwater facility that could potentially contribute to cumulative impacts include traffic bringing employees to and from the facility, and operating equipment such as the pumps for the groundwater remediation wells. In addition, there are some new structures such as diversion channels, evaporation ponds, and tailings impoundments that have been proposed for the Sweetwater facility (NRC, 2008). These would be passive facilities to manage waste water and surface water runoff, so most of the noise impacts would occur during construction. In addition, as described in SEIS Section 5.1.1, there are four uranium properties within 8 km [5-mi] that the applicant is exploring (see Table 5-1). Should the applicant develop these properties, there would be additional noise impacts associated with all phases. The processing plant for the proposed Lost Creek ISR Project would be used for all of these facilities (NRC, 2011a). Because these properties are all located about the same distance or more {24 km [15 mi]} away from the nearest residence at Bairoil, and because no new processing plant would be built, noise impacts from equipment associated with their construction and operation would be less than those for the proposed Lost Creek ISR Project.

Additional traffic associated with these four uranium properties would contribute to highway noise, especially for lightly travelled highways through the smaller cities. Assuming each of the properties would be about the same scale as the proposed Lost Creek ISR project, the noise impacts from associated traffic would also be similar. The degree to which the increased traffic would contribute to potential cumulative impacts on noise, however, would depend on the timing of the four facilities. To date, the only property for which NRC has received a letter of intent is the Lost Soldier (Ur-Energy, 2010), and the applicant has indicated that the license application would not be submitted until 2012. The other facilities (Lost Creek North, Lost Creek South, and the KM Horizon) are closer to the proposed Lost Creek ISR Project but are in the earlier stages of exploration (NRC, 2011a). For this reason, it is assumed that the con tribution from their

construction and operation to cumulative impacts on noise would be limited for the time period considered (through 2020).

The NRC staff concludes that the operation, construction, aquifer restoration, and decommissioning phases of the proposed Lost Creek ISR Project are likely to have only SMALL incremental impacts on noise when added to the SMALL cumulative impacts expected from other past, present, and reasonably foreseeable future actions within a radius of about 8 km [5 mi], largely because of the distance of these facilities from the closest residence in Bairoil. Additionally, noise levels would be mitigated by administrative and engineering controls in order to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits. Considering the potential noise impacts along lightly travelled highways that pass through smaller cities (Bairoil, Jeffrey City), traffic associated with proposed Lost Creek ISR Project would have a temporary and MODERATE incremental impact on noise when added to the MODERATE cumulative impacts expected from other past, present, and reasonably foreseeable. The magnitude of the cumulative impacts from increased traffic would, however, depend on the timing of the facilities. Current plans indicate that most of the uranium properties would be developed in sequence with the proposed Lost Creek ISR Project, reducing potential cumulative impacts from traffic noise.

Under Alternative 3 (Vacuum Dryer), the cumulative impact on noise levels would be the same as those assessed for the proposed action. The only difference between the two alternatives is the addition of a vacuum dry that would process the yellowcake slurry produced in the proposed action into a dry yellowcake powder. Because this additional process would be contained within the uranium processing building, there would be no additional noise on heard outside. Also, as described in Section 5.3, installation of a dryer would reduce the number of truck shipments needed to transport yellowcake from the proposed Lost Creek ISR Project, as well as route truck traffic away from Bairoil and Jeffrey City, with shipments instead traveling south to I-80 and ultimately to east to Metropolis, Illinois for additional processing. This would reduce the potential incremental noise impacts from the proposed Lost Creek ISR Project in the smaller communities of Bairoil and Jeffrey City. Therefore, the dry yellowcake alternative would only have a SMALL incremental impact on noise when added to the SMALL cumulative impacts in the geographic study area from other past, present, and reasonably foreseeable future actions.

5.9 Historical and Cultural Resources

Cumulative impacts to historic and cultural resources were assessed within the area evaluated for the cumulative impact on land use described in SEIS Section 5.2 and shown on Figure 5-3 since the proposed project is both located in the Great Divide Basin which encompasses a portion of the BLM Rawlins Field Office, whose charter includes land management. As noted in Section 5.2, the affected area covers approximately 48,782 km^2 [18,835 mi^2] of land and includes a portion of Sweetwater County, Carbon County, Albany County, Laramie County, and a small portion of Fremont County and is referred to herein as the “historic and cultural resources study area” for the analysis of potential cumulative impacts.

Potential impacts to historic and cultural resources could result from energy development, erosion, and grazing activities. Recent BLM reports (regional management plans; coal, gas, oil, lease applications) provide valuable information on past, present, and reasonably foreseeable future development activities that could result in cumulative effects on historic and cultural resources when added to impacts associated with the proposed Lost Creek ISR Project (BLM,

2004, 2006, 2008b). The cumulative effects analysis timeframe begins in 2008 and terminates in 2020 as described in SEIS Section 5.1.2. The year 2008 is when the applicant submitted a license application to NRC for a new source material license for the proposed Lost Creek ISR Project; the year 2020 is the project year that the NRC estimates the license would be terminated after the decommissioning phase of the ISR project.

As described in Section 5.2, activities occurring in the study area which could potentially affect historic and cultural resources include grazing, oil and gas development, coal production, and uranium mining and milling, and CBM production. Grazing allotments cover 1,413,463 [3,492,744 ac] of land within the historic and cultural resources study area, 5,962 oil and gas wells have been drilled (as noted in Section 5.2 about half of these wells are active) and the development of oil and gas wells estimated through the year 2020 is projected to result in the disturbance of 40,262 ha [99,492 ac] of land; coal mining has been projected to disturb approximately 14,912 ha [36,846 ac] of land; and the development of 13 existing or potential ISR sites affecting approximately 1,495 ha [3,705 ac] of land and an additional 592 ha [1,462 ac] from an existing conventional uranium mine could affect resources within the historic and cultural resources study area as described in Section 5.2.

Archaeological investigations within the BLM Rawlins Field Office planning area show that people have inhabited the area for at least 12,000 years. Prehistoric sites represent the largest percentage of cultural resource sites within the study area. Historic sites include expansion-era trails, freight roads, and stage stations. By the end of 2005 approximately 15,643 sites had been recorded within the RMP planning area. Prehistoric sites throughout the BLM Rawlins Field Office planning area have similarities with respect to artifact assemblages, feature types, and function but can also have variances based on ecological setting and cultural influences from surrounding regions. Within the revised 2008 RMP (Table 3-3), the entire BLM Rawlins Field Office planning area was subdivided into 14 subregions. The subregions are identified by geographic features which allows for a greater understanding of prehistoric peoples utilized the region. One such cultural subregion is the Great Divide Basin. Within the Great Divide Basin there is a total of 1,008,105 total acres, of which 706,925 acres are managed by the BLM. A total of 3,012 sites were recorded, with the majority being prehistoric (2,807 sites) versus 393 historic sites. (BLM, 2008e)

Hundreds of archaeological sites are discovered and recorded each year as the result of cultural resource investigations associated with energy development projects. As the demand for federally-owned minerals increases, there will be a demand to identify cultural resources. The majority of sites are recorded during federal management and licensing actions. A majority of the actions within the BLM Rawlins Field Office planning area are associated with oil and gas development, which is centered in the western portion of the RMP planning area (BLM, 2008b). These activities are ongoing and are projected to expand in the future. However, any potential impacts to historic and cultural resources would likely be minimized for projects occurring on federal lands, licensed or permitted by Federal agencies, or which are licensed or funded in part by the government because these projects would be subject to the National Historic Preservation Act (NHPA), Section 106 consultation process, and applicable federal and state statutes. Within the revised RMP EIS, BLM states that the greatest cumulative impact to cultural resources would be from development activities occurring on private or state lands with no federal jurisdiction. These developmental activities would adversely affect both the physical remains of the historic trails and the integrity of the setting where it contributes to NRHP eligibility, causing a significant impact. It is anticipated that significant impacts to cultural resources would occur as a result of unanticipated discoveries that would result from surface disturbing activities. BLM also stated that significant impacts to cultural resources would

occur as a result of unanticipated discoveries resulting from ground-disturbing activities. (BLM, 2008b)

Along with the proposed Lost Creek ISR Project, there are other ISR and conventional uranium (underground and pit) operations in various stages of the licensing process within the Great Divide Basin as noted in Table 5-1. Uranium-related exploration within the study area includes the Sweetwater Uranium Project, an open pit/conventional mine, which is operated by Kennecott Uranium Company and located approximately 9 km [6 mi] from the proposed Lost Creek ISR site. Four of these projects are within 22.5 km [14 mi] or less of the proposed Lost Creek ISR project. As shown in Table 5-1, there are eleven ISR or ISR/conventional facilities are in various stages of planning and development within 80 km [50 mi] of the proposed Lost Creek ISR project.

A Class I site file search was conducted by the applicant prior to archaeological field work commencing at the proposed Lost Creek ISR Project. The site file research identified the three previous surveys that included: WY SHPO Cultural Resources Office (WYCRO) project numbers 80-278, 88-875, and 93-1306. Western Wyoming College completed project 80-278 for a proposed uranium drill site. BLM conducted project 88-875 for a proposed fence line. Pronghorn Archaeological Services performed a survey for the Wamsutter Road Expansion in 1993 The file search also found that project 88-875 located archaeological site 48SW7633, a possible sheepherder's camp. This site was recommended not eligible for listing on the NRHP by the original investigators. Kinneer, et al. (2007) relocated the site and also recommended the site not be eligible for the NRHP.

The proposed Lost Creek ISR project area and associated study areas were subjected to systematic cultural resources investigations (Class III investigation) in 2007. Archaeological investigations were conducted under BLM Cultural Resource Use Permit No. 033–WY–SR06. Systematic survey of the proposed project area covered 1,523 ha [3,764 ac] of BLM-managed land and 270 ha [666 ac] of State of Wyoming land. The survey resulted in the relocation of Site 48SW7633 and the identification of 17 new sites and 75 isolated resources. (Kinneer, et al., 2007)

Seven of the newly identified archaeological sites were recommended ineligible for the NRHP. The 10 remaining sites were subjected to further evaluative testing. Based on the identification and testing results, three prehistoric sites (48SW16604, 48SW16608, and 48SW16765) were recommended as eligible for the NRHP. All remaining sites and isolated finds were determined ineligible for listing on the NRHP. (Kinneer et al., 2007)

As stated in SEIS Section 4.9.1.1.1, archaeological site 48SW16604 will be adversely affected by the proposed Lost Creek ISR project. The applicant's contractor developed a treatment plan (data recovery plan) for site 48SW16604. To mitigate this impact, a memorandum of agreement (MOA) was developed and executed among the NRC, BLM, WY SHPO, and the Eastern Shoshone and Northern Arapaho Tribes. Two additional NRHP-eligible sites (48SW16608 and 48SW16765) are located near proposed construction areas but will be avoided. If avoidance is not possible, then site-specific treatment plans would be developed and submitted to the NRC and Wyoming SHPO for review (Kinneer, et al., 2007). In addition to formalizing the data recovery plan for site 48SW16604, the applicant also established an inadvertent discovery provision within the MOA for compliance with the Native American Graves Protection and Repatriation Act and the proposed draft license also contains a license condition that addresses inadvertent discoveries. Direct impacts to historic and cultural resources from the proposed

Lost Creek ISR project would result in MODERATE impacts. NRC staff concludes that most impacts would be the result of the adverse effect to site 48SW16604. This MODERATE impact would be mitigated by implementing the treatment plan that is finalized in the MOA and adherence to applicant-committed measures. SEIS section 4.9.1 also discusses the proposed Lost Creek ISR project impact on paleontological resources. The NRC staff concluded that the proposed project would have a SMALL impact on paleontological resources.

Based upon previous cultural resource inventories, applicant-committed mitigation measures, and future energy development activities in the area the NRC staff has determined that the cumulative impact to cultural and historic resources within the study area from other past present and reasonably foreseeable actions is MODERATE. The MODERATE incremental impact from the proposed Lost Creek ISR Project on historic and cultural resources would be noticeable but not destabilizing to the cultural and historic resources within the historic and cultural resources study area and not change the MODERATE cumulative impact finding.

Regarding paleontological resources, the proposed project area is marked by the presence of Quaternary age, near-surface deposits, and Tertiary age formations. However, based on the geology of the site and the poor exposure of fossil-bearing sediment, the NRC staff concludes that the proposed Lost Creek ISR Project would not significantly impact any fossil remains. If fossil remains are discovered during construction, the applicant would stop work and contact the appropriate State and Federal agencies. Based on this analysis, the proposed project would have a SMALL incremental impact on paleontological resources when added to the SMALL cumulative impact to these resources expected from other past, present, and reasonably foreseeable future actions.

The cumulative impact on historic and cultural resources from implementing Alternative 3 (Vacuum Dryer) would be the same as evaluated for the proposed action since the footprint for the processing plant and wellfields would be the same as for the proposed action. NRC staff concludes that Alternative 3 would have a MODERATE incremental effect on historic and cultural resources when added to the MODERATE cumulative impact on historic and cultural resources from other past, present, and reasonably foreseeable future actions. With respect to paleontological resources, the cumulative impact from implementing Alternative 3 (Vacuum Dryer) would be the same as evaluated for the proposed action, since the footprint would be similar. Based on this analysis, impacts associated with implementing Alternative 3 would have a SMALL incremental impact on paleontological resources when added to the SMALL cumulative impact to these resources expected from other past, present, and reasonably foreseeable future actions.

5.10 Visual and Scenic Resources

Cumulative impacts to visual and scenic resources were assessed within a radius of about 20 km [12 mi] of the proposed Lost Creek ISR Project. This distance was chosen as the geographic boundary for the analysis of potential cumulative impacts because it represents the maximum line of sight (taking into account the curvature of the earth) on a flat plain for a structure with a height of about 30 m [100 ft] above the surroundings. This is a conservative estimate for the Great Divide Basin, since the rolling topography in the basin would further reduce the distance over which tall structures would be visible. Also, as described in detail in SEIS Section 4.10, distances greater than about 3.2 km [2 mi] are defined by BLM as background zones for the purposes of visual resource management (VRM). A geographic boundary of 20 km [12 mi] also covers the highest (most sensitive) visual classification areas in the vicinity of the proposed Lost Creek ISR Project, rated as VRM Class III by BLM (BLM, 2006,

2008). As discussed in SEIS Section 5.1.2, the timeframe used to analyze potential cumulative impacts with respect to visual and scenic resources begins in 2008 and ends in the year 2020, based on the estimated operating life of the proposed Lost Creek ISR Project.

As described in SEIS Section 4.10, the principal potential impacts on visual and scenic resources from the proposed Lost Creek ISR Project would be the contrast of surface infrastructure (e.g., drilling rigs, powerlines, process buildings, header houses, pipelines) with the existing visual inventory. These types of visual impacts are consistent with the management objectives of the VRM Class III area (BLM, 2008e) that includes the 20-km [12-mi] geographic boundary considered in the cumulative impacts analysis. As described in detail in SEIS Section 4.10, the potential impacts to visual and scenic resources from the surface structures and equipment of the proposed Lost Creek ISR Project would be SMALL for all four ISR phases. The NRC staff bases this conclusion primarily on the low profile of most of the proposed structures {maximum building height of 14 m [45 ft]} and the distance of the proposed processing plant from the nearest public road {7.2 km [4.5 mi]} (LCI, 2008). These structures would be shielded from view by the rolling topography of the Great Divide Basin, and the applicant has indicated it would reduce visual and scenic impacts by using mitigation measures consistent with BLM guidelines (BLM, 1984) such as selecting building materials and paint that blend with the natural environment. However, as described in SEIS Section 4.10.1, short term impacts to visual and scenic resources could be MODERATE as a result of dust emissions. As described in Section 4.10.3, the impacts to visual and scenic resources under Alternative 3 (Vacuum Dryer) would be the same to those described for the proposed action. Because a vacuum dryer would be installed inside the proposed process building, there would be no change in the external profile of the proposed Lost Creek ISR Project, and the impacts to the because there would be no liquid slurry transported offsite for processing, the possibility of liquid spills during tanker loading would be eliminated.

The past, ongoing, and reasonably foreseeable future actions that could potentially contribute to cumulative impacts on visual and scenic resources in the vicinity of the proposed Lost Creek ISR Project include (i) mineral exploration and production (predominantly uranium recovery), and (ii) extraction of energy resources such as coal, oil, natural gas, and coal bed methane. These activities are described in SEIS Section 5.1.1. Because many of the activities (drilling, pipeline and surface infrastructure construction, developing access roads) are similar to those described in SEIS Chapter 2 and SEIS Section 4.10 for the proposed Lost Creek ISR Project, the same types of impacts to visual and scenic resources will be associated with other mineral and energy extraction activities that occur within about 20 km [12 mi] of the proposed site. At present, both Carbon County and Sweetwater County (where the proposed Lost Creek ISR Project is located) are experiencing growth in energy resource development, much of which is related to coal, oil, and gas exploration and production, but there are no oil and gas wells or coal mines within the 20-km [12-mi] radius that could potentially contribute to cumulative impacts related to visual and scenic resources (see Figure 5-2).

The Sweetwater conventional uranium mill is located about 9-km [6 mi] to the south southwest of the proposed Lost Creek ISR project. The Sweetwater facility has an active NRC license, but it is currently in standby mode (NRC, 2008). It is currently used as a licensed byproduct disposal site and there is an ongoing groundwater corrective action plan in place (NRC, 2008). The tailings impoundments and standing structures for the mill are taller than about 7.6 m [25 ft] and could potentially be visible from the proposed Lost Creek ISR Project. In addition, as described in SEIS Section 5.1.1, there are four uranium properties within 20 km [12 mi] that the applicant is exploring, and an additional potential ISR site near the Sweetwater conventional

uranium mill (see Table 5-1). Should the applicant develop the four closest properties, there would be additional visual and scenic impacts associated with all phases. Dust emissions from these facilities would likely be similar to the proposed Lost Creek ISR facility, and the potential cumulative impacts to visual and scenic resources from these past, present, and reasonably foreseeable future actions would be SMALL to MODERATE. The processing plant for the proposed Lost Creek ISR Project would be used for all of these facilities (NRC, 2011a). Because no new processing plant would be built and the buildings needed for these uranium projects would be lower in profile, visual and scenic impacts from equipment associated with their construction and operation would be less than those for the proposed Lost Creek ISR Project.

Most of the visual and scenic impacts associated with ISR development are temporary as drilling is completed and decommissioning removes buildings from the site (see SEIS Chapter 2). The degree to which the reasonably foreseeable production at the closest uranium properties would contribute to potential cumulative impacts on visual and scenic resources, however, would depend on the timing of the facilities. To date, the only property for which NRC has received a letter of intent is the Lost Soldier (Ur-Energy, 2010), and the applicant has indicated that the license application would not be submitted until 2012. The other facilities (Lost Creek North, Lost Creek South, the KM Horizon, and Sweetwater) are closer to the proposed Lost Creek ISR Project but are in the earlier stages of exploration (NRC, 2011a). For this reason, it is assumed that the contribution from their construction and operation to cumulative impacts on visual and scenic resources would be limited for the time period considered (through 2020) when the proposed Lost Creek ISR Project would be decommissioned and the license terminated.

The NRC staff concludes that the SMALL incremental impacts to visual and scenic resources from the proposed Lost Creek ISR Project described in SEIS Section 4.10 would not likely contribute to a perceptible increase to the SMALL potential impacts to the viewshed within 20 km [12 mi] of the proposed Lost Creek ISR Project when added to other past, present, and reasonably foreseeable future actions. This conclusion is based, in part, on (i) the existing classification of the viewshed as VRM Class III (BLM, 2008e); (ii) the lack of significant oil, gas, coal, and coal bed methane resources within 20 km [12 mi] of the proposed Lost Creek ISR Project; (iii) the relatively low profile {14 m [45 ft]} of the buildings; (iv) mitigation measures to reduce the contrast of the proposed structures with the existing visual inventory; and (v) the longer timeframes that will likely be necessary to license and bring nearby uranium properties into production.

Under Alternative 3 (Vacuum Dryer) the Dry Yellowcake Alternative would have the same cumulative impact on visual and scenic resources as the proposed action, because there would be no additional buildings or features constructed. This alternative to the proposed action only involves the addition of a vacuum dryer into a space that would have been constructed under the proposed action, but not filled. This empty space is contained entirely within the uranium processing building. Therefore, this alternative would have only a SMALL incremental impact on visual and scenic resources when added to the SMALL cumulative impacts expected in the Great Divide Basin from other past, present, and reasonably foreseeable future actions.

5.11 Socioeconomics

As described in SEIS Section 5.1.2, the timeframe for this cumulative effects analysis for socioeconomic resources begins in 2008 and ends in 2020. The geographic boundary varies

for the socioeconomic resource indicators listed and is described as part of the analyses for each subcategory. Most potential socioeconomic impacts from the proposed Lost Creek ISR Project would be SMALL, with MODERATE impacts occurring only for housing in nearby small communities. These impacts are described in detail in SEIS Section 4.11.

The geographic boundary for the cumulative population analysis includes Sweetwater, Fremont, Natrona, and Carbon Counties. Population change over time is generally an excellent indicator of cumulative social and economic change in a given area. Wyoming's population has grown from 332,416 in 1970, and is projected to grow modestly from 2010 to 2020 (from 539,740 to 578,730) as is shown in Figure 5-5. Growth in Sweetwater County grew from 18,391 in 1970 to 41,700 in 2010 and is projected to reach 46,530 in 2020. Fremont County grew from 28,352 in 1970 to 38,390 in 2010, and is projected to be 40,110 in 2020. Natrona County grew from 51,264 to 74,050 between 1970 and 2010 and is anticipated to reach 79,650 in 2020. Carbon County population increased from 13,354 in 1970 to 16,160 in 2010 and will further expand to 17,230 in 2020.

These relatively flat county population projections do not take into account current economic conditions, climate change legislation (including cap and trade components), and future technological changes. If the projected 2,600 wells associated with natural gas and CBM production (BLM, 2008b) are constructed and become functional across the Great Divide Basin, workers will be required to build and operate these facilities. Additional workers will also be

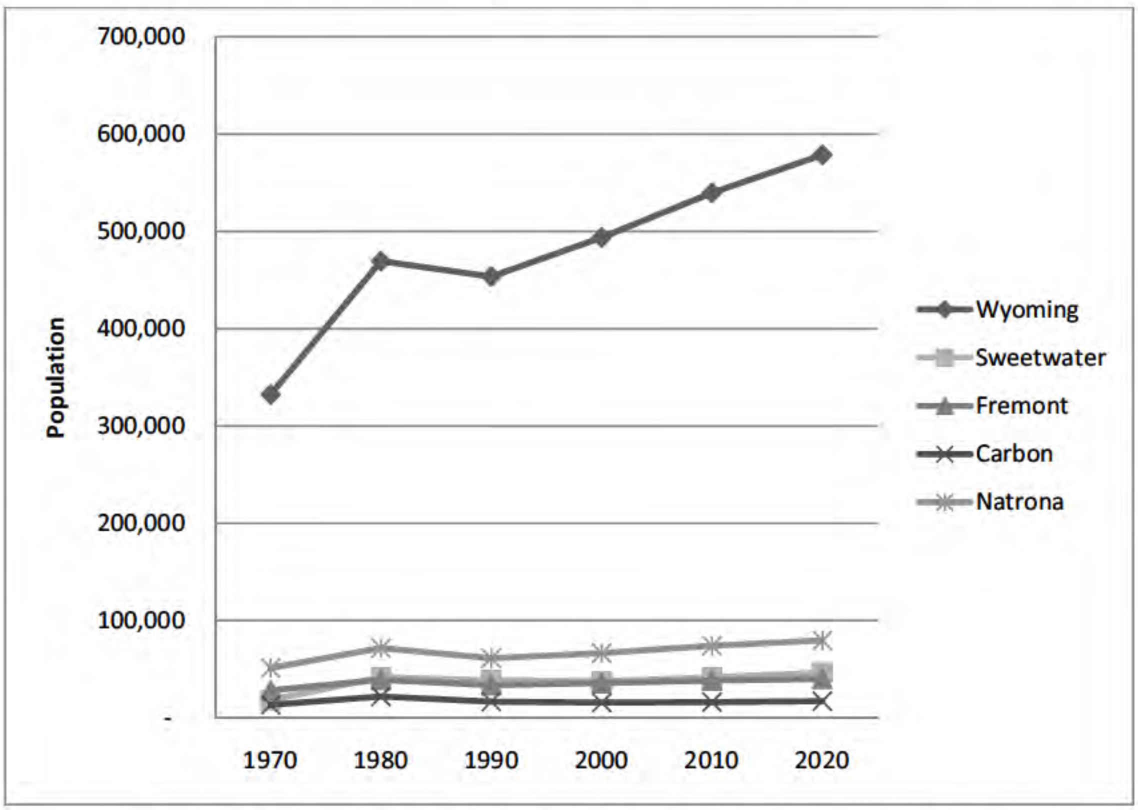

Figure 5-5. Population of Wyoming State, Sweetwater, Fremont, Natrona, and Carbon Counties, 1970–2020.
Source: Wyoming Department of Administration and Information, Economic Analysis Division (http://eadiv.state.wy.us), June 2010.

required to staff any expansion in uranium extraction projects, including development of four uranium properties within 8 km [5-mi] of the proposed site that the applicant is exploring (NRC, 2011a), as well as other uranium properties described in SEIS Section 5.1.1, (see Table 5-1). It is likely that any additional workers would desire to live closer to their place of employment and become active in their community. The city of Rawlins, and the Towns of Bairoil and Wamsutter may see population increases associated with increased energy development in the Great Divide Basin. Projected population trends for these towns are shown in Figure 5-6. Rawlins would be a more likely place for a family to settle than Bairoil or Wamsutter, because of the greater amount of services it has to offer (e.g. schools, retail establishments, places of worship, leisure time activities). Rawlins had a 2010 population of 9,063. Assuming that energy development unfolds as is projected, the addition of new workers in Rawlins and smaller towns like Bairoil and Wamsutter would have a MODERATE cumulative impact on population. The relatively small pool of workers associated with the proposed Lost Creek ISR Project (89-115) would have only a SMALL incremental impact on population. If a disproportionate number of workers associated with the proposed Lost Creek ISR project elect to reside in very small municipalities like Bairoil and Wamsutter, the incremental impact could be MODERATE.

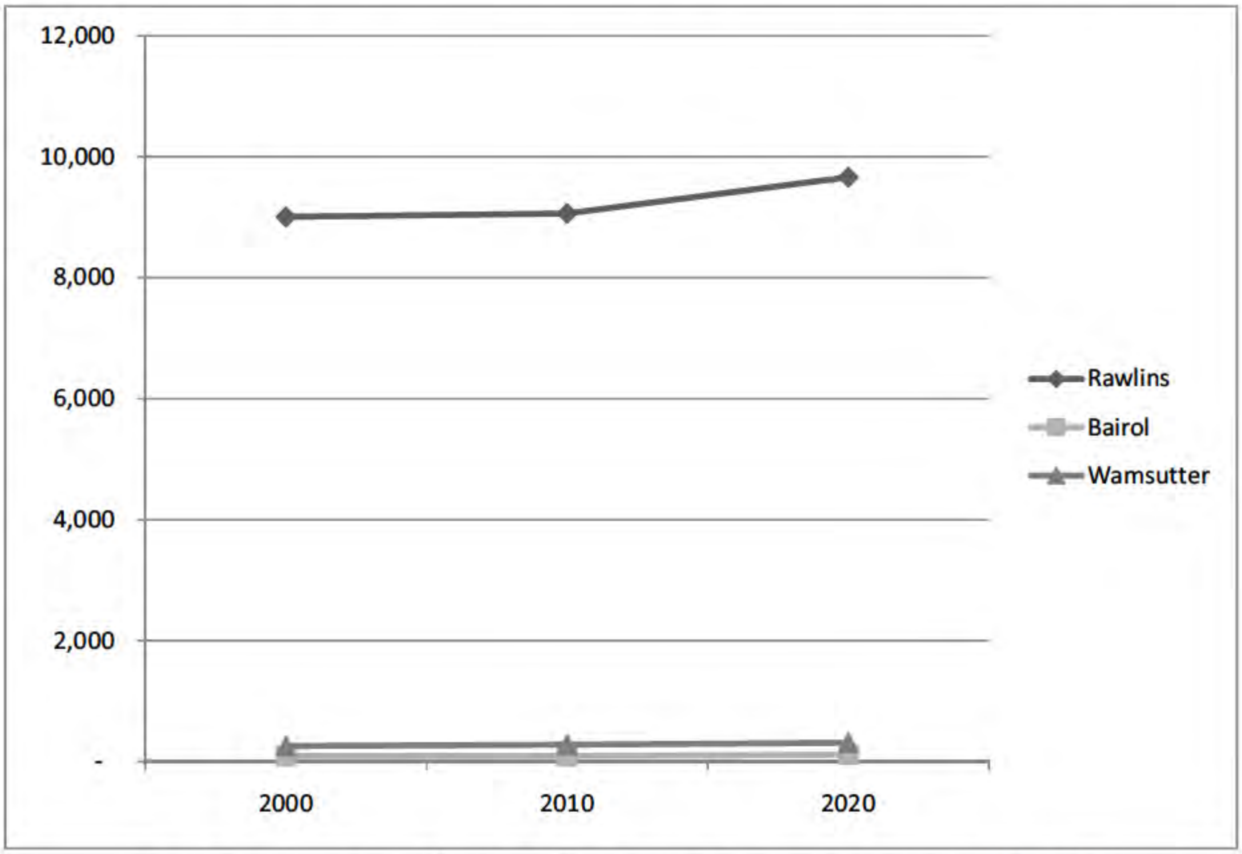

Figure 5-6. Population Trends for Rawlins, Bairoil, and Wamsutter 2000–2020.
Source: Wyoming Department of Administration and Information, Economic Analysis Division (http://eadiv.state.wy.us), June 2010.

5.11.1 Employment

The geographic boundary for the cumulative employment analysis includes Sweetwater, Fremont, Natrona, and Carbon Counties. While no individual county employment projections are available, the State of Wyoming is expected to experience modest growth through 2018, with an average annual growth rate of 0.9 percent). Minor gains in mining (708 jobs or 7.2 percent) and oil and gas extraction (327 jobs or 7.6 percent) are projected (Wyoming Department of Employment, Research & Planning, 2010). The Great Divide Basin may experience an increased rate of growth due to the numerous energy development projects anticipated to occur. If the estimated additional 2600 mostly gas wells are constructed and become functional, workers will be required to build and operate these facilities. Additional workers will also be required to staff expansion of uranium extraction projects. This projected growth related to present and future projects would result in SMALL-to-MODERATE cumulative impacts to employment in the form of additional job opportunities. The number of jobs associated with the proposed Lost Creek ISR Project site would be approximately 30-50 during construction and 90-105 during operation. Based on the number of workers expected at the proposed facility, the proposed Lost Creek ISR Project would have a SMALL incremental impact on employment.

5.11.2 Housing

The geographic boundary for the cumulative housing analysis includes Sweetwater, Fremont, Natrona, and Carbon Counties. With the projected growth in oil and gas, CBM, and uranium extraction, new employees moving into the area will require housing. Smaller communities, such as Bairoil and Wamsutter are likely to experience MODERATE cumulative impacts due to limited housing availability. Assuming, however, that new employees relocate to one of the larger communities, such as Rawlins, there should be adequate housing opportunities that would be able to absorb the influx of facility workers. Therefore, the cumulative impact would be SMALL. Given the limited number of Lost Creek ISR facility employees, there may be SMALL incremental impacts to housing markets, prices, and real estate development in larger communities such as Rawlins. However, housing impacts may be MODERATE if a portion of potential Lost Creek ISR Project employees elects to reside in smaller communities, such as Bairoil and Wamsutter.

5.11.3 Education

Sweetwater School District No.1 and Carbon County School District One represented the geographic boundary for the school enrollment resource socioeconomic subcategory. These areas were selected because most permanent Lost Creek ISR facility employees would be likely to live in one of these two districts. Most of the construction workforce, however, is not expected to relocate entire families during the relatively brief construction phase. Sweetwater School District No.1 includes Rock Springs and Wamsutter and had a total school enrollment of 4,424 for school year 2007 (Wyoming Department of Education, 2007). Carbon County School District One includes Rawlins and Bairoil and had 1,787 students enrolled for school year 2006 (Wyoming Department of Education 2007). With the 7 to 8 percent projected (through 2018) growth in oil and gas, CBM, and uranium extraction employment (Wyoming Department of Employment, Research & Planning, 2010), new employees with families moving into the area will send their children to schools in these school districts. Cumulative impacts to school enrollment are expected to MODERATE through 2020. Based on the number of workers (89–

115) required for the proposed Lost Creek ISR Project, the proposed action would have a SMALL incremental impact on school resources in the school enrollment study area.

5.11.4 Public Services

The geographic boundary for the public services socioeconomic resource includes Sweetwater and Carbon Counties. There may be incremental impacts to local government facilities and public services as population increases in affected counties and communities, which generally result in across-the-board increases in demand on services. Additionally, various reasonably foreseeable future development activities may result in increased demand for specific services (e.g., road maintenance). Operational impacts to public services and public infrastructure, as a result of the workforce relocating with their families, would be area-specific, and could be long-term. Therefore, cumulative impacts to public services are expected to be MODERATE. Given the number of workers (89-115) required for the proposed Lost Creek ISR Project, incremental impacts from the proposed action would have a SMALL effect on public services.

5.11.5 Local Finance

The geographic boundary for the local finance socioeconomic resource is Sweetwater County. Tax revenue would accrue mainly in Sweetwater County and to the State, and because of the structure of the taxing system, taxes may not accrue or be distributed to the localities proportionate to the population/public service impacts experienced by those entities. The tax system in place helps capture tax revenue during construction, operation, and decommissioning of most industrial facilities. Additionally, a*d valorem* taxes from current and future mineral extraction operations would bring in additional revenue. With the projected growth in oil and gas, CBM, and uranium extraction expected in Sweetwater County, there would be a MODERATE cumulative impact on local finance. Given that the proposed Lost Creek ISR project is only one of numerous potential future projects, contributions from the Lost Creek ISR facility are expected to have a relatively SMALL incremental impact on local finance.

The NRC staff has determined that the cumulative impact on socioeconomic resources resulting from other past, present, and reasonably foreseeable future actions ranges from SMALL to MODERATE. Impacts to population, school enrollment, public services and local finance would be MODERATE while impacts to employment and housing would be SMALL to MODERATE.

The NRC staff has also concluded that the proposed Lost Creek ISR Project would have a SMALL to MODERATE incremental effect on socioeconomic resources when considered with other past, present, and reasonably foreseeable actions. Impacts to housing would be SMALL to MODERATE, while incremental impacts to population, employment, school enrollment, public services, and local finance would be SMALL.

Under Alternative 3 (Vacuum Dryer), NRC staff concluded that cumulative impact on socioeconomic resources would be similar to that described for the proposed action since the same resources would be affected in a nearly identical manner. Therefore, NRC staff has determined that the cumulative impact on socioeconomic resources resulting from other past, present, and reasonably foreseeable future actions is the same as for the proposed action and ranges from SMALL to MODERATE. Furthermore, the NRC staff determined that the proposed Lost Creek ISR Project would also have the impacts as those described for the proposed action. SMALL to MODERATE incremental effects on socioeconomic resources would be expected when considered with other past, present, and reasonably foreseeable actions.

5.12 Environmental Justice

There are no concentrations of people living below the poverty level near the proposed project area, and no concentrated minority populations are located near the proposed project area. Impacts relating to environmental justice for the proposed Lost Creek ISR Project are described in more detail in SEIS Section 4.12. The geographic boundary for this resource includes Sweetwater, Carbon, Fremont, and Natrona Counties.

The GEIS identified no minority populations in the Wyoming West Uranium Million Region but did identify the Wind River Indian Reservation in northern Fremont County as a low-income population (NRC, 2009). However, the Wind River Indian Reservation is more than 160 km [100 (road) miles] from the proposed Lost Creek site. For this reason, it was determined that there were no environmental justice considerations expected for the area around the Lost Creek site, which would potentially include four additional uranium properties within 8 km [5-mi] that the applicant is exploring as is described in SEIS Section 5.1.1 (see Table 5-1).

The relative homogeneity of the population of Wyoming suggests that there are no readily identifiable minority populations and the potential for disproportionate impacts that could lead to environmental justice issues would be reduced. Because the economic base of the study area is largely ranching and resource extraction, low-income areas are not only dispersed within the study area, but are small in size. Families with incomes below the poverty level may reside within the study area, but are not disproportionately represented.

Based on this information with respect to minority and low income populations, and the analysis of human health and environmental impacts presented in Chapters 4 and 5, NRC staff concluded that the potential for incremental, disproportionately high and adverse impacts to environmental justice populations from past, present or reasonably foreseeable future development within the study area would be SMALL. The NRC staff also concluded that the proposed Lost Creek ISR Project would have a SMALL incremental effect on environmental justice issues when considered with other past, present, and reasonably foreseeable actions across the four-county study area.

The cumulative impact on environmental justice resulting from the Dry Yellowcake Alternative would be similar to the proposed action. Therefore, similar to the proposed action, this alternative would cause no disproportionately high and adverse impacts to minority or low-income areas. This alternative would have only a SMALL incremental effect on environmental justice populations when considered with other past, present, and reasonably foreseeable future actions.

5.13 Public and Occupational Health and Safety

The cumulative impact on public and occupational health and safety was considered within an 80-km [50-mi] radius of the proposed Lost Creek ISR Project. Historically, the NRC has used the 80-km [50-mi] radius as a standard bounding geographic area to evaluate population doses from releases at ISR facilities. This section considers both radiological and nonradiological impacts from normal operations and accidents. The public and occupational health and safety impacts from the proposed Lost Creek ISR Project could range from SMALL to MODERATE, depending on the specific impact, and are detailed in SEIS Section 4.13.1. During all phases of

normal operation, health and safety from radiological and nonradiological impacts would be SMALL. Based on discussions in 4.13.1.2.1, impacts to occupational workers would be SMALL except in the unlikely event that an accident was not mitigated. In this case, the impacts to workers could be MODERATE. The impact to the public from radiological and nonradiological accidents would be SMALL. For nonradiological accidents, as described in Section 4.13.1.2.4, impacts could range from SMALL to MODERATE for onsite workers if not appropriately mitigated. As described in SEIS Section 5.1.2, the timeframe for this analysis is 2008 to 2020, which is the expected lifecycle of the proposed facility. The year 2007 is when the applicant submitted its license application to NRC for the proposed Lost Creek ISR Project.

The cumulative impact analysis timeframe would terminate in 2020, which is the year that NRC estimates license termination would occur should a license be granted. There would be no impact on public health and safety from the proposed action following license termination. The proposed project would make a minor contribution to cumulative impacts in the Great Divide Basin in terms of radiation doses in the environment to both the public and workers. There would be no impact during the construction phase of the proposed project, and only a negligible increase during the operation and decommissioning phases. Annual doses to the population outside the boundaries of the proposed project would be far below any applicable limits, for both occupationally exposed workers and members of the public (Section 4.13).

As stated in the GEIS (NRC, 2009), the Lost Creek site is located in the Wyoming West Uranium Milling Region. As described in SEIS Section 5.1.1.1, there are 17, past, present, and reasonably foreseeable future uranium sites within the geographic study area (see Table 5-1). None of the identified sites, however, are currently involved in uranium processing, although four are in the decommissioning phase. One site the Kennecott Sweetwater Mine and Mill, is located about 9 km [6 mi] south of the perimeter of the Lost Creek site. Although this facility is on standby and not currently operating, it is currently licensed and could resume operations in the future. Other sites are in the earlier stages of exploration and development (NRC, 2011a), and would not come into operation until late in the cumulative analysis timeframe (2008 to 2020).

The maximum expected exposure to any member of the public from the proposed Lost Creek ISR facility, as with other operating ISR facilities in the U.S., is expected to be on the order of less than 0.1 mSv/yr [10 mrem/yr] at the site boundary (NRC, 2009). This exposure, combined with exposures from other facilities, is expected to remain far below the public limit of 1 mSv/yr [100 mrem]/yr] and have a negligible contribution to the 6.2 mSv/yr [620 mrem/yr] average yearly dose received by a member of the public from exposure to natural background radiation.

As described in SEIS Section 4.13.1.2, both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20. Licensees are required to implement an NRC-approved radiation protection program to protect occupational workers. Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits. As stated in Section 4.13, for normal operations, radon-222 would be the only significant radionuclide anticipated to be released; the primary sources would be from wellfield venting and releases from within the central plant for process operations (predominantly via vent stacks on the ion-exchange columns and various tanks). As stated in SEIS Section 4.13.1.2.1, the highest estimated dose at the site boundary (a hypothetical occupant living in the southeast corner of the proposed project area) is about 3 percent of the regulatory dose limits in 10 CFR 20.1301 (LCI, 2008b; 2010), yielding a SMALL impact from normal operations. Analysis of two separate accident scenarios (Thickener Failure and Spill, and Pregnant Lixiviant and Loaded Resin

Spills) would also result in hypothetical exposures that are less than NRC regulatory limits (LCI, 2008b, 2010b) and produce SMALL potential impacts (SEIS Section 4.13.1.2.2).

Studies of the existing radioactivity levels in the environment have been conducted and presented in Section 3.12 of this SEIS. The identified radioactivity concentrations in the soil, air, and water are consistent with other background concentrations in the region. This states that currently, prior to activities at the proposed Lost Creek facility, there is not a public and occupational health and safety impact concern. Other past, present, and reasonably foreseeable future activities described previously are anticipated to have a SMALL impact on radiological public health and safety for the study area.

SEIS Section 4.13 provides the baseline information for the cumulative impact discussion. The types and quantities of chemicals (hazardous and nonhazardous) for proposed use at the Lost Creek ISR Project do not differ from those evaluated in the GEIS. The use of hazardous chemicals at ISR facilities is controlled under several regulations (see SEIS Section 4.13.1.2.3 for a list of these regulations) that are designed to provide adequate protection to workers and the public. The handling and storage of chemicals at the facility would follow standard industrial safety standards and practices. Industrial safety aspects associated with the use of hazardous chemicals are regulated by the Wyoming Occupational Safety and Health Administration. Nonradological worker safety would be addressed through occupational health and safety regulations and practices.

According to the GEIS (NRC, 2009), the non-radiological impacts for other similar facilities located within 80 km [50 mi] would also adhere to the standards and regulations described above and within SEIS Section 4.13 and would have SMALL impacts, non-radiological cumulative impacts can be considered SMALL.

The NRC staff determined that the cumulative impact on public and occupational health within an 80-km [50-mi] radius of the proposed Lost Creek ISR Project from past, present, and reasonably foreseeable future actions would be SMALL. Therefore, the proposed project is projected to have a SMALL incremental impact on public and occupational health and safety when added to the SMALL cumulative impacts expected from other past, present, and reasonably foreseeable future actions described in Section 5.1.1 of this SEIS. Since the proposed facility is located in a remote, sparsely populated area with limited public access, the exposure to members of the public would be limited. Occupational health hazards would be limited because licensees are required to implement an NRC-approved radiation protection program to protect occupational workers. Additionally, ISR facilities would follow standard industrial safety standards and practices.

The cumulative impact on public and occupational health and safety resulting from the Dry Yellowcake Alternative 3, would be slightly greater than the proposed action. The addition of a vacuum dryer to produce a dry yellowcake powder has the potential to release radioactive dust particles. However, since the equipment (vacuum dryer) would be fully contained within the processing building, the potential for worker impact (exposure) would be increased, but would still be SMALL. The potential for public exposure would also be SMALL because of the high dispersion characteristics of the region. Therefore, this alternative would have only a SMALL incremental impact on public and occupational health and safety in the Great Divide Basin when added to other SMALL cumulative impacts expected from other past, present, and reasonably foreseeable future actions.

5.14 Waste Management

Cumulative impacts on waste management were assessed in the context of impacts within the Crooks Gap Uranium District (which includes the proposed Lost Creek ISR Project) and the Gas Hills Uranium District. Selecting this geographic area includes uranium facilities that are located at distances up to about 83 km [51 mi] north of the proposed Lost Creek ISR Project. This area was chosen as the geographic boundary for the analysis of potential cumulative impacts on waste management because even though it includes uranium mining/milling facilities outside of the uranium district that includes the proposed Lost Creek ISR Project (see SEIS Section 5.1.1 and Table 5-1), these more distant facilities would generate solid, hazardous, or radioactive wastes that would be likely to use some of the same disposal facilities. As discussed in SEIS Section 5.1.2, the timeframe used to analyze potential cumulative impacts with respect to visual and scenic resources begins in 2008 and ends in the year 2020, based on the estimated operating life of the proposed Lost Creek ISR Project.

As described in SEIS Section 2.1.1.1.6, all stages of the proposed Lost Creek ISR Project (construction, operation, aquifer restoration, and decommissioning) would generate effluents and waste streams, all of which must be processed and disposed of, properly. These would include both liquid and solid wastes. Any process wastewater generated during, or after, the uranium extraction phase of site operations would be classified as byproduct material (NRC, 2000, 2003).

As described in SEIS Section 2.1.1.1.6, the applicant has indicated that the liquid byproduct waste volumes during operations would be about 230 to 340 L/min [60 to 90 gal/min], and the maximum liquid byproduct waste produced during aquifer restoration would be about 492 L/min [130 gal/min]. The applicant has received permits from WDEQ for up to five UIC Class I disposal wells for deep injection of the liquid byproduct waste. The maximum permitted disposal capacity in these five wells would be 946 L/min [250 gal/min] (WDEQ, 2010). As described in SEIS Section 4.14, the impacts associated with the proposed liquid waste disposal system would be SMALL, based on the permitted capacity of the Class I disposal wells.

The NRC staff reviewed the material submitted by the applicant and estimated the total proposed Lost Creek ISR Project lifecycle waste volumes as the summation of the operational waste volumes and the total decommissioning waste volumes (LCI, 2008b, 2010). The different solid waste generation volumes for the proposed Lost Creek ISR Project are described in detail in SEIS Section 2.1.1.1.6. Assuming a total operating period of as much as 8 years considering the production and aquifer restoration phases for the proposed Lost Creek ISR Project (see SEIS Section 2.1.1.1.6), the total volume of solid byproduct material that would be generated for offsite disposal through the end of decommissioning would be about 3,644 m^3 [4,766 yd^3]. The total amount of nonhazardous solid waste (including sewage sludge and decommissioning wastes) generated for offsite disposal would be about 4,132 to 5,367 m^3 [5,404 to 7,020 yd^3]. In addition, a total of 1,211 to 2,422 L [320 to 640 gal] of waste petroleum and 36 to 73 kg [80 to 160 lb] of hazardous waste would be generated during 8 years of operation. As described in detail in SEIS Section 4.14, waste management impacts from the proposed Lost Creek ISR Project would be SMALL, primarily because of the readily available disposal capacity.

As described in Section 5.1.1, other past, present, and reasonably foreseeable future actions in the vicinity of the proposed Lost Creek ISR Project site that could generate solid, hazardous, or radioactive wastes include other uranium mining/milling activities, CBM activities, coal mining, and oil and gas exploration. As described previously (see SEIS Section 5.4), there are no

active coal mines or CBM fields within the geographic study area. There is oil and gas exploration and production in the region, but most of this activity and the existing oil and gas production units are outside of the geographic study area to the south and the west (BLM, 2004).

As described in Section 5.1.1.2, there are a number of past, present, and reasonably foreseeable future uranium projects in the geographic study area that could potentially contribute to the cumulative impacts on waste management (see Table 5-1). Each of these facilities would generate solid and hazardous wastes and would be responsible for complying with applicable regulations and site-specific license agreements that manage generated wastes.

NRC regulations require that an ISR applicant must have the necessary contracts and permits in place to ensure proper disposal of byproduct material prior to beginning uranium production. As described in SEIS Section 2.1.1.1, the applicant states that they would manage liquid byproduct material through a combination of two 0.39 ha [0.96 ac] storage ponds and deep well injection (LCI, 2008b). The applicant has obtained permits from WDEQ for five UIC Class I deep disposal wells for liquid byproduct material (WDEQ, 2010). The State permitting process for these wells evaluated the suitability of proposals to ensure groundwater resources would be protected and potential environmental impacts would be limited to acceptable levels. Based on the assumption that the state would not permit deep injection wells that would have a significant potential to impact groundwater resources, the NRC staff concludes the cumulative impacts of using deep disposal wells for the proposed action, along with the potential impacts from other present and reasonably foreseeable future actions, would be SMALL.

As described in SEIS Section 5.1.1.1 and Table 5-1, there are four conventional uranium mills that have either completed or are undergoing decommissioning. In addition, the Sweetwater conventional uranium mill, located about 9-km [6 mi] to the south southwest of the proposed Lost Creek ISR project, has an active NRC license, but it is currently in standby mode (NRC, 2008). These facilities are not producing uranium, and would not be likely to generate significant waste streams that would require offsite disposal. These facilities have groundwater corrective actions (NRC, 2008), but addressing issues in aquifers that are much shallower and not connected with the deep aquifers (Fort Union Formation) that the applicant will be using as part of the deep disposal well system. As described in Table 5-1, there are currently four planned ISR facilities for which NRC has received letters of intent (Jab and Antelope, Lost Soldier, West Alkali Creek, and Power Resources Gas Hills), one conventional mill (Strathmore Minerals Gas Hills), and one heap leach site (Sheep Mountain) in the geographic study area (Beahm, et al., 2010; Ur-Energy, 2010). Assuming that these facilities would have similar lifecycle waste volumes as those estimated for the proposed Lost Creek ISR Project, the total amount of solid byproduct material generated for offsite disposal would be about 21,865 m^3 [28,595 yd^3] {i.e., 3,644 m^3 [4,766 yd^3] × 6 facilities}. In addition, the applicant has indicated that there are three other properties (Lost Creek North, Lost Creek South, and the KM horizon) that are in the early stages of exploration. The applicant has indicated that they plan to develop these properties as well as the Lost Soldier project in sequence, using the processing plant for the proposed Lost Creek ISR Project (NRC, 2011a). For this reason, while the operating waste volumes for these uranium properties would be similar to those discussed previously, their decommissioning would not contribute to potential cumulative impacts on waste management since they would all use the proposed Lost Creek processing plant. In addition, because they are early in the exploration process, the timing of the development of these properties would not overlap with the properties that are further along in the planning stages.

Other waste stream and effluent generation rates (such as liquid effluents) would still be subject to the NRC license conditions limiting plant throughput, as well as the conditions of other permits such as the UIC Class I injection wells (WDEQ, 2010). Although the maximum rates of waste generation would not change if the additional properties (Lost Creek North and South, the KM horizon, and Lost Soldier) are developed as planned (NRC, 2011a), the total amount of these wastes to be disposed over the project lifecycle would increase, scaling in proportion to the amount of additional yellowcake produced.

The applicant has indicated that they are pursuing several disposal options for the solid byproduct material, including both in-state and out-of-state disposal, but have not yet finalized a contract established with an NRC-or State-licensed disposal facility (LCI, 2008a,b). Local capacity for disposal of byproduct material is available at the Pathfinder-Shirley Basin site in Mills, Wyoming. As reasonably foreseeable uranium ISR sites are licensed, this local capacity may become limited. Future uranium ISR applicants may have to engage other low-level radioactive waste disposal facilities that are licensed to accept byproduct material. Another existing facility that is licensed by NRC to accept byproduct material for disposal is the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Three sites additional are licensed by NRC Agreement States to accept byproduct material for disposal: (i) the Energy Solutions site in Clive, Utah; (ii) the White Mesa uranium mill site in Blanding, Utah and (iii) the Waste Controls Specialists site in Andrews, Texas. Based on the disposal options currently available and the disposal agreement that the NRC requires prior to operations, NRC staff concluded that the potential cumulative waste management impacts associated with the generation of byproduct material would be SMALL.

The applicant must also comply with applicable State and Federal regulations, with respect to disposing of nonhazardous solid and hazardous wastes. Because of landfill space limitations in Sweetwater County, Wyoming, the applicant indicated that nonhazardous solid waste would be disposed of at a public landfill located in Carbon County, Wyoming.

In summary, based on the assumption that the applicant obtains the necessary permits and contractual agreements for disposing of its byproduct wastes, the NRC staff concludes that the incremental impacts on waste management from the proposed Lost Creek ISR Project (see Section 4.14) would be SMALL. Based on the disposal options available now and in the future for the wastes that would be generated over the facility lifecycle, and the disposal agreement that NRC requires prior to operations for disposal of solid byproduct wastes, these SMALL incremental impacts are not likely to contribute to a perceptible increase in the SMALL potential cumulative impacts to waste management in the vicinity of the proposed Lost Creek ISR Project site when added to past, present, and reasonably foreseeable future actions.

Under Alternative 3 (Vacuum Dryer), the cumulative impact on waste management would be slightly greater than the proposed action. The additional process of producing the dry yellowcake powder involves removing the liquid from the yellowcake slurry (proposed action). While this process takes place in a vacuum dryer, some additional liquid effluent may be produced. As such, this would be considered liquid byproduct material, and would be disposed of via deep well injection. The liquid waste disposal system would only be for the propose Lost Creek ISR Project, and therefore this alternative would have only a SMALL incremental impact on waste management in the geographic area (the Crooks Gap Uranium District and the Gas Hills Uranium District) when added to the SMALL cumulative impacts on associated with other past, present, and reasonably foreseeable future actions.

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 Introduction

As described in NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) (NRC, 2009, Section 8.0), monitoring programs are developed for *in-situ* uranium recovery (ISR) facilities to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and the environment beyond the facility boundary. Monitoring programs provide data on operational and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected.

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 (NRC) safety and environmental reviews. The description of the proposed monitoring programs for the Lost Creek ISR Project is organized as follows:

- Radiological monitoring (Section 6.2)
- Physiochemical monitoring (Section 6.3)
- Ecological monitoring (Section 6.4)

The occurrence of spills and leaks at ISR facilities is considered in Section 2.11.2 of the GEIS (NRC, 2009) and the management of spills and leaks is not part of the routine environmental monitoring program described herein. Spills and leaks, including the design of the infrastructure to detect leaks, are described in the NRC safety evaluation.

6.2 Radiological Monitoring

This section describes Lost Creek ISR, LLC's [LCI's (referred to herein as the applicant)] proposed environmental radiological monitoring program, as described in its license application (LCI, 2008a,b) and in responses to NRC requests for additional information and open issues (LCI, 2010). The purpose of this monitoring program is to characterize and evaluate the radiological environment, to provide data on measurable levels of radiation and radioactivity, and to provide data on principal pathways of exposure to the public (NRC, 2003a).

In accordance with Criterion 7 of Appendix A to Title 10 of the *Code of Federal Regulations* (CFR) Part 40, NRC requires a preoperational monitoring program to establish facility baseline conditions. After baseline conditions are established, ISR operators are required to conduct an operational monitoring program to measure or evaluate compliance with standards and the environmental impact from operations. Although not a requirement, NRC Regulatory Guide 4.14 (NRC, 1980) provides guidance for implementing monitoring programs at uranium mills (which include ISR facilities) that are acceptable to the NRC staff.

The applicant submitted a preoperational monitoring program that established background radiological characteristics by providing data and results that included sampling frequency and methods, sampling locations, and types of analyses. However, because the applicant did not provide all the required information, to verify the conclusions in the NRC safety review, the NRC would require by license condition that the applicant provide a preoperational radiological environmental monitoring program report for NRC approval prior to major site construction that would include environmental results for game (as food samples), analyze surface water for

dissolved Ra-226, and soil samples colocated with air particulate samples in accordance with Regulatory Guide 4.14 (as revised) to comply with Criterion 7 to Appendix A of 10 CFR Part 40.

The results from the applicant's baseline sampling program are presented in Section 3.12.1 of this supplemental environmental impact statement (SEIS). The following sections briefly describe the applicant's proposed environmental monitoring program. The NRC staff's analysis of the adequacy of the proposed environmental monitoring program is considered within the NRC safety review. The applicant would be required by license condition to submit a semi-annual report that summarizes the operational effluent and environmental monitoring program results.

6.2.1 Airborne Radiation Monitoring

The applicant proposes to conduct continuous air particulate and radon sampling at the locations identified in Figure 6-1. Particulate samples (HV on Figure 6-1) at five locations would be changed weekly and analyzed as a composite quarterly for natural uranium, Ra-226, Th-230, and Pb-210 in accordance with Regulatory Guide 4.14 (LCI, 2008b, 2011). Radon gas and passive gamma radiation samplers (PR) would be sited at 12 locations within and on the border of the proposed project area (Figure 6-1). Five of these sample sites would be colocated with the air particulate samplers as recommended in Regulatory Guide 4.14. Monitoring would be conducted with alpha track etch detectors, and the samplers would be analyzed quarterly. This methodology would detect radon levels at, or above, 1 pCi/L [0.33 pCi/gal], based on a 90-day sample (LCI, 2010).

As described in Sections 1.5 and 4.1.2 of the applicant's technical report (LCI, 2010), the applicant would not be drying and packaging yellowcake material under the proposed action. Yellowcake slurry would be produced and transported offsite to a licensed drying facility. Therefore, during normal operations, radon would be the main radioactive effluent from operations. The applicant did not describe locating air samplers near buildings or wellfields except for air particulate sample location HV-2 (see Figure 6-1) near the processing plant, and radon samplers PR-4 and PR-5 (located north and east of the processing plant), and radon samplers PR-9 and PR-12 (located in the center and at the edge of the ore body and proposed wellfields).

The applicant placed the air particulate and radon environmental monitoring samplers at locations that are consistent with Regulatory Guide 4.14. However, the NRC safety review could not conclude that the applicant's proposed effluent monitoring program would comply with the applicable regulations in 10 CFR Part 20 [i.e., 10 CFR 20.1101(d), 10 CFR 20.1302(a)] and Criteria 8 of Appendix A to 10 CFR Part 40] because the applicant's proposed program failed to include sampling of gaseous or particulate effluent. Based on the NRC staff safety review of the applicant's technical report, NRC would require by license condition that the applicant collect meteorological data on a continuous basis until the data are determined by NRC to be representative of long-term conditions and to demonstrate that the applicant's calculations of radon with progeny are in accordance with the regulations cited above and in 10 CFR Part 20, Appendix B, Table 2.

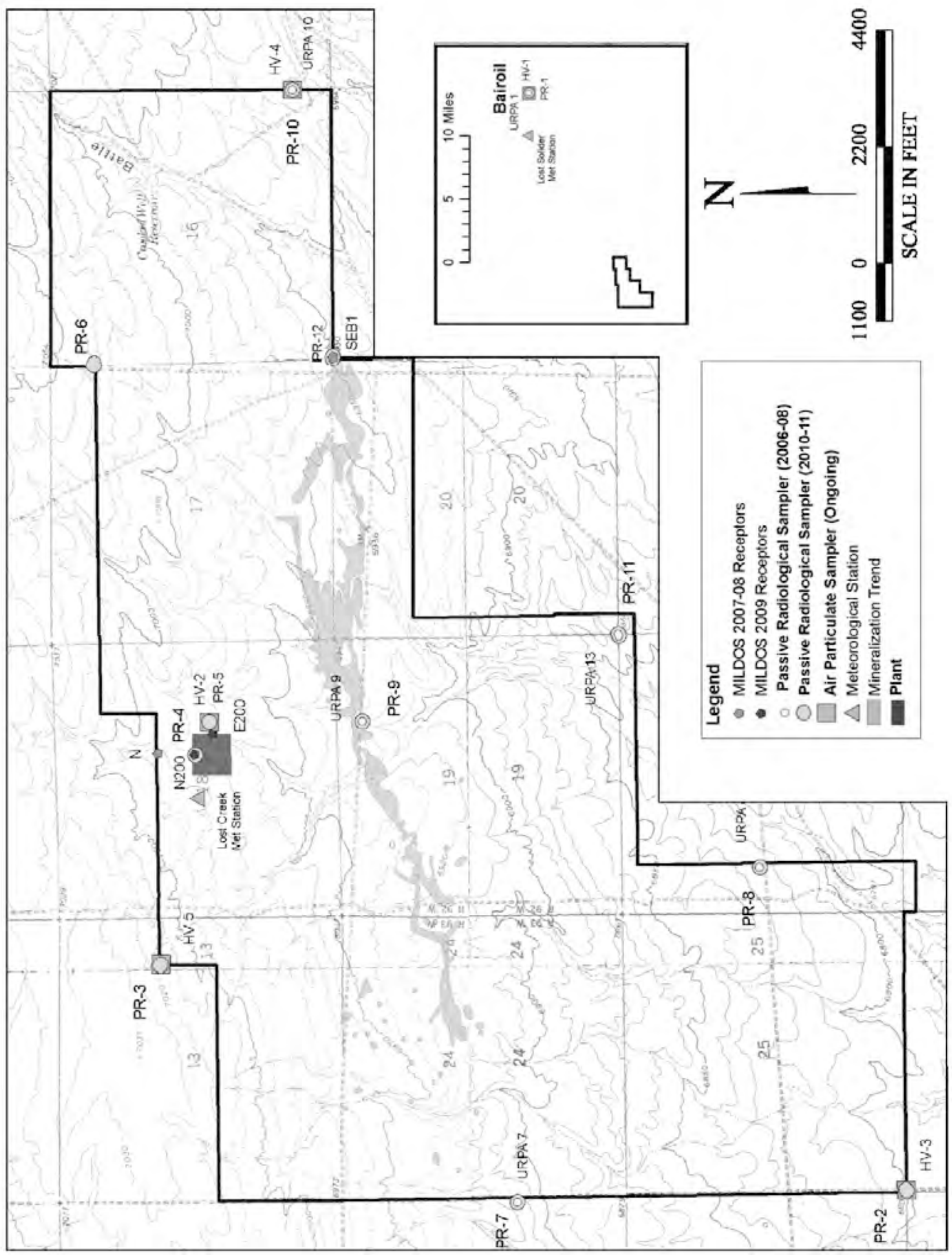

Figure 6-1. Radon, Direct Radiation, and Air Particulate Sampling Locations. Source: Modified From LCI (2008b)

6.2.2 Soils and Sediment Monitoring

During operations, the applicant proposes to annually collect soil samples at the five air particulate sampling locations (HV) shown in Figure 6-1 and analyze them for natural uranium, Ra-226, Th-230, and Pb-210 in accordance with Regulatory Guide 4.14 (NRC, 1980). The applicant is not proposing to routinely monitor sediment during operations since the streams are ephemeral.

6.2.3 Vegetation, Food, and Aquatic Monitoring

The only vegetation in the study area is sagebrush, which is neither forgeable for cattle, nor is it expected to rapidly adsorb surface radiological contamination. There is no agricultural crop production within the proposed licensed area or within 3.2 km [2 mi] of the proposed project area. Therefore, the applicant has not proposed to collect vegetation samples as part of routine environmental monitoring.

There are no surface waters to support aquatic life in the drainage area surrounding the site, therefore, no aquatic monitoring would be performed.

Cattle and game are the only nearby food sources; the applicant sampled beef in 2008 and 2009 (LCI, 2010) as part of the baseline assessment of radiological conditions. Because the processing plant and wellfields would be fenced, cattle would be excluded from these areas. Further, cattle are only in the area for approximately 6 months out of the year and graze over large areas due to the limited food supply. As previously described, NRC would require, by license condition, that the applicant submit a preoperational environmental program report for NRC approval that would include game as a food sample. However, cattle and game sampling would not be part of the routine environmental monitoring program.

6.2.4 Surface Water Monitoring

The Lost Creek site lacks perennial, and even intermittent, surface waters, and as such, the applicant did not propose to monitor surface water (streams only flow in response to major precipitation events). Due to the lack of perennial streams, the NRC staff concurred with the applicant that surface water monitoring within the proposed project area is not appropriate. The applicant (LCI, 2010) has proposed to use surface water samplers located around the proposed project area to measure surface water quality during major precipitation events. These storm water sampling points are shown on Figure 6-2.

6.2.5 Groundwater Monitoring

The applicant reported that no drinking water or agricultural wells are located within 2 km [1.2 mi] of the proposed project area. The applicant also reported that no livestock watering wells are located within the proposed project area; however, there are groundwater use permits for Bureau of Land Management (BLM) livestock wells located within 2 km [1.2 mi] of the proposed project area. The applicant committed to quarterly sampling of radiological constituents in ground water at any operating wells located within 1 km [0.6 mi] of the proposed project area given BLM consent. Samples would be analyzed for uranium and Rn-226 and results submitted to NRC in semi-annual or annual monitoring reports as described in the NRC safety review.

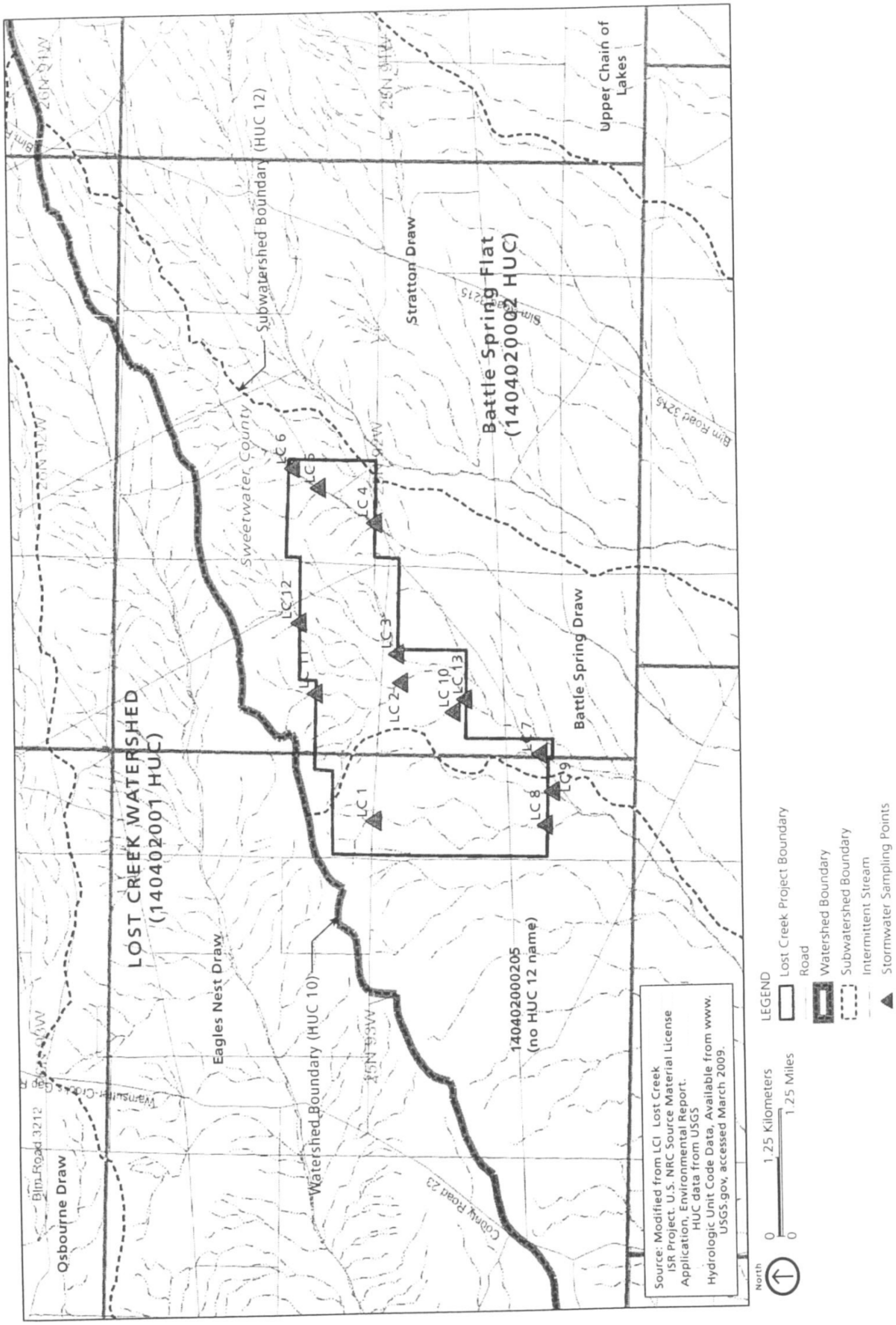

Figure 6-2. Storm Water Sampling Locations
Source: Modified From LCI (2008a)

6.3 Physiochemical Monitoring

This section describes the proposed monitoring program to characterize and evaluate the chemical and physical environment at the proposed Lost Creek site. The ISR process significantly alters the water quality in the production zone aquifer. Therefore, before uranium extraction may occur in a production aquifer, the U.S. Environmental Protection Agency (EPA) must issue an aquifer exemption for the production aquifer. SEIS Appendix C discusses the criteria EPA uses for an aquifer exemption. During operations, physiochemical groundwater monitoring is conducted to help prevent and limit potential impacts to groundwater quality in any of the nonexempt aquifers surrounding the exempt production zone aquifer.

Physiochemical monitoring provides data on operational and environmental conditions so that prompt corrective actions can be taken if an adverse condition is detected (NRC, 2003b). The physiochemical monitoring program at the proposed Lost Creek project includes groundwater monitoring and wellfield and pipeline flow and pressure monitoring described in Sections 6.3.1 and 6.3.2, respectively.

6.3.1 Wellfield Groundwater Monitoring

GEIS Section 8.3 (NRC, 2009) describes how ISR production processes directly affect groundwater in the operating wellfield. For this reason, groundwater conditions are extensively monitored before, during, and after operations. The methodology on how to determine appropriate well spacing and sampling frequency is determined as described in NUREG–1569 (NRC, 2003b). Section 6.3.1.1 of this SEIS describes the preoperational groundwater monitoring at Lost Creek, Section 6.3.1.2 describes the NRC-required groundwater quality monitoring that the applicant has proposed during and after operations, and Section 6.3.1.3 describes other groundwater monitoring the applicant has proposed.

6.3.1.1 Preoperational Groundwater Sampling

Section 8.3.1.1 of the GEIS describes how a baseline groundwater quality program would be established prior to uranium production (NRC, 2009). The purpose of this program is to characterize the water quality in monitoring wells that are used to detect lixiviant excursions from the ore production zones, to recover excursions, and to establish restoration target values (RTVs) for aquifer restoration after the operations phase is complete.

The applicant installed a monitoring well network within the proposed Lost Creek project area to evaluate preoperational water quality as part of the site characterization as described in SEIS Section 3.5.2.3.3. The baseline groundwater monitoring program and the results of that monitoring program are described in detail in the applicant's technical report (LCI, 2008b, Sections 5.7.8.1 and 7.3, respectively). To establish baseline groundwater quality, quarterly groundwater samples were collected from 25 monitoring wells. Of the 25 preoperational monitoring wells sampled, more than two-thirds show elevated radionuclide concentrations consistent with the occurrence of uranium ore within the aquifer.

Sampling of all the wells occurred in 2006 and 2007 to establish the preliminary baseline of groundwater quality underlying the proposed project area. All wells were sampled for the Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD) Guideline 8 groundwater quality parameters to establish the WDEQ class of use as described in SEIS Section 3.5.2.3.3 and as summarized in Table 6-1 (LCI, 2010b, Attachment OP–8).

Table 6-1. Baseline Water Quality Monitoring Parameters

Parameters Major Ions	Trace Constituents
Calcium	Aluminum
Magnesium	Ammonia
Potassium	Arsenic
Sodium	Barium
Bicarbonate	Boron
Chloride	Cadmium
Carbonate	Chromium
Sulfate	Copper
Nitrate (Total)	Iron
Fluoride	
General Water Chemistry	Manganese
Alkalinity 1	Mercury
Total Dissolved Solids	Molybdenum
pH (field measured)	Nickel
pH (lab measured)	Selenium
Specific Conductance (field measured)	Silica
Temperature (field measured)	Vanadium
Zinc	
Radionuclides	
Gross Alpha 1	
Gross Beta 1	
Radium-226	
Radium-228*	
Uranium	
*The 1982 sampling did not include these parameters (Lost Creek, October 2007)	

This sampling program, in combination with the historical samples collected by Conoco, Inc. provided a preliminary baseline of groundwater quality (LCI, 2008a). The purpose of the preoperational analysis is to evaluate the overall groundwater quality in the proposed license area under normal preoperational conditions. However, this preliminary baseline does not necessarily provide the final basis for establishing restoration criteria within the wellfields (NRC, 2003b). Prior to the injection of lixiviant in any wellfield, NRC would require by license condition that the applicant establish background preoperational groundwater quality data for

the overlying and underlying aquifers and restoration target values (RTVs) for the ore-zone aquifers for all wellfields. This information would include sampling and analysis data from, and sampling and analysis requirements for, the ore zone, perimeter monitoring wells, and overlying and underlying aquifers for each wellfield.

Once the baseline water quality for each wellfield is established, it would be used to determine the appropriate RTVs to assess the effectiveness of groundwater restoration on a wellfield-specific basis. The RTVs are a combination of the average and range of baseline values for the constituents listed in Table 6-1 for wells completed in the HJ horizon, the proposed production zone. This assessment would be provided to WDEQ after being reviewed and approved by the applicant’s Safety and Environmental Review Panel (SERP). NRC would also review and approve the RTVs for specific constituents.

6.3.1.2 Groundwater Quality Monitoring

GEIS Section 8.3.1.2 (NRC, 2009) describes the placement of monitoring wells around the perimeter of wellfields, in the aquifers both overlying and underlying the ore-bearing (production) aquifers, and within the production aquifer for the early detection of potential horizontal and vertical excursions of lixiviants (see SEIS Figure 2-10). Monitoring well placement is based on (i) what is known about the nature and extent of the confining layer and the presence of drill holes (ii) hydraulic gradient and aquifer transmissivity, and (iii) well abandonment procedures used in the region. The ability for a monitoring well to detect groundwater excursions is influenced by several factors: (i) the thickness of the aquifer monitored, (ii) the distance between the monitoring wells and the wellfield, (iii) the distance between the adjacent monitoring wells, (iv) the frequency of groundwater sampling, and (v) the magnitude of changes in chemical indicator parameters that are monitored to determine whether an excursion has occurred. As a result, the spacing, distribution, and number of monitoring wells at a given ISR facility are site-specific and established by license conditions (NRC, 2009). The proposed wellfield monitoring at the Lost Creek site is described in Section 6.3.1.2.1. The proposed monitoring for the storage ponds is described in Section 6.3.1.2.2.

6.3.1.2.1 Wellfield Monitoring

The groundwater monitoring program at the proposed Lost Creek ISR Project would be designed to detect excursions of lixiviant outside the wellfield under production and into the overlying or underlying aquifers. The applicant has documented its proposed groundwater monitoring program, and the NRC staff are evaluating the adequacy of the program as part of the its safety review. The wellfield monitoring program at the Lost Creek site considers the occurrence of both the fault and of abandoned boreholes within the wellfields.

Monitoring wells at the Lost Creek site would be installed in a perimeter ring around each wellfield, with the completion interval of each well targeted to the mineralized zones. Monitoring wells would also be completed in the aquifers immediately above and below the uppermost and lowermost mineralized zone, the UKM and LFG horizons, respectively. Overlying and underlying monitoring wells would be installed to detect vertical excursions. The applicant has proposed and the NRC would require by license condition, that the overlying and underlying monitoring wells be installed at a minimum density of one well for each 1.6 ha [4.0 ac] per wellfield. However, the applicant has stated that the actual density would be based on the aquifer characteristics of the mineralized zone and the overlying and underlying aquifers (LCI, 2008b). This data would be included in the wellfield packages submitted to NRC by

license condition for review and approval. The wellfield package would also undergo WDEQ review after the applicant's SERP has completed its review to ensure that the hydrologic testing results and proposed extraction activities are consistent with technical requirements. NRC review and approval would ensure that the wellfield-specific monitoring program would be adequate to provide a timely indication of either a horizontal or vertical excursion.

As described in SEIS Sections 3.5.2.3.1 and 4.5.2.1.2.2, aquifer testing conducted in the proposed project area has indicated a potential for hydraulic connection between the production zone (HJ Horizon) and the overlying FG and underlying UKM aquifers. The results of pumping tests conducted by the applicant indicate that the radius of influence of a single pumping well is greater than 152 m [500 ft]. NRC would require by license condition that perimeter wells be installed in a wellfield in accordance with information presented in Section 3.2.2.2 of the approved license application. The actual distances between the monitoring ring and the production wells and between each well within the ring would be based on the aquifer characteristics of that wellfield, and these distances would be refined as additional data becomes available for each wellfield. The monitoring wells located in the perimeter ring would be installed in the same aquifer as the production zone so that they are in hydraulic communication with the producing wellfields. The applicant would be required by license condition to provide a wellfield package that shows that all perimeter monitoring wells are screened in the same production zones in which uranium extraction would occur. The applicant's proposed monitoring program must allow adequate detection of potential excursions so that production fluids could be controlled within 60 days, as required by the NRC. The applicant would also be required to demonstrate the adequacy of the monitoring program for the overlying and underlying aquifers at each wellfield in accordance with NRC regulations.

The wells would be sampled to determine baseline water quality data to establish upper control limits (UCLs) for operational excursion monitoring. NRC would require by license condition that each well be sampled four times, with a minimum of 2 weeks between sampling events. During the first two sampling events, each well would be analyzed for the full set of WDEQ-required constituents (see Table 6-1). The constituent list could be reduced during subsequent sampling events based on the results from the first two sampling events and analyzed for the UCL parameters described in the next paragraph.

The indicator for lixiviant migration in the wellfields, and for which UCLs would be established, includes chloride, conductivity, and total alkalinity. Chloride was chosen because it is very mobile in groundwater and due to its low natural levels in the native groundwater; chloride would be introduced into the lixiviant from the ion-exchange process. Conductivity was chosen because it is an indicator of overall groundwater quality. Finally, total alkalinity was selected as an indicator because bicarbonate is the major constituent added to the lixiviant during production.

If two of the three test values for the excursion indicator parameters exceed the UCL values in a well during a monitoring event or if any one excursion indicator parameter exceeds its UCL by 20 percent, then a verification sample would be collected within 48 hours. If the verification sample confirms that the sample exceeds the UCL values, then the well would be placed on excursion status. If the second sample does not exceed the UCLs, a third sample would be taken. If neither the second nor third-round sample results exceed the UCLs, then the first sample would be considered in error. By license condition, the applicant would be required to notify the NRC project manager and WDEQ-LQD by telephone or e-mail within 24 hours of confirming a lixiviant excursion and to provide written confirmation to the NRC project manager within 7 days of a confirmed excursion. The applicant would also be required to initiate

corrective actions. Finally, the applicant would have to submit a written report describing the excursion event, corrective actions, and corrective action results to the NRC within 60 days of the confirmed excursion.

The fault that traverses the project area was also considered in the applicant's design of the monitoring program. As described in SEIS Sections 3.5.2.3.1 and 4.5.2.1.2.2, while the fault acts as an impediment to groundwater flow, it does not appear to act as an impermeable barrier. Further, the strata are displaced across the fault. NRC would require, by license condition, that for wellfield production units that abut (within 30 m [100 ft]) the fault that the applicant submit a plan to NRC for review and approval documenting the location and screened horizon in monitoring wells to monitor potential excursions across the fault into the upper and lower aquifers on the opposite side of the fault. These wells would be included in the routine excursion monitoring program and would include the corresponding groundwater elevations.

As discussed in SEIS Section 4.5.2.1.2.2, vertical excursions can also occur due to improperly sealed drillholes (i.e., boreholes and wells). Because of the abandoned drillholes located at the proposed Lost Creek site, NRC would require, by license condition that the applicant attempt to locate and abandon all historic drillholes located within the perimeter well ring such that the drillhole would not provide a conduit for the migration of production fluids. The applicant would also be required by license condition to submit a report to NRC prior to the start of operations in a wellfield production unit documenting its efforts to identify and properly abandon all abandoned drillholes within the area of influence of a wellfield.

6.3.1.2.2 Storage Pond Monitoring

In addition to the wellfield monitoring wells, NRC would require by license condition that the applicant install two monitoring wells in the southwestern and southeastern corner of the storage pond area. Quarterly monitoring of the shallow wells surrounding the storage ponds would be performed and monthly monitoring of the water levels in the wells would be performed. The pond design includes a double liner system and a leak detection monitoring program in accordance with 10 CFR Part 40 requirements. The proposed monitoring program consists of quarterly measurements of the ground water elevations. In addition, the applicant stated that other water quality parameters may be analyzed in this program based upon future activities near the wells. The pond monitoring sample results would be reported in the annual reports from NRC inspections. Details on the storage pond monitoring are provided in the NRC safety review.

6.3.1.2.3 Other Groundwater Monitoring

The applicant has proposed to monitor groundwater trends in water level elevations during ISR operations through its life-of-mine groundwater monitoring program (LCI, 2010). This program would entail quarterly monitoring of the water level in 25 on-site monitoring wells. The applicant has stated that other water quality parameters may be analyzed at selected wells in this program based upon future activities occurring near the wells.

6.3.2 Wellfield and Pipeline Flow and Pressure Monitoring

GEIS Section 8.3.2 (NRC, 2009) describes operator monitoring of injection and production well flow rates to manage water balance for the entire wellfield. Additionally, the pressure of each production well and the production trunk line in each wellfield header house would be

monitored. Unexpected pressure losses could indicate equipment failure, a leak, or a problem with well integrity.

The proposed program for the wellfield and pipeline flow and pressure monitoring is described in detail in the applicant's technical report (LCI, 2008b, Section 3.2.7.1). Injection well and production well flow rates and pressures would be monitored at each header house to balance injection and production flow in each pattern within the wellfield. The flow rate of each production and injection well would be continuously monitored by individual electronic flow meters located in each wellfield header house. By NRC license condition, the applicant would be required to measure and record injection manifold pressures and flow rates on a daily basis. Both flow meters and pressure gauges would be tied into the header house control panel, which would be in communication with the processing plant control room.

High and low pressure, as well as flow alarms, would be installed on the wells to alert wellfield and plant operators if specified ranges are exceeded. The wells would also be equipped with automatic shutoff valves to stop flow if abnormal changes in either flow or pressure occur. The wellfield and pipeline flow monitoring would alert the operators of malfunctions that could lead to either wellfield infrastructure or pipeline failures, thus minimizing the potential impact to groundwater.

6.3.3 Surface Water Monitoring

The applicant did not propose to monitor surface water for the proposed project area, because all of the drainages are ephemeral, and the U.S. Army Corps of Engineers (USACE) determined that no jurisdictional waters exist in the area. The applicant stated that runoff to the drainages only occurs during major precipitation events and during snowmelt in the spring, and only a portion of it infiltrates to the surficial aquifer (LCI, 2008b). The applicant has proposed to sample surface water from storm water runoff within, and at, the borders of the proposed project area during major precipitation events (Figure 6-2).

6.4 Meteorological Monitoring

The applicant did not propose to conduct routine environmental monitoring of air quality. As described in SEIS Section 6.2.1, the applicant would be required by license condition to collect meteorological data on a continuous basis at a data recovery rate of 90 percent, until the collected data are determined to be representative of long-term conditions.

6.5 Ecological Monitoring

Ecological monitoring that the applicant would conduct in accordance with the NRC license includes vegetation monitoring and wildlife monitoring (LCI, 2008a, Section 4.6.4). As a separate effort from the radiological monitoring of vegetation, food, and aquatic monitoring described in Section 6.2.3 that would be required by the NRC license, ecological monitoring would include monitoring measures to assess vegetation and wildlife populations that could be affected by the proposed project. Monitoring and agency reporting would be conducted throughout the life of the proposed project. The applicant prepared a detailed Wildlife Protection and Wildlife Monitoring Plan that was developed in accordance with recommendations and requirements of U.S. Fish and Wildlife Service (FWS), BLM, Wyoming Game and Fish Department (WGFD) and WDEQ-LQD. This section summarizes the ecological monitoring that the applicant would conduct.

6.5.1 Vegetation Monitoring

The applicant stated in the license application that it would monitor disturbed areas for the presence of undesirable (noxious or invasive) species and use control measures to prevent their spreading. Vegetation monitoring in reclaimed areas would be conducted according to BLM and WDEQ requirements and in accordance with the reclamation plan (LCI, 2008a, Section 4.6.4; LCI, 2010b, Attachment OP–6).

6.5.2 Wildlife Monitoring

The applicant has proposed annual wildlife monitoring in and near the proposed project area throughout the life of the project to document key wildlife species, population trends, and habitats (LCI, 2008a, Section 4.6.4.2). As described in SEIS Section 6.4, the applicant has also developed a Wildlife Protection Plan and Wildlife Monitoring Plan for the site (LCI, 2011, Attachment OP-6). This section summarizes the wildlife monitoring that the applicant would conduct.

6.5.2.1 Annual Report and Meetings

The applicant would coordinate the Wildlife Protection Plan and Wildlife Monitoring Plan monitoring program with the BLM Rawlins Field Office and the WGFD. Consultation with the FWS, BLM, and WGFD would be conducted prior to initiating monitoring and would be documented in a work plan, with BLM and WGFD concurrence (LCI, 2008a, Section 4.6.4.2). The applicant would prepare an annual monitoring report and submit it to BLM, WGFD, and other interested parties by November 15 of each year. The monitoring report would include (i) survey methods, results, any trends, and an assessment of protection measures implemented during the past year; (ii) recommendations for changes in protection measures for the coming year; (iii) recommended modifications to monitoring or surveying; and (iv) recommendations for additional species to be monitored (e.g., a newly listed species). Data and mapping would be formatted to meet BLM requirements (i.e., geographic information systems data and maps. (LCI, 2008a, Section 4.6.4.2)

6.5.2.2 Annual Inventory and Monitoring

Wildlife inventory and monitoring would be performed by the BLM or WGFD biologists, or a qualified scientist under contract by the applicant (LCI, 2008a, Section 4.6.4.2).

6.5.2.3 Raptors

The applicant would annually monitor known raptor nests between April and July to determine nest status (LCI, 2011, Attachment OP–6) using either ground or aerial surveys in accordance with WGFD protocol to minimize adverse effects to nesting raptors.

The applicant would also conduct three surveys for nesting raptors between March and June each year within the proposed project area and extending to a 1.6-km [1-mi] radius outside of the project boundary (LCI, 2011, Attachment OP-6) to determine the status and productivity of the nests.

The closest human disturbance to active and inactive raptor nests, visual barriers within the line of site of raptor nests, and prey abundance (rabbits, jackrabbits, and cottontails) would be

reported in each annual report (LCI, 2011, Attachment OP–6) to assess whether any activity or disturbance was related to extraction activities.

6.5.2.4 Sage-Grouse

The applicant's Wildlife Protection Plan and Wildlife Monitoring Plan states that lek surveys (designed to locate any new leks in the study area), annual lek attendance surveys (counts of birds on known leks), and brood surveys would be completed within the proposed project area and within a surrounding 6.4-km [4-mi] radius of the proposed project area boundary (LCI, 2011, Attachment OP–6). The applicant would follow BLM and WGFD protocol. All documented and known leks would be monitored on an annual basis to determine their attendance and trends in activity. Monitoring would occur three times during the appropriate season (late March to early May) and following WGFD standard protocol. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2011, Attachment OP–6).

6.5.2.5 Migratory Birds

The applicant would conduct nesting bird surveys for nongame species during the first week of June, following recommended WDEQ techniques. All birds, observed or heard, and the vegetation and habitat type where they were found, would be recorded. These surveys would document high interest bird species identified by BLM. (LCI, 2011, Attachment OP–6, Section 2.4)

6.5.2.6 Big Game

The applicant would complete one aerial survey and one ground 3-day survey for big game winter habitat use annually. The applicant would record the locations of big game species and vegetation and habitat type during each survey. (LCI, 2011, Attachment OP–6)

6.5.2.7 General Wildlife

No monitoring of other wildlife species has been proposed by the applicant. Known mortality of wildlife species resulting from project activities would be recorded and reported. Large die-offs, or evidence of possible wildlife exposure to toxic chemicals, would be reported immediately to the BLM, WGFD, and FWS (LCI, 2008a).

6.5.2.8 Sensitive Species

The applicant has not proposed to monitor sensitive species (except as noted previously for raptors, sage-grouse, and migratory birds).

The applicant has stated it would record and report mortality of federally-listed wildlife species (LCI, 2011, Attachment OP-6). As noted previously for general wildlife, the applicant has also stated it would report to BLM, WGFD, and FWS significant die-offs or other evidence of possible wildlife exposure to toxic chemicals (LCI, 2008a).

6.6 References

10 CFR Part 20. *Code of Federal Regulations,* Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office. 2010.

10 CFR Part 40 Appendix A. *Code of Federal Regulations*, Title 10, *Energy*, Part 40 Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content." Washington, DC: U.S. Government Printing Office. 2010.

LCI. "Lost Creek ISR, LLC, Lost Creek Project, Application for WDEQ Permit to Mine, Revision 6." ML110270148. Casper, Wyoming: Lost Creek International, LLC. 2011.

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NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs—Final Report." Washington, DC : U.S. Nuclear Regulatory Commission. July 2003a.

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

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7 COST-BENEFIT ANALYSIS

7.1 Introduction

This chapter summarizes benefits and costs associated with Alternative 1 (implementing the proposed action), Alternative 2 (the No-Action alternative), and Alternative 3 (Dry Yellowcake). Chapter 4 of this Supplemental Environmental Impact Statement (SEIS) describes the potential socioeconomic impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Lost Creek *In-Situ* uranium Recovery (ISR) Project by Lost Creek ISR, LLC (the applicant).

The implementation of the proposed action would primarily generate regional and local benefits and costs. The regional benefits of constructing and operating the proposed Lost Creek ISR Project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Some of these regional benefits, such as tax revenues, would accrue specifically to Sweetwater County, Wyoming, where the proposed Lost Creek ISR Project would be located, and the Towns of Bairoil and Wamsutter, and the Cities of Rock Springs and Green River. Other benefits may extend to neighboring Carbon County, Wyoming, and to the City of Rawlins. Costs associated with the proposed Lost Creek ISR Project would be, for the most part, limited to the area surrounding the site. Examples of these environmental impacts would include changes to current land use, wildlife habitat, and increased road traffic.

7.2 No-Action Alternative

Under the No-Action alternative, the U.S. Nuclear Regulatory Commission (NRC) would not grant the license for the proposed Lost Creek ISR Project. The No-Action alternative would result in the applicant not constructing, operating, restoring the aquifer, or decommissioning the proposed Lost Creek ISR Project. No facilities, roads, or wellfields would be built and no pipelines would be laid as described in Section 2.1.1.2. No uranium would be recovered from the subsurface ore body; therefore, no injection, production, and monitoring wells would be installed. No lixiviant would be introduced into the subsurface, and no buildings would be constructed to process extracted uranium or store chemicals involved in that process. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. As a result, the proposed site would not be disturbed by the proposed project activities, and ecological, natural, and socioeconomic resources would remain unaffected. All potential environmental impacts from the proposed action would be avoided. Similarly, all project-specific socioeconomic impacts (e.g., related to employment, economic activity, population, housing, local finance) would be avoided.

7.3 Benefits From the Proposed Action in Sweetwater County

Under the proposed action, the applicant would construct, operate, decommission, and conduct aquifer restoration at the proposed Lost Creek ISR Project site in Sweetwater County, Wyoming. As discussed in Section 2.1.1.1.2.7, construction of the processing plant, access roads, and initial development of the wellfields for the proposed Lost Creek ISR Project would take place over a 18–24 month period; the processing plant and supporting structures would take approximately 6 to 8 months to construct. Operation of the processing plant for uranium recovery and processing would be expected to occur over approximately 7 years. During that 7-year period, uranium recovery would move, sequentially, from wellfield to wellfield as shown in

SEIS Figure 2-1 until all the economically available uranium is recovered. After extraction from each wellfield was completed, aquifer restoration activities and associated stability monitoring would take place. This would be followed by decommissioning and land surface reclamation, described in Section 2.1.1.1.5.6, and is expected to last approximately 1 year per wellfield.

The principal socioeconomic impact from the proposed Lost Creek ISR Project would be an increase in the jobs in Sweetwater County, Wyoming, and the surrounding counties. As described in Section 4.11.1, “Proposed Action (Alternative 1),” the applicant expects to employ 94 workers during construction and 89 workers during operation (LCI, 2011). As discussed in Section 4.11.1, the NRC staff concludes that the site-specific impact on socioeconomic conditions from constructing the Lost Creek ISR Project would be less than described in the GEIS and SMALL. Some construction workers would commute from outside the county to the construction site, and skilled workers (e.g., engineers, accountants, managers) would come from outside the local workforce. Most employees are expected to commute from larger communities in Wyoming, such as Casper, Rawlins, and Rock Springs. During construction, some workers could temporarily relocate to the proposed project area and contribute to the local economy through purchasing goods and services and paying taxes.

If the majority of construction employment requirements are filled by a workforce from outside the region, assuming a multiplier of about 0.7,[1] there could be an influx of 66 jobs (i.e., 94 × 0.7). Because of the short duration (6 to 8 months) and small size of the construction force, the influx of these jobs would have a SMALL economic impact and SMALL benefit to the business in the region of influence.

For operations, if the majority of the employment requirements were filled by a workforce from outside the region, given a multiplier of 0.7, there could be an influx of 62 jobs (i.e., 89 × 0.7). Because the operation of the ISR facility at Lost Creek is expected to last 7 years (Section 4.11.1.2, “Operation Impacts”), if the majority of operational requirements are filled by a workforce from outside the region, there could be an influx of 178 people, based on 2.88 persons per household for the State of Wyoming (USCB, 2011). As stated in Section 4.11.1.2, because of the small size of the operations workforce (approximately 89 workers) and the potential influx of 62 jobs in support of facility operations, the impact on housing availability during ISR facility operations could range from SMALL for the region to MODERATE for nearby small communities. Similarly the influx of these jobs and a reduction of unemployment would have benefits to the businesses that could range from SMALL for the region to MODERATE for nearby small communities.

The workforce involved during aquifer restoration would be less than the workforce involved during the operation of the proposed project. Thus, the principal socioeconomic impact or benefit from the proposed Lost Creek ISR Project during aquifer restoration is expected to be SMALL. Similarly for decommissioning due to the small number of workers needed, the impact on socioeconomic conditions from decommissioning the proposed Lost Creek facility would be SMALL.

[1]The economic multiplier is used to summarize the total impact that can be expected from change in a given economic activity. It is the ratio of total change to initial change. The multiplier of 0.7 was used as a typical employment multiplier for the milling/mining industry (Economic Policy Institute, 2003).

In addition to creating jobs, the operation of the proposed Lost Creek ISR Project and its employment opportunities would contribute to local, regional, and State revenues through the purchase of goods and services and through the taxes levied on such goods and services. Further, severance taxes of 4 percent of taxable market value associated with uranium milling and mining in Sweetwater County are levied by the State of Wyoming Mineral Tax Division of the Department of Revenue (Wyoming Department of Revenue, 2009). The applicant's current resource estimate the proposed project is 2,923,403 kg [6,445,000 lb] of uranium over the life of the project (LCI, 2008, Table 4.10-2). If the applicant is able to fully recover this resource and sell it at a nominal market price (as of January 17, 2011, the price was $68 per pound of U_3O_8) the severance tax would yield approximately $17,530,400 in net economic benefits over the life of the project. This figure excludes potential reserve resources and the potential benefits derived from taxes on royalties or lease payments to local landowners stemming from the operation of the proposed project.

7.3.1 Benefits From Potential Production

Both the employment generated and the taxes paid by the applicant would depend on the production of yellowcake slurry. The volume of yellowcake slurry produced would depend on the market price for dry yellowcake (as uranium) and the cost of production. Since 2007, the spot-market price for uranium has fluctuated significantly, from a high of over $130 in 2007 to as low as $40 in 2009. As of January 17, 2011, the price was $68 per pound.

The project's potential benefits to the local community depend on the applicant's operating costs being lower than the future price of uranium. If the price of uranium drops below the operating costs then the operation of the facility would become uneconomic and operations could be suspended or discontinued.

7.3.2 Costs to the Local Communities

Table 7-1 identifies the towns and cities within 40 km [25 mi] of the proposed Lost Creek ISR Project and towns and cities within commuting distance. The table also presents the towns' and cities' populations and distances from the project site. As stated in Section 7.3, the construction of the proposed project is expected to employ 94 workers, and if it is assumed that the majority of the construction employment requirements are filled by a workforce from outside the region there could be an influx of 66 jobs. Because of the short duration of construction (6 to 8 months for the processing plant and supporting structures, 18–24 months per wellfield) and small size of the construction force, the impact to housing demand would be SMALL. Workers would not be expected to bring families and school-age children with them; therefore, there would be a SMALL impact on education services and on health and social services.

For operations, Section 7.3 indicates employment requirements of 89 workers, and if these employment requirements are filled by a workforce from outside the region there could be an influx of 62 jobs. Because the operation of the ISR facility at Lost Creek is expected to last 7 years and if the majority of operational requirements are filled by a workforce from outside the region, there could be an influx of 178 people, based on 2.88 persons per household for the State of Wyoming (USCB, 2011). As stated in Section 4.11.1.2.3, "Housing" demand for permanent housing is anticipated to increase in the communities surrounding the proposed Lost Creek ISR Project site leading up to the startup of ISR facility operations. The larger population centers closest to the Lost Creek ISR Project are Rawlins, Rock Springs, and Casper, all of which are within commuting distance of the proposed project area. The impact on housing availability during ISR facility operations could range from SMALL for the region to

Table 7-1. Communities Closest to the Proposed Lost Creek ISR Project

Communities	Population*	Distance from Project Site–km [mi]
Within 25 Miles of the Project Site		
Bairoil (T)	98	24 [15]
Between 25 and 50 Miles From the Project Site		
Wamsutter (T)	310	43 [27]
Rawlins (T)	8,793	61 [38]
Beyond 50 Miles From the Project Site		
Rock Springs (C)	20,905	134 [84]
Casper (C)	54,874	145 [91]
*U.S. Census Bureau, 2009 T = Town C = City		

MODERATE for nearby small communities. The proposed Lost Creek ISR Project also would have a SMALL impact on health and social services, and education. As described in Section 7.3, the impact on socioeconomic conditions during decommissioning and aquifer restoration for the proposed Lost Creek ISR facility would be SMALL. The local communities would require a minimal increase in emergency response and medical treatment capabilities because of the small risk of industrial accidents due the proposed project. Table 7-2 summarizes the costs and benefits of the proposed project.

7.4 Evaluation of Findings for Alternative 3 (Dry Yellowcake)

Under Alternative 3, the applicant would construct, operate, conduct aquifer restoration, and decommission facilities for ISR uranium milling and processing of dry yellowcake as the final product. This alternative differs from the proposed action only by the addition of dryer equipment for the processing of dry yellowcake from a wet slurry. The dryer equipment would be installed in the processing plant (which would be constructed with a space allocated for drying equipment) at the Lost Creek site. The dry yellowcake would then be transported from the Lost Creek site directly to Metropolis, Illinois, for ultimate processing into fuel for nuclear reactors. The addition of the drying process would eliminate the step of transporting the yellowcake slurry from the Lost Creek site to an intermediate facility before shipment to Metropolis, Illinois, for further processing.

As stated in Section 4.11.3, Socioeconomic impacts from the construction, operation, and decommissioning of the proposed Lost Creek ISR facility and aquifer restoration under Alternative 3 would be the same as the impacts from construction under the proposed action. While there would be additional machinery and infrastructure developed for the production of the dry yellowcake within the processing plant and some additional construction, NRC expects that these changes would not result in an impact on socioeconomic conditions. Therefore, the overall impacts associated with this alternative would be the same as those described for the proposed action: SMALL.

7.5 Evaluation of Findings for the Proposed Lost Creek ISR Project

Implementation of the proposed action or Alternative 3 would have a SMALL overall economic impact on the region of influence. The implementation of the proposed action would primarily generate regional and local benefits and costs. The regional benefits from the proposed Lost Creek ISR Project would be increased employment, economic activity, and tax revenues in

Table 7-2. Summary of Benefits and Costs of the Proposed Lost Creek ISR Project

Cost-Benefit Category	Proposed Action
Benefits*	
Capacity Produced	6.4 million pounds of U_3O_8 over the life of the operation
Other Monetary	$17.5 million (estimated for severance tax)
Nomonetary (50 percent of jobs will be from Campbell County)	94 jobs—during construction and fewer for decommissioning 66 jobs—local jobs from economic multiplier during construction and fewer for decommissioning 89 jobs—during operation and fewer for aquifer restoration 62 jobs—local jobs from economic multiplier during operation and fewer for aquifer restoration
Costs*	
Education Infrastructure	SMALL†
Health and Social Services	SMALL†
Housing Demand	SMALL for region, MODERATE for small communities†
Emergency Response	SMALL
*Benefits and Costs are similar for Alternative 3 (Dry Yellowcake) †Primarily due to the operation of the proposed action	

the region around the site. Some of these regional benefits, such as tax revenues, would accrue specifically to Sweetwater County and towns closest to the project site. Other benefits may extend to neighboring counties and the State of Wyoming. Costs associated with the proposed Lost Creek ISR Project would be limited to the area surrounding the site and the communities within commuting distance. The implementation of Alternative 3 would generate regional and local benefits and costs, but the differences of these impacts from those of the proposed action would be negligible. Table 7-2 summarizes the benefits and costs of the proposed action which are similar to Alternative 3, as stated in the footnote of Table 7-2.

7.6 References

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LCI. "Subject: Workers." E-mail (February 21) from J. Cash, UR-Energy USA to A. Bjornsen, Project Manager, NRC. ML110410510. Casper, Wyoming: Lost Creek *In-Situ* Recovery, LLC. 2011.

LCI. "Lost Creek Project Environmental Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming, Application for US NRC Source Material License (Docket No. 40-9068)." Casper, Wyoming: LCI. March 2008.

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

USCB (U.S. Census Bureau). "American FactFinder, Sweetwater County, Wyoming." 2011. <http://factfinder.census.gov/servlet/ADPTable?_bm=y&-context=adp&-ds_name=ACS_2009_3YR_G00_&-tree_id=3309&-redoLog=true&-_caller=geoselect&-geo_id=05000US56037&-format=&-_lang=en> (27 April 2011).

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8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the potential environmental impacts and consequences of the proposed action and reasonable alternatives, including the No-Action alternative. In doing so, the potential impacts and consequences are described in terms of: (i) the unavoidable adverse environmental impacts; (ii) the relationship between local, short-term uses of the environment and the maintenance of long-term productivity; and (iii) the irreversible and irretrievable commitment of resources. The information is presented for the proposed action and each alternative for the 13 resource areas and described by stage of the proposed facility lifecycle (i.e., construction, operation, aquifer restoration, and decommissioning). These conclusions are provided in Table 8-1.

The following terms are defined in U.S. Nuclear Regulatory Commission (NRC) NUREG–1748 (NRC, 2003):

- Unavoidable adverse environmental impacts: impacts that cannot be avoided and for which no practical means of mitigation are available.
- Irreversible: commitments of environmental resources that cannot be restored.
- Irretrievable: applies to material resources and would involve the commitment of materials that, when used, cannot be recycled or restored for other uses by practical means.
- Short-term: represents the period from preconstruction to the end of the decommissioning activities, and, therefore, generally affects the present quality of life for the public.
- Long-term: represents the period of time following the termination of the site license, with the potential to affect the quality of life for future generations.

As described in Chapter 4, the significance of potential environmental impacts is categorized as follows:

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

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

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

The alternatives and their environmental impacts are summarized in the following sections. Sections 8.1, Proposed Action (Alternative 1); 8.2, No-Action (Alternative 2); and 8.3, Dry Yellowcake (Alternative 3) describe the environmental consequences from implementing these alternatives.

8.1 Proposed Action (Alternative 1)

Under Alternative 1, the NRC would issue Lost Creek ISR, LLC (LCI, referred to herein as the applicant) a source material license for the construction, operation, aquifer restoration, and decommissioning for in-situ recovery (ISR) uranium milling and processing at the Lost Creek ISR Project site, as proposed in the license application and related submittals.

The construction phase is expected to occur over a period of about 7 years during which time buildings, access roads, wellfields, pipelines, and underground injection control (UIC) disposal wells for injection of liquid effluent would be constructed. SEIS Figure 2-1 illustrates the sequential development of the proposed site and shows the duration for the construction of the processing plant and wellfields. The applicant estimates these actions would disturb approximately 115 ha [285 ac] of the 1,705 ha [4,220 ac] of the proposed project area over the life of the project. The operations phase would last approximately 7–8 years; however, wellfield production would be staggered by wellfield during that time as shown in Figure 2-1 and described in SEIS Chapter 2. The duration of operations in each wellfield would range from 2 to 3 years. Injection wells would inject lixiviant (recovery) solutions into the ore body to recover uranium. Production wells would recover the dissolved uranium, which would be processed into a slurry at the processing plant. The slurry would then be shipped offsite for processing into yellowcake as described in SEIS Section 4.3. Aquifer restoration would be initiated to ensure that water quality and groundwater use from surrounding aquifers was not impacted by the proposed action. The applicant has estimated that aquifer restoration per wellfield would take approximately 30 months and would also be staggered following the production schedule as shown in SEIS Figure 2-1 (LCI, 2010). During the aquifer restoration phase, contaminated groundwater would be transferred from one wellfield to the next, replaced with baseline groundwater through pumping action (i.e., “sweeping” groundwater), and then passed through ion exchange and reverse osmosis equipment during groundwater treatment to minimize the groundwater volume consumed during the aquifer restoration phase. After aquifer restoration in a wellfield, the wells would be plugged and abandoned. During decommissioning, estimated to take approximately 1 year for each wellfield and 26 months for the processing plant, disturbed lands would be returned to their preextraction use and the land reclaimed.

One identified archaeological prehistoric site, eligible for inclusion on the *National Register of Historic Places*, would be affected by the proposed action. A Memorandum of Agreement (MOA) was developed and executed by the signatories [NRC, Bureau of Land Management (BLM), Wyoming State Historic Preservation Officer (SHPO), LCI, Attorney General of Wyoming, and the Eastern Shoshone, and Northern Arapaho Tribes] for the implementation of a treatment (mitigation) plan, should the archaeological site be disrupted during construction. The potential environmental impacts from this alternative are summarized in Table 8-1.

8.2 No-Action (Alternative 2)

Under the No-Action alternative, the NRC would not issue a license. No buildings, roads, wellfields, and supporting infrastructure would be built; no uranium would be recovered from the subsurface ore body. Therefore, the aquifer would be unaffected by activities at the proposed Lost Creek ISR Project and there would be no need to restore the aquifer or for decommissioning. The decision to not license the proposed Lost Creek Project would leave a large resource unavailable for energy production supplies to fuel power generation facilities.

Under the No-Action alternative, there would be no impact to land use because the facility would not be constructed; there would neither be earthmoving activities to disturb the land nor restrictions put on the land for grazing or ranching. The existing land use would continue, and the property would be available for other uses. There would be no impact on the local transportation system, as the current volume and existing traffic patterns would be unchanged. Because the land surface would not be disturbed under the No-Action alternative, there would be no additional impact to soils. Natural phenomena, such as wind and water erosion, would remain the most significant force associated with geology and soils at the site. The subsurface geology at the site would be unaffected, because there would be no injection of fluids.

Surface water, in the form of ephemeral channels, would continue to flow, only in response to snow melts and large precipitation events. Under the No-Action alternative, groundwater would be unaffected by the proposed ISR operation. The groundwater quality in the aquifer and the water levels in wells surrounding the proposed project area would be unaffected. Because there would be neither earthmoving nor grazing restriction activities under the No-Action alternative, the existing vegetation, habitats, and wildlife communities would be undisturbed. Because Lost Creek is located in a core area for sage-grouse, impacts on leks and sage-grouse breeding would be avoided. There would be no impact to air quality because there would be no activities to generate either fugitive dust or gaseous emissions nor would there be any noise-generating activities.

No historic or cultural resources would be disturbed under the No-Action alternative nor would there be any proposed activities that could affect the viewshed. The viewshed would consist of existing activities in the area, such as herd management and mineral exploration. There would be no additional radiological exposure to the general public other than that from background radiation levels. No additional waste streams or materials, such as construction and demolition waste, sanitary waste, or byproduct material, would be generated.

Under the No-Action alternative, there would be no impact on the socioeconomic condition of the area. No new jobs would be created, no additional revenue would accrue to the tax base, and there would be no impact on housing availability or public services. There would be no disproportionately high and adverse impact on minority and low-income populations.

8.3 Dry Yellowcake (Alternative 3)

Under Alternative 3, the applicant would construct and operate the same type of facilities as in Alternative 1 except that a rotary vacuum dryer would be used to further process the yellowcake slurry into a dry powder on-site in the processing plant. The environmental impacts on each of the 13 resource areas from implementing Alternative 3 would be similar to the impacts from the proposed action. Because the same land area would be disturbed as Alternative 1 {i.e., 115 ha [285 ac]} and the footprint of the processing plant and wellfields would not change, the effect on the herd management areas, vegetation, habitats, and wildlife, geology and soils, and historic and cultural resources would be the same as for Alternative 1. Because the proposed production from the wellfields would be the same for Alternative 3 as for Alternative 1, the impact to surface water and groundwater would be the same as for the proposed action (Alternative 1). Because the dryers would be installed inside the processing plant, there would be no additional impact on air quality, noise, and visual scenic resources under normal operating conditions. The implementation of Alternative 3 would not change the public health impacts from those described for Alternative 1 because the dryer emissions would not exhaust to the atmosphere; however, occupational health could be affected by worker handling of yellowcake powder under Alternative 3. The dryer installation and operation could require

specialized expertise compared to Alternative 1, resulting in a small socioeconomic impact. The implementation of Alternative 3 would have the greatest effect on transportation and waste management. Under Alternative 3, trucks would be transporting dry yellowcake to a processing facility in Metropolis, Illinois, a distance of 2,100 km [1,300 mi] instead of 300 km [190 mi] to near Suffolk, Wyoming as shown in Figure 4-2. The environmental impacts from implementing this alternative are summarized in Table 8-1.

8.4 References

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

Table 8-1. Summary of Environmental Consequences of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Land Use (A ternat ve 1) Sect on 4.2.1	There wou d be a SMALL mpact on and use over the fe of the proposed project because the process ng p ant and we f e ds wou d be fenced restr ct ng graz ng access and the andowner (BLM) cou d dec de to keep the eastern access road. However, because the process ng p ant covers a sma area (4 ha [10 ac]), and the we f e ds [wh ch cover approx mate y 41 ha (16.5 ac)] each, wou d be deve oped sequent a y, on y a sma area wou d be restr cted from w d fe or graz ng access at any g ven t me. If the andowner (BLM) w shes to ma nta n the eastern access road, an add t ona 13 ha [31 ac] of and wou d be unava ab e for graz ng.	No mpact. There wou d be no rrevers b e and rretr evab e comm tment of and resources from mp ement ng the proposed act on. The durat on of the proposed act on wou d be approx mate y 12 years after wh ch t me the and cou d be rec a med and made ava ab e for other uses.	There wou d be a SMALL mpact on and use from mp ement ng the proposed act on s nce certa n areas wou d be restr cted from other uses over the fe of the project.	There wou d be no ong-term mpact on and resources from mp ement ng the proposed act on. The and wou d be ava ab e for other uses at the end of the cense per od.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
(A ternat ve 3) Sect on 4.2.3	S nce the mp ementat on of A ternat ve 3 wou d affect the same footpr nt descr bed for the proposed act on, the mpact on and use wou d be the same as descr bed for the proposed act on and certa n areas (.e., the process ng p ant and we f e ds) wou d be fenced m t ng graz ng access. The ye owcake dryer wou d be p aced n the process ng p ant; no add t ona and wou d be d sturbed.	There wou d be no rrevers b e or rretr evab e comm tment of and from add ng the ye owcake dryer (A ternat ve 3) to the uran um process ng p ant. The bu d ng footpr nt wou d not change.	The add t on of the ye owcake dryer (A ternat ve 3) to the uran um process ng fac ty wou d resu t n the same mpact descr bed for the proposed act on (A ternat ve 1) s nce the same and area wou d be affected.	There wou d be no ong-term mpact on and use as a resu t of add ng the ye owcake dryer (A ternat ve 3) to the uran um process ng fac ty. The and wou d be ava ab e for other uses at the end of the cense per od.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Transportation (A ternat ve 1) Sect on 4.3.1	There wou d be a SMALL mpact on transportat on. Dur ng a phases of the proposed act on (A ternat ve 1), sma ncreases n traff c on area roads from commuter transportat on, the sh pment of ye owcake s urry to a dryer ocat on, fo owed by ye owcake product sh pments on nat ona transportat on routes.	There wou d be an rrevers b e and rretr evab e comm tment of fue for veh c e and equ pment operat on, heat ng, commuter traff c, and reg ona transport.	Dur ng a phases of the proposed act on (A ternat ve 1), there wou d be a SMALL mpact. Sma ncreases n the number of traff c acc dents resu t ng n njur es or fata t es cou d occur. Dur ng per ods of ntense project deve opment, such as construct on and decomm ss on ng, there wou d be a not ceab e ncrease n traff c on oca roads. The gener c env ronmenta mpact statement (GEIS) conc uded the r sk from transport ng ye owcake, on exchange res n, byproduct mater a , and hazardous chem ca s was SMALL (NRC, 2009).	There wou d be no transportat on mpacts attr butab e to the proposed act on (A ternat ve 1), fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.3.3	There wou d be SMALL ncreases n both oca and reg ona traff c attr butab e to the add t on of the ye owcake dryer (A ternat ve 3), but ess oca truck traff c dur ng operat ons compared to the proposed act on s nce the ntermed ate step of transport ng ye owcake s urry to a dryer fac ty wou d not occur. The remova of dryer equ pment dur ng decomm ss on ng cou d resu t n a s ght ncrease n truck ng act v ty.	There wou d be a SMALL, but rrevers b e, comm tment of fue for transport of the dry ye owcake.	There wou d be SMALL, short-term ncreases (.e., over the fe of the project) n both oca and reg ona traff c from the add t on of the ye owcake dryer (A ternat ve 3). The staff est mated 25 sh pments per year compared to the range of 34 to 145 sh pments per year eva uated n the GEIS that resu ted n a SMALL mpact determ nat on.	There wou d be no transportat on mpacts attr butab e to A ternat ve 3, fo ow ng cense term nat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Geology and Soils (A ternat ve 1) Sect on 4.4.1	There wou d be a SMALL mpact on geo ogy and so s. Dur ng the construct on and decomm ss on ng phases of the proposed act on (A ternat ve 1), so s wou d be d sturbed by the use of earthmov ng equ pment, remova of topso , grad ng and c ear ng of and to construct access roads, and from the dr ng and p ugg ng and abandonment of we s after we f e d comp et on. Approx mate y 115 ha [285 ac] wou d be d sturbed over the fe of the project to construct we f e ds, the process ng p ant, and access roads.	There wou d be no rrevers b e or rretr evab e comm tments of geo ogy or so a though topso wou d be str pped. An area of approx mate y 24 ha [58 ac] wou d be str pped of topso . Topso sa vaged dur ng the construct on phase of the project wou d be rep aced dur ng the rec amat on and reseed ng processes.	There wou d be a SMALL mpact on geo ogy and so s. Earthmov ng act v t es wou d d sturb approx mate y 115 ha (285 ac) from the construct on of the we f e ds, process ng p ant, and access roads. Approx mate y 24 ha [58 ac] of topso wou d be str pped. Topso sa vaged dur ng the construct on phase of the project wou d be rep aced dur ng the rec amat on and reseed ng processes.	There wou d be no ong-term mpacts on geo ogy and so s fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.4.3	There wou d be no add t ona mpact to change the SMALL mpact f nd ng on geo ogy and so s from the add t on of the ye owcake dryer (A ternat ve 3), s nce the footpr nt for the process ng fac ty wou d be the same as for the proposed act on (A ternat ve 1) and there wou d be ne ther so d sturbance nor rock remova .	There wou d be no rrevers b e or rretr evab e comm tments of geo ogy or so from the add t on of the ye owcake dryer (A ternat ve 3) s nce the footpr nt from the proposed act on (A ternat ve 1) wou d be the same and no rock remova wou d occur.	There wou d be a SMALL mpact on geo ogy and so s comparab e to that descr bed for the proposed act on (A ternat ve 1) from the add t on of the ye owcake dryer (A ternat ve 3). The footpr nt of the fac ty wou d rema n unchanged from the proposed act on. No add t ona so d sturbance or rock remova wou d occur.	There wou d be no ong-term mpacts on geo ogy and so s fo ow ng cense term nat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Surface Waters and Wetlands (A ternat ve 1) Sect on 4.5.1.1	There cou d be a SMALL mpact on the ephemera surface water dra nages. Dur ng arge prec p tat on events (arge snowme t and heavy prec p tat on), stormwater runoff cou d f ow nto channe s; potent a y affect ng downstream wet ands; however, s nce surface water qu ck y nf trates or evaporates, and the c osest so ated wet and s approx mate y 8.7 km [5.4 m] downstream from the proposed project area, the mpact wou d be SMALL. The app cant's mp ementat on of best management pract ces wou d m t gate the potent a mpact. No jur sd ct ona wet ands occur on or near the s te.	There wou d be ne ther an rrevers b e nor rretr evab e comm tment of surface water or wet and resources s nce these do not occur on the proposed project area and the c osest so ated wet and s ocated 8 km [5 m] downstream from the proposed project area.	No mpact. The proposed act on w not d scharge to ephemera surface water dra nages.	No mpact. The proposed act on w not d scharge to ephemera surface water dra nages.
(A ternat ve 3) Sect on 4.5.1.3	There wou d be a SMALL mpact on the ephemera surface water dra nages. The est mated mpact on the surface water ephemera dra nages and downstream wet ands wou d be the same as descr bed for the proposed act on.	There wou d be ne ther an rrevers b e nor rretr evab e comm tment of surface water or wet and resources s nce these do not occur on the proposed project area.	The est mated mpact on surface water wou d be the same as descr bed for the proposed act on (A ternat ve 1).	No mpact. The proposed act on w not d scharge to ephemera surface water dra nages.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Groundwater (Alternative 1) Section 4.5.2.1	There would be an impact on groundwater from implementing the proposed action (Alternative 1) by consumption of groundwater, degradation of water quality in the ore production zone, and the drawdown in water levels affecting wells located outside the project boundaries that are drilled into the ore-bearing aquifer. There would be three stock wells adversely affected by drawdown. The groundwater chemistry could be affected by spills, leaks, and excursions over the ISR facility lifecycle.	About 99 percent of the groundwater used during the ISR process would be treated and re-injected into the subsurface; however, about one percent of the groundwater would be consumed.	Short-term impacts from consumptive use (drawdown of the aquifer) during operations and aquifer restoration could result in a MODERATE impact. However, the applicant's implementation of mitigative measures could reduce this impact to SMALL. The water level in wells surrounding the proposed project area would be affected and the water quality in the production zone would be degraded. However, the affected aquifer contains naturally occurring high levels of radionuclides that exceed both state and Federal drinking water standards.	Both the State of Wyoming and NRC require restoration of affected groundwater following operations. The groundwater quality would be restored to ensure that aquifers would not be affected. Although water levels would be affected in the short-term, the water levels should eventually recover with time.
(Alternative 3) Section 4.5.2.3	The impact on groundwater from implementing Alternative 3 would be the same as described for the proposed action. There would be no effect on groundwater quality from adding a yellowcake dryer (Alternative 3), since groundwater would neither be used for the operation of the dryer nor would liquid effluent be discharged beyond that considered for the proposed action (Alternative 1).	Like the proposed action, about 99 percent of the groundwater used during the ISR process for the yellowcake dryer alternative (Alternative 3) would be treated and re-injected into the subsurface; however, about one percent of the groundwater would be consumed.	The short-term impact on groundwater from the addition of the yellowcake dryer (Alternative 3) would be the same, as described for the proposed action (Alternative 1) because the unit would neither use groundwater nor directly discharge liquid effluent to groundwater.	Both the State of Wyoming and NRC require restoration of affected groundwater following operations. The groundwater quality would be restored to ensure that surrounding aquifers would not be affected. Although water levels would be affected in the short-term, the water levels should eventually recover with time.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Ecological Resources (A ternat ve 1) Sect on 4.6.1	Under A ternat ve 1 (the proposed act on), there wou d be a SMALL mpact on vegetat on, b g game, up and game b rds, raptors, waterfow and shoreb rds, nongame/m gratory b rds, other mamma s, rept es and amph b ans. S nce the proposed Lost Creek ISR Project s ocated n a Greater sage-grouse core area, remova of vegetat on, hab tat fragmentat on, ncreased no se and traff c, and d sp acement of w d fe spec es wou d resu t n MODERATE oca mpacts on protected spec es and other sens t ve spec es that depend on the sagebrush shrub and hab tat type. The app cant has comm tted to mp ement m t gat ve measures to reduce the potent a mpact on the Greater sage-grouse as we as other w d fe spec es.	Vegetat ve commun t es d rect y mpacted by earthmov ng act v t es (sagebrush) and w d fe njur es and morta t es wou d be rrevers b e. However, the mp ementat on of m t gat ve measures such as the use of seasona t m ng restr ct ons, fenc ng to m t w d fe movement, bury ng power nes, and the app cant's enforcement of speed m ts wou d reduce the potent a mpact to w d fe. Furthermore, areas mpacted by earthmov ng act v t es wou d be rec a med and reseeded.	Dur ng any of the ISR phases, d rect mpacts to eco og ca resources from mp ement ng A ternat ve 1 (the proposed act on) cou d nc ude njur es and fata t es caused by e ther co s ons w th project-re ated traff c or hab tat destruct on from topso remova . Most hab tat d srupt on wou d cons st of c ear ng and deve op ng the we f e ds, wh ch wou d not resu t n arge transformat on of the ex st ng hab tat. W d fe cou d a so be d sp aced by ncreased no se, traff c, and structures. The Federa y- sted cand date spec es, the Greater sage-grouse, s known to occur n the v c n ty of the proposed Lost Creek ISR Project: e even eks occur w th n a 6.4-km [4-m] rad us of the proposed project area. The app cant has comm tted to mp ement m t gat ve and mon tor ng measures to reduce the potent a mpact on the Greater sage-grouse as we as other w d fe spec es.	Some of the vegetat ve commun t es that ex st w th n the proposed Lost Creek ISR Project cou d be d ff cu t to reestab sh through art f c a p ant ngs and natura seed ng cou d take many years. Spec es assoc ated w th the affected vegetat ve commun t es cou d e ther be reduced n number or rep aced by genera st spec es.
(A ternat ve 3) Sect on 4.6.3	Impacts on eco og ca resources under A ternat ve 3 (add t on of the ye owcake dryer) wou d be the same as descr bed for the proposed act on (.e., SMALL for vegetat on, MODERATE for certa n protected spec es) s nce the footpr nt of the process ng p ant wou d not change, thus avo d ng ground d sturbance and vegetat on remova .	The rrevers b e or rretr evab e comm tment of eco og ca resources from mp ement ng A ternat ve 3 wou d be the same as descr bed for the proposed act on.	The short-term mpact and uses of the env ronment wou d be the same under A ternat ve 3 as descr bed for the proposed act on because the footpr nt of the process ng p ant wou d not change, thus avo d ng ground d sturbance and vegetat on remova .	The ong-term mpact from mp ement ng A ternat ve 3 wou d be the same as descr bed for A ternat ve 1 s nce the same act v t es wou d occur that cou d potent a affect eco og ca resources and the construct on footpr nt wou d be the same.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Air Resources (A ternat ve 1) Sect on 4.7.1	There wou d be a SMALL mpact except near the Town of Ba ro where there cou d be a MODERATE mpact to peop e res d ng on transportat on routes from fug t ve dust em ss ons generated by trave on unpaved roads. Dur ng mp ementat on of the proposed act on there wou d be ncreased fug t ve dust, veh c e and equ pment em ss ons from earthmov ng act v t es to construct the process ng p ant, dr we s and deve op the we f e ds, ay p pe ne, and construct access roads. S m ar mpacts wou d be exper enced dur ng the decomm ss on ng phase. There wou d be a SMALL mpact on a r qua ty dur ng a ISR phases from veh cu ar traff c on unpaved roads, except through the Town of Ba ro , and from d ese em ss ons from project equ pment.	There wou d be no rrevers b e or rretr evab e comm tment of a r resources from mp ement ng the proposed act on.	There wou d be a temporary, short-term mpact on a r qua ty pr mar y dur ng the construct on and decomm ss on ng phases of the proposed act on due to earthmov ng act v t es and from veh c e em ss ons. Th s effect wou d be temporary and h gh y oca zed, and wou d be further reduced by the app cant's mp ementat on of m t gat ve measures to contro fug t ve dust. There wou d a so be an nterm ttent, MODERATE mpact from fug t ve dust em ss ons to those res d ng on transportat on routes from trave on unpaved roads through the Town of Ba ro dur ng any of the ISR phases.	No mpact. There wou d be no ong-term effect on a r qua ty e ther from mp ement ng the proposed act on or fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.7.3	There wou d be no mpact on a r qua ty from mp ement ng A ternat ve 3 beyond that descr bed for the proposed act on. A vacuum dryer s des gned for no em ss ons to exhaust to the atmosphere.	There wou d be no rrevers b e or rretr evab e comm tment of a r resources from mp ement ng the proposed act on.	The short-term mpact from mp ement ng A ternat ve 3 wou d be the same as descr bed for the proposed act on (A ternat ve 1). Fug t ve dust em ss ons wou d be generated from trave on unpaved road surfaces. Under A ternat ve 3, there wou d be ess oca traff c from sh pp ng ye owcake s urry s nce dr ed ye owcake wou d be generated ons te.	No mpact. There wou d be no ong-term mpact on a r resources from the add t on of the ye owcake dryer fo ow ng cense term nat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Noise (A ternat ve 1) Sect on 4.8.1	Dur ng the ISR construct on phase of A ternat ve 1, no se eve s wou d be e evated on, and n the v c n ty of, the s te. However, s nce the nearest res dent s ocated approx mate y 24 km [15 m] from the proposed project area, the mpact on the pub c wou d be SMALL at that ocat on. For those v ng w th n 300 m [1,000 ft] of transportat on routes n sma er commun t es, the no se mpact cou d be MODERATE, but nterm ttent. Dur ng the other ISR phases, no se eve s at the s te wou d be ess than dur ng the ISR construct on phase.	Not app cab e.	There wou d be a SMALL mpact at the ocat on of the nearest res dent (24 km [15 m]) from the proposed project area and an nterm ttent, but MODERATE mpact for those v ng w th n 300 m [1,000 ft] of transportat on routes through sma er commun t es.	No mpact. There wou d be no no se mpact from mp ement ng the proposed act on fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.8.3	The no se mpact from mp ement ng A ternat ve 3 wou d be SMALL s nce no res dences, commun t es, and sens t ve areas are ocated w th n 300 m [1,000 ft] of transportat on routes. There wou d no effect on the nearest res dent s nce th s person s ocated 24 km [15 m] from the proposed project area.	Not app cab e.	The short-term mpact from mp ement ng A ternat ve 3 wou d be SMALL s nce d fferent oca transportat on routes wou d be used compared to the proposed act on. No res dences, commun t es, and sens t ve areas are ocated w th n 300 m [1,000 ft] of the oca transportat on route and the nearest res dent s ocated 24 km [15 m] from the proposed project area.	No mpact. There wou d be no ong-term no se mpact from the add t on of the ye owcake dryer (A ternat ve 3). The equ pment wou d be decomm ss oned after 7 years of operat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Historical, Cultural, and Paleontological Resources (A ternat ve 1) Sect on 4.9.1	Dur ng construct on of the proposed act on (A ternat ve 1), there wou d be a MODERATE mpact to cu tura and h stor c resources dur ng the ISR construct on phase. To m t gate the mpact, the NRC, BLM, SHPO, Tr bes, and the app cant deve oped and executed a Memorandum of Agreement wh ch forma zed the treatment p an for s te 48SW16604 wh ch wou d be adverse y affected dur ng construct on. If other NRHP-e g b e s tes cannot be avo ded, then treatment p ans wou d be deve oped. If other h stor c and cu tura resources were encountered dur ng the ISR fecyc e, then the app cant wou d not fy the appropr ate author t es per the MOA and nadvertent d scovery prov s on.	If h stor c and archaeo og ca s tes cou d not be avo ded dur ng the ISR fecyc e, then th s cou d resu t n an rrevers b e and rretr evab e oss of archeo og ca resources.	Imp ementat on of the proposed act on (A ternat ve 1) wou d resu t n the remova of an archeo og ca s te. The mpact has been m t gated by the negot at on of a MOA.	If potent a mpacts from mp ementat on of the proposed act on are not m t gated, then ong-term mpacts to archeo og ca s tes wou d resu t.
(A ternat ve 3) Sect on 4.9.3	Imp ementat on of A ternat ve 3 wou d resu t n the same MODERATE mpact to h stor c and cu tura resources as the proposed act on (A ternat ve 1) s nce there wou d be no ncrease n the footpr nt of e ther the process ng fac ty or the we f e ds that wou d resu t n ground d sturbance.	L ke the proposed act on (A ternat ve 1), f h stor c and archaeo og ca s tes cou d not be avo ded dur ng the ISR fecyc e, then th s cou d resu t n an rrevers b e and rretr evab e oss of archeo og ca resources.	Imp ementat on of the add t on of the ye owcake dryer (A ternat ve 3) wou d resu t n the remova of an archeo og ca s te. The mpact has been m t gated by the negot at on of a MOA.	If potent a mpacts from mp ementat on of A ternat ve 3 are not m t gated, then ong-term mpacts to archeo og ca s tes wou d resu t.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Visual and Scenic Resources (A ternat ve 1) Sect on 4.10.1	Dur ng a phases of the ISR project there cou d be a SMALL short-term mpact on the v sua sett ng from the passage of traff c on un mproved roads. Dur ng the ISR construct on and decomm ss on ng phases, there cou d be a short-term, MODERATE mpact from earthmov ng act v t es that generate fug t ve dust. However, the proposed act v t es at the proposed Lost Creek ISR Project are cons stent w th the BLM VRM C ass III des gnat on.	No mpact.	There wou d be a SMALL short-term mpact to the v sua andscape from mp ement ng the proposed act on wh ch wou d be cons stent w th the BLM VRM C ass III des gnat on of the area and the ex st ng m nera extract on act v t es ongo ng n the area, and because of the remoteness of the area.	No mpact. There wou d be no mpact on the v sua andscape from the proposed act on fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.10.3	There wou d be no mpacts on v sua and scen c resources from mp ement ng A ternat ve 3 beyond that descr bed for the proposed act on s nce the dry ng equ pment wou d be comp ete y conta ned w th n the process ng p ant.	No mpact.	No short-term mpacts on v sua and scen c resources wou d occur from the add t on of the ye owcake dryer (A ternat ve 3) beyond that descr bed for the proposed act on (A ternat ve 1), s nce the equ pment wou d be comp ete y conta ned w th n the process ng p ant.	No mpact. There wou d be no mpact on the v sua andscape from the proposed act on fo ow ng cense term nat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Socioeconomic (A ternat ve 1) Sect on 4.11.1	Imp ement ng the proposed act on (A ternat ve 1) wou d have a SMALL soc oeconom c mpact over the fe of the project.	Not app cab e.	Imp ement ng the proposed act on wou d have a SMALL mpact on the oca commun t es.	Fo ow ng cense term nat on, workers who supported act v t es at the Lost Creek s te wou d need to f nd other emp oyment. There wou d be a oss of revenue to nearby commun t es, Sweetwater County, and the State fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.11.3	Imp ement ng A ternat ve 3 (add t on of a ye owcake dryer) wou d have a SMALL soc oeconom c mpact over the fe of the project because a comparab e number of workers wou d be emp oyed.	Not app cab e.	Imp ement ng A ternat ve 3 (add t on of a ye owcake dryer) wou d have a SMALL mpact on soc oeconom c cond t ons over the fe of the project because a comparab e number of workers wou d be emp oyed.	Fo ow ng cense term nat on, workers who supported act v t es at the Lost Creek s te wou d need to f nd other emp oyment. There wou d be a oss of revenue to Sweetwater County fo ow ng cense term nat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Environmental Justice (A ternat ve 1) Sect on 4.12.1	There wou d be no d sproport onate y h gh and adverse mpacts to m nor ty or ow- ncome popu at ons from the construct on, operat on, aqu fer restorat on, and decomm ss on ng of the proposed Lost Creek ISR Project under the proposed act on (A ternat ve 1).*	Not app cab e.*	There wou d be no d sproport onate y h gh and adverse mpacts to m nor ty or ow- ncome popu at ons from the construct on, operat on, aqu fer restorat on, and decomm ss on ng of the proposed Lost Creek ISR Project under the proposed act on (A ternat ve 1).	None.
(A ternat ve 3) Sect on 4.12.3	There wou d be no d sproport onate y h gh and adverse mpacts to m nor ty or ow- ncome popu at ons from the construct on, operat on, aqu fer restorat on, and decomm ss on ng of the proposed Lost Creek ISR Project under A ternat ve 3.	Not app cab e.*	There wou d be no d sproport onate y h gh and adverse mpacts to m nor ty or ow- ncome popu at ons from the construct on, operat on, aqu fer restorat on, and decomm ss on ng of the proposed Lost Creek ISR Project under A ternat ve 3.	None.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Public and Occupational Health and Safety (A ternat ve 1) Sect on 4.13.1	There wou d be a SMALL mpact on pub c and occupat ona hea th from mp ement ng the proposed act on. Construct on and decomm ss on ng wou d generate fug t ve dust em ss ons that wou d not resu t n a s gn f cant dose to the pub c or s te workers. The em ss ons from construct on equ pment wou d be of short durat on, read y d spersed nto the atmosphere, the preva ng w nd d rect on s away from the ocat on of the nearest res dence.	Not app cab e.	There wou d be a SMALL mpact from rad o og ca exposure. The h ghest ca cu ated dose for a hypothet ca person v ng n the southeast corner of the proposed project area wou d resu t n a dose that s 3 percent of the 1mSv [100 mrem] dose m t spec f ed n NRC regu at ons. The rad o og ca mpacts from acc dents wou d be SMALL for workers f procedures to dea w th acc dent scenar os were fo owed, and SMALL for the pub c because of the fac ty's remote ocat on. The nonrad o og ca pub c and occupat ona hea th mpacts from norma operat ons, acc dents, and chem ca exposures wou d be SMALL f the app cant's hand ng and storage procedures were fo owed.	No mpact. There wou d be no ong-term mpact to pub c and occupat ona hea th fo ow ng cense term nat on.
(A ternat ve 3) Sect on 4.13.3	There cou d be a potent a ncreased worker r sk from the add t on of the ye owcake dryer (A ternat ve 3) because the operat ons of a dryer fac ty wou d requ re add t ona hand ng and process ng of rad oact ve mater a resu t ng n SMALL ncrementa mpacts to workers and the pub c under norma operat ons. The GEIS conc uded there cou d be a MODERATE mpact to workers from an unm t gated dryer acc dent.	Not app cab e.	There wou d be a potent a ncreased short-term r sk to workers from the add t ona hand ng requ rements. However, the pub c and occupat ona mpacts wou d be bounded by the cond t ons descr bed n the GEIS.	No mpact. There wou d be no ong-term mpact to pub c and occupat ona hea th fo ow ng cense term nat on.

Table 8-1. Summary of Environmental Consequences of the Proposed Action (continued)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Waste Management (A ternat ve 1) Sect on 4.14.1	Dur ng a phases of the proposed act on (A ternat ve 1), generat on of ow vo umes of wastes wou d resu t n a SMALL mpact on d sposa capac ty, s nce perm tted fac t es are ava ab e to accept the waste. Construct on wastes wou d be most y nonhazardous so d wastes such as scrap meta and other bu d ng mater a s. Operat ons wastes wou d nc ude both rad o og ca and nonrad o og ca so ds and qu ds (br ne, p ant wash down water, and others), and decomm ss on ng wastes wou d nc ude both rad o og ca and nonrad o og ca wastes (both so d and qu d). S nce the d sposa of qu d eff uent wou d have to comp y w th WDEQ UIC perm t requ rements, the NRC staff conc uded the mpact wou d be SMALL.	Dur ng a phases of the proposed act on (A ternat ve 1), energy and space used to proper y hand e and d spose of a types of waste wou d represent an rrevers b e comm tment of resources, resu t ng n a SMALL mpact.	Dur ng a phases of the proposed act on (A ternat ve 1), hazards assoc ated w th hand ng and transport of wastes wou d represent a short-term and SMALL mpact. S nce the d sposa of qu d eff uent wou d have to comp y w th WDEQ UIC perm t requ rements, the NRC staff conc uded the mpact wou d be SMALL.	Dur ng a phases of the proposed act on (A ternat ve 1), permanent d sposa or storage of both rad o og ca and nonrad o og ca wastes wou d represent a ong-term, but SMALL, mpact on the product v ty of the and a ocated for these act v t es. S nce the d sposa of qu d eff uent wou d have to comp y w th WDEQ UIC perm t requ rements, the NRC staff conc uded the mpact wou d be SMALL.
(A ternat ve 3) Sect on 4.14.3	The waste management mpacts from mp ement ng A ternat ve 3 (the add t on of the ye owcake dryer) wou d be the same as that descr bed for the proposed act on s nce approx mate y the same vo ume of so d waste and qu d eff uent wou d be generated.	Dur ng a phases of A ternat ve 3, energy and space used to proper y hand e and d spose of a types of waste wou d represent an rrevers b e comm tment of resources, resu t ng n a SMALL mpact.	Dur ng a phases under A ternat ve 3, hazards assoc ated w th hand ng and transport of wastes wou d represent a short-term and SMALL mpact.	Dur ng a phases of A ternat ve 3, permanent d sposa or storage of both rad o og ca and nonrad o og ca wastes wou d represent a ong-term, but SMALL, mpact on the product v ty of the and a ocated for these act v t es.

*Sect on 4.12.1 of th s SEIS conc uded that there are no d sproport onate y h gh and adverse mpacts to m nor ty or ow- ncome popu at ons from the Lost Creek Project.

9 LIST OF PREPARERS

This section documents all individuals who were involved with the preparation of this final Supplemental Environmental Impact Statement (SEIS). Contributors include staff from the U.S. Nuclear Regulatory Commission (NRC) and consultants. Each individual's role, education, and experience are outlined as follows.

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10 DISTRIBUTION LIST

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APPENDIX A

CONSULTATION CORRESPONDENCE

CONTENTS

TABLE

Section Page

A CONSULTATION CORRESPONDENCE

A.1 Consultation Correspondence

The Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966 require that Federal agencies consult with applicable State and Federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historic and archaeological resources. This appendix contains consultation documentation related to these Federal acts.

Table A-1. Chronology of Consultation Correspondence

Author	Recipient	Date of Letter	ADAMS Accession Number
Wyoming State Parks and Cultural Resources (J. Daniele)	U.S. Department of Interior, Bureau of Land Management (P. Madigan)	July 24, 2008	ML110560623
Wyoming State Parks and Cultural Resources (J. Daniele)	U.S. Department of Interior, Bureau of Land Management (P. Madigan)	July 24, 2008	ML110560824
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming State Historic Preservation Office (M. Hopkins)	October 3, 2008	ML082620425
U.S. Nuclear Regulatory Commission (G. Suber)	U.S. Fish and Wildlife Service (B. Kelly)	October 3, 2008	ML082680219
U.S. Department of Interior, Bureau of Land Management (W. Hill)	Centennial Archaeology. Inc. (C. Zier)	October 16, 2008	ML110590540
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (G. Suber)	October 23, 2008	ML083100218
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming Game and Fish Department (T. Christiansen)	October 29, 2008	ML082960565
U.S. Fish and Wildlife Service (B. Kelly)	U.S. Nuclear Regulatory Commission (G. Suber)	November 12, 2008	ML083290451
U.S. Nuclear Regulatory Commission (A. Kock)	Shoshone Business Council (I. Posey)	January 28, 2009†	ML090230476
U.S. Nuclear Regulatory Commission (I. Yu, B. Shroff, and A. Bjornsen)	U.S. Nuclear Regulatory Commission (A. Kock)	March 2, 2009	ML090230476
U.S. Nuclear Regulatory Commission (P. Bubar)	Eastern Shoshone Tribe (A. Shoyo)	June 17, 2009	ML103470608
U.S. Nuclear Regulatory Commission (L. Camper)	Wyoming State Historic Preservation Office (R. Currit)	June 30, 2009	ML091260663
U.S. Nuclear Regulatory Commission (S. Cohen)	U.S. Fish and Wildlife Service (B. Kelly)	October 19, 2009	ML092580128

Table A-1. Chronology of Consultation Correspondence (continued)

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Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (S. Cohen)	December 10, 2009	ML093440852
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission	January 25, 2010	ML100350395
U.S. Nuclear Regulatory Commission (L. Camper)	Wyoming State Historic Preservation Office (M. Hopkins) Wyoming State Historic Preservation Office (R. Currit) U.S. Department of Interior, Bureau of Land Management, State Office (W. Hill) U.S. Department of Interior, Bureau of Land Management, Rawlins Field Office (P. Madigan) UR-Energy USA (W. Heili) Northern Arapaho Tribe (H. Spoonhunter) Shoshone Business Council (I. Posey) U.S. Attorney General's Office (D. Gerstein)	August 24, 2010†	ML102010050
U.S. Nuclear Regulatory Commission (L. Camper)	U.S. Attorney General's Office (D. Gerstein) Wyoming State Historic Preservation Office (M. Hopkins) Shoshone Business Council (I. Posey) Northern Arapaho Tribe (H. Spoonhunter) UR-Energy USA (W. Heili) U.S. Department of Interior, Bureau of Land Management, Rawlins Field Office (P. Madigan) U.S. Department of Interior, Bureau of Land Management, State Office (W. Hill) Wyoming State Historic Preservation Office (R. Currit)	November 26, 2010†	ML103210133
U.S. Nuclear Regulatory Commission (L. Camper)	Advisory Council on Historic Preservation (R. Nelson)	January 13, 2011	ML103470098

†Similar letters were sent to multiple parties.

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Jul 24, 2008

Patrick Madigan
Bureau of Land Management PM 8-11-08
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Re: Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming (SHPO File # 0708JRD021)

Dear Mr. Madigan:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your determination that site 48SW16604 is eligible for listing in the National Register of Historic Places.

We agree that site 48SW16604 will be adversely impacted. We recommend the BLM/SHPO Protocol be followed:

1. Data Recovery Plan: If the historic property is eligible for inclusion in the National Register under Criterion D only, and the adverse effect will be minimized by data recovery, then the BLM will prepare a data recovery plan and follow the procedures in Section VII.A of this Protocol. A Memorandum of Agreement is not required to implement the data recovery plan.

Please refer to SHPO project #0708JRD021 on any future correspondence regarding this project. If you have any questions, please contact Joseph Daniele, Archaeologist/Review and Federal Consultation at 307-777-8793.

Sincerely,

Joseph Daniele
Wyoming State Historic Preservation Office

RECEIVED

AUG 11 2008

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Re: Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming (SHPO File # 0708JRD021)

Dear Mr. Madigan:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your determination that site 48SW16604 is eligible for listing in the National Register of Historic Places.

We agree that site 48SW16604 will be adversely impacted. We recommend the BLM/SHPO Protocol be followed.

1. Data Recovery Plan. If the historic property is eligible for inclusion in the National Register under Criterion D only, and the adverse effect will be minimized by data recovery, then the BLM will prepare a data recovery plan and follow the procedures in Section VII.A of this Protocol. A Memorandum of Agreement is not required to implement the data recovery plan.

Please refer to SHPO project #0708JRD021 on any future correspondence regarding this project. If you have any questions, please contact Joseph Daniele, Archaeologist/Review and Federal Consultation at 307-777-8793.

Sincerely,

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RECEIVED

Bureau of Land Management
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October 3, 2008

Ms. Mary Hopkins
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Wyoming State Historic Preservation Office
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SUBJECT: INITIATION OF SECTION 106 PROCESS FOR LOST CREEK ISR, LLC'S LOST CREEK URANIUM RECOVERY PROJECT LICENSE REQUEST (Docket 040-09068)

Dear Ms. Hopkins:

The U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC for a new radioactive source materials license to develop and operate the Lost Creek Uranium Recovery Project (an *in-situ* leach operation) located in Sweetwater County, WY. The project area consists of approximately 4,200 acres of public land, administered by the U.S. Bureau of Land Management (BLM) and the State of Wyoming. The project area lies within Township 25 north and ranges 92 and 93 west of the Sixth Principal Meridian, and is centered approximately at 42 degrees 8 minutes North latitude and 107 degrees 51 minutes West longitude. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations,* Part 51 (10 CFR 51) is the NRC regulation that implements the National Environmental Policy Act of 1969, as amended. The agency is currently preparing an environmental assessment (EA) for the proposed action that would tier off a Generic Environmental Impact Statement currently undergoing public review. In accordance with Section 106 of the National Historic Preservation Act, the EA would include an analysis of potential impacts to historic and cultural resources. To support the environmental review, the NRC is requesting information from the State Historical Preservation Officer to facilitate the identification of historic and cultural resources that may potentially be affected by the Lost Creek Uranium Recovery Project license application. Any information you provide would be used to enhance the scope and quality of NRC staff's review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

Lost Creek ISR, LLC's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc .gov/reading-rm/adams.html. The accession number for the application is ML073190550.

M. Hopkins 2

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan Bjornsen of my staff by telephone at 301-415-1195 or by email at alan.bjornsen@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief
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Office of Federal and State Materials and
Environmental Management Programs

Docket No.: 040-09068

Enclosure:
Lost Creek ISR, LLC Proposed Area

October 3, 2008

Brian T. Kelly, Field Supervisor
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SUBJECT: REQUEST FOR INFORMATION REGARDING ENDANGERED OR THREATENED SPECIES AND CRITICAL HABITAT FOR THE PROPOSED LICENSE APPLICATION FOR LOST CREEK ISR, LLC'S LOST CREEK URANIUM RECOVERY PROJECT (Docket 040-09068)

Dear Mr. Kelly:

The U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC for a new radioactive source materials license to develop and operate the Lost Creek Uranium Recovery Project (an *in-situ* leach operation) located in Sweetwater County, WY. The project area consists of approximately 4,200 acres of public land, administered by the U.S. Bureau of Land Management (BLM) and the State of Wyoming. The project area lies within Township 25 north and ranges 92 and 93 west of the Sixth Principal Meridian, and is centered approximately at 42 degrees 8 minutes North latitude and 107 degrees 51 minutes West longitude. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations,* Part 51 (10 CFR 51) is the NRC regulation that implements the National Environmental Policy Act of 1969, as amended. The agency is currently preparing an environmental assessment (EA) for the proposed action that would tier off a Generic Environmental Impact Statement currently undergoing public review. In accordance with Section 7 of the Endangered Species Act, the EA would include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC is requesting information from the U.S. Fish and Wildlife Service to facilitate the identification of endangered or threatened species or critical habitat that may potentially be affected by the Lost Creek Uranium Recovery Project license application. Any information you provide would be used to enhance the scope and quality of NRC staff's review in accordance with 10 CFR 51 and 50 CFR 402. After reviewing all the information collected, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

Lost Creek ISR, LLC's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML073190550.

B. Kelly 2

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T 8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan Bjornsen of my staff by telephone at 301-415-1195 or by email at alan.bjornsen@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief
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Environmental Protection and Performance
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Division of Waste Management
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and Environmental Management Programs

Docket No.: 040-09068

Enclosure:
Lost Creek ISR, LLC Proposed Area

Rawlins

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

TAKE PRIDE IN AMERICA

In Reply Refer To:
8151 (930)
568-WY-AR09
RCapron

OCT 16 2008

Dr. Christian J. Zier
Centennial Archaeology, Inc.
300 East Boardwalk, Building 4-C
Fort Collins, CO 80525

Dear Dr. Zier:

We are pleased to provide you with a Wyoming Bureau of Land Management (BLM) Cultural Resource Use Permit No. 568-WY-AR09. This permit authorizes data recovery at 48SW16604, associated with the Lost Creek IR project. The specific location is identified on the permit. This archaeological site is on land administered by the Wyoming Bureau of Land Management, Rawlins Field Office. All activities should be coordinated with Tim Marshall. Work is authorized from October 20, 2008, through October 19, 2009.

All work and reporting requirements must follow the approved data recovery plan unless prior approval for modification is made with BLM RFO. Mr. Christopher C. Kinneer is required to carry a copy of the permit with him while in the field.

If you have any questions about this permit, please contact Ranel S. Capron at (307) 775-6108 or via e-mail at Ranel_Capron@blm.gov.

Sincerely,

Ranel Stephenson Capron

for William M. Hill
Deputy State Director,
Resources Policy and Management

Attachment

ARTS. PARKS.
HISTORY.
Wyoming State Parks & Cultural Resources

State Historic Preservation Office
Barrett Building, 3rd Floor
2301 Central Avenue
Cheyenne, WY 82002
Phone: (307) 777-7697
Fax: (307) 777-6421
http://wyoshpo.state.wy.us

October 23, 2008

Gregory F. Suber, Chief
Environmental Review Branch
U.S. Nuclear Regulatory Commission
Mail Stop T-8F05
Washington, D.C. 20555

re: Lost Creek ISR, LLC., Lost Creek Uranium Recovery Project License Request (Docket 040-09068) (SHPO File # 1008RLC009)

Dear Mr. Suber:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project.

A search of our records shows that several cultural resource surveys have been conducted in the area of potential effect, but that the majority of the project area has yet to be surveyed for cultural resources. Following 36 CFR Part 800, and prior to any ground disturbing activities, we recommend the U.S. Nuclear Regulatory Commission carry out appropriate efforts necessary for identification of historic properties, which may include a file search, background research, consultation, consideration of visual effects, sample field investigations or field survey. The identification efforts must be conducted by a consultant meeting the Secretary of the Interior's Professional Qualification Standards (48 FR 22716, Sept. 1983). A report detailing the results of these efforts must be provided to SHPO staff for our review and comment. Further, we recommend that you coordinate these efforts closely with the Rock Springs Field Office of the U.S.D.I. Bureau of Land Management

We have enclosed a copy of a cultural resource consultants list for your use. Please refer to SHPO project control number #1008RLC009 on any future correspondence dealing with this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

A–10

October 29, 2008

Tom Christiansen
Sage Grouse Coordinator
Wyoming Game and Fish Department
Green River Field Office
351 Astle Avenue
Green River, WY 82935

SUBJECT: REQUEST FOR INFORMATION REGARDING SAGE GROUSE HABITATS FOR THE PROPOSED LICENSE APPLICATION FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT (Docket 040-09067)

Dear Mr. Christiansen:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently-licensed *in-situ* recovery projects, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 7 of the Endangered Species Act, the EA will include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC requested information from the U.S. Fish and Wildlife Service (FWS) to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. According to a letter sent to the NRC from the FWS dated August 1, 2008, the FWS indicated that they are currently conducting a review to determine if the greater sage-grouse warrants listing and that you may have more information on the greater sage-grouse habitats within the project area and appropriate mitigative measures to minimize potential impacts to the species. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

T. Christiansen - 2 -

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission, Attention: Mr. Gregory F. Suber, Mail Stop T8F05, Washington, DC 20555. If you have any questions, please contact Ms. Irene Yu of my staff by telephone at 301-415-1951 or by email at Irene.Yu@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure: Uranerz Energy Corporation Figure 1-4

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road – Suite 308
Cheyenne, Wyoming 82009

In Reply Refer To:

ES/61411/W.26 /WY09SL0021

NOV 1 2 2008

Mr. Gregory F. Suber
U.S. Nuclear Regulatory Commission
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials and
Environmental Programs
Washington, D.C. 20555-0001

Dear Mr. Suber:

Thank you for your letter of October 3, 2008 requesting information on endangered or threatened species and critical habitat for the proposed Lost Creek uranium in-situ recovery facility (docket 040-09068) in Sweetwater County, Wyoming.

In response to your letter, the Service is providing you with information on (1) federally listed species, (2) migratory birds, (3) wetland and riparian areas, and (4) sensitive species. The Service provides recommendations for protective measures for federally listed species in accordance with the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.). Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j.

Threatened and Endangered Species

The following threatened and endangered species may occur in Sweetwater County, and could also occur on or near this project site. If you determine that the proposed project may affect any of the following listed species, please contact our office to discuss consultation requirements under the Act.

SPECIES	STATUS	HABITAT
Black-footed ferret (*Mustela nigripes*)	Endangered	Prairie dog towns
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Seasonally moist soils and wet meadows of drainages below 7000 feet

Black-footed ferret: Black-footed ferrets may be affected if prairie dog towns are impacted. Please be aware that black-footed ferret surveys are no longer recommended in black-tailed prairie dog towns statewide. However, we encourage you to protect all prairie dog towns for their value to the prairie ecosystem and the myriad of species that rely on them.

If a field check indicates that prairie dog towns may be affected, you should contact this office for guidance on ferret surveys.

Ute ladies'-tresses: Ute ladies'-tresses is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically include fine silt/sand, gravels and cobbles, and highly organic, peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens.

Migratory Birds

Please recognize that consultation on listed species may not remove your obligation to protect the many species of migratory birds, including eagles and other raptors, protected under the MBTA and BGEPA. Of particular focus are the species identified in the Service's *Birds of Conservation Concern 2002*. In accordance with the Fish and Wildlife Coordination Act (16 USC 2912 (a)(3)), this report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Act. This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners and is available at http://www.fws.gov/migratorybirds/reports/bcc2002.pdf.

The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

In order to promote the conservation of migratory bird populations and their habitats, the Service recommends that your agency implement those strategies outlined within the Memorandum of Understanding directed by the President of the U.S. under the Executive Order 13186, where possible. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

***In situ* Uranium Mining**

High selenium concentrations can occur in wastewater from in situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of a grassland irrigated with wastewater from an *in situ* uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the *in situ* wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving *in situ* wastewater. Waterborne selenium concentrations ≥ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994) which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 µg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 µg/L.

Wetlands/Riparian Areas

Wetlands perform significant ecological functions, which include: (1) providing habitat for aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. The Service recommends measures be taken to avoid and minimize wetland losses in accordance with Section 404 of the Clean Water Act, and Executive Order 11988 (floodplain management) as well as the goal of "no net loss of wetlands." If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins,

erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and stream banks.

Sensitive Species

Mountain Plover: Although the Service has withdrawn the proposal to list the mountain plover (*Charadrius montanus*) and we will no longer be reviewing project impacts to this species under the Act, we continue to encourage conservation of this species as it remains protected under the MBTA. Measures to protect the mountain plover from further decline may include (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. We strongly encourage the development of protective measures with an assurance of implementation should mountain plovers be found within the project area.

Greater Sage-grouse: The Service has determined that the greater sage-grouse (*Centrocercus urophasianus*) does not warrant listing at this time. However, the Service continues to have concerns regarding sage-grouse population status. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations range-wide (Braun 1998, Wisdom *et al.* 2002). Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting or brood rearing habitat) is present in the project area, the Service recommends no project-related disturbance March 1 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage-grouse persistence within these areas. Likewise, if important winter habitats are present, we recommend no project-related disturbance from November 15 through March 14.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the project area, and appropriate mitigation to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning, to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act, MBTA or BGEPA, please contact Pedro 'Pete' Ramirez at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,

Scott Hicks

for Brian T. Kelly
Field Supervisor
Wyoming Field Office

Enclosure (1)

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (V. Stelter)

Literature Cited

Boon, D.Y. 1989. Potential selenium problems in Great Plains soils. In L.W. Jacobs, ed. Selenium in agriculture and the environment. American Society of Agronomy, Inc, and Soil Science Society of America. SSSA Special Pub. No. 23. Madison, WI. pp: 107-121.

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Fairbrother, A.F., M. Fix, T. O'Hara, and C.A. Ribic. 1994. Impairment of growth and immune function of avocet chicks from sites with elevated selenium, arsenic, and boron. Journal of Wildlife Diseases. 30(2):222-233.

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Ramirez, P. and B. Rogers. 2000. Selenium in a Wyoming grassland community receiving wastewater from an in situ uranium mine. U.S. Fish and Wildlife Service Contaminant Report # R6/715C/00. Cheyenne, WY. Sept. 31.

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See, R.B., D.L. Naftz, D.A. Peterson, J.G. Crock, J.A. Erdman, R.C. Severson, P. Ramirez, Jr., and J.A. Armstrong. 1992. Detailed study of selenium in soil, representative plants, water, bottom sediment, and biota in the Kendrick Reclamation Project Area, Wyoming, 1988-90. U.S. Geological Survey Water Resources Investigations Report 91-4131. 142 pp.

Skorupa, J.P., and H.M. Ohlendorf. 1991. Contaminants in drainage water and avian risk thresholds. Pages 345-368 *in* A. Dinar and D. Zilberman (eds.). The economics and management of water and drainage in agriculture. Kluwer Academic Publishers, Boston, MA.

U.S. Fish and Wildlife Service. 1989. Black-footed ferret survey guidelines for compliance with the Endangered Species Act, April 1989. U. S. Fish and Wildlife Service, Denver, Colorado and Albuquerque, New Mexico. 15pp.

Wisdom, M.J., B.C. Wales, M.M. Rowland, M.G. Raphael, R.S. Holthausen, T.D. Rich, and V.A. Saab. 2002. Performance of Greater Sage-Grouse models for conservation assessment in the Interior Columbia Basin, USA. Conservation Biology16: 1232-1242.

January 28, 2009

Mr. Ivan Posey
Chairman
Shoshone Business Council
P. O. Box 538
Fort Washakie, WY 82514

SUBJECT: REQUEST FOR INFORMATION REGARDING TRIBAL HISTORIC AND CULTURAL RESOURCES POTENTIALLY AFFECTED BY THE PROPOSED LICENSE APPLICATION FOR UR-ENERGY USA's LOST CREEK URANIUM RECOVERY PROJECT IN SWEETWATER COUNTY, WYOMING (DOCKET NO. 040-09068)

Dear Mr. Posey:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from UR-Energy USA for a new radioactive source materials license to construct and operate the Lost Creek Uranium Recovery Project (an *in-situ* recovery operation) located in Sweetwater County, Wyoming. The Lost Creek Project consists of one large unit, with the processing plant located in the north-central portion of the permit area. Additional facilities associated with the proposed project include wellfields, header houses, waste storage ponds, deep disposal wells, ancillary buildings, and materials storage.

Lost Creek site is located approximately 70 miles southeast of the City of Lander, and approximately 40 miles northwest of the City of Rawlins. The project site covers approximately 4,220 acres, of which approximately 3,580 acres are federally owned Bureau of Land Management land, and the State of Wyoming, Office of State Lands and Investment own 640 acres. Access to the Lost Creek site would either be via Wamsutter Crooks Gap and Bairoil Roads, south from Jeffrey City, off US Highway 287, or from Bairoil, off State Route 73, via Bairoil and Sooner Roads. The Lost Creek site is located in Township 25N, Range 92 West, Sections 16-19, and Range 93W, Sections 13, 14 & 25, and is situated in the Battle Spring Draw, which drains to Battle Spring Flat, approximately nine miles southwest of the site. A map showing the site location of the Lost Creek Project is shown in Figure 1 (enclosed).

As established in Title 10 Code of Federal Regulations Part 51 (10 CFR Part 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the NRC is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. The NRC's EA process includes an opportunity for public and inter-governmental participation in the development of the EA. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural properties. To support the environmental review, the NRC is requesting information to facilitate the identification of Tribal historic sites or cultural resources that may be affected by the proposed Lost Creek Uranium Recovery Project. Specifically, the NRC is interested in learning of any sites that you believe have traditional religious or cultural significance. Any input you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR Part 51 and 36 CFR 800.

I. Posey 2

After reviewing all of the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

The UR-Energy USA's Lost Creek Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency-wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The docket number for the application is 040-09068. Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission ATTN: Mrs. Andrea L. Kock, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Alan B. Bjornsen of my staff by telephone at 301-415-1195 or by email at Alan.Bjornsen@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Andrea L. Kock, Branch Chief
Environmental Review Branch
Environmental Protection and Performance
Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09068

Cc: Mr. Reed Tidzump
Tribal Historical Preservation Officer
Shoshone Oil & Gas Commission
P.O. Box 538
Fort Washakie, WY 82514

Mr. Richard Brannan, Chairman
Arapaho Tribal Business Council
P.O. Box 396
Fort Washakie, WY 82514

Ms. Amanda White
Arapaho Tribal Preservation Officer
533 Ethete Road
Fort Ethete, WY 82520

March 2, 2009

MEMORANDUM TO: Andrea Kock, Chief
Environmental Review Branch
EPPAD/DWMEP/FSME

FROM: Irene W. Yu, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Behram Shroff, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Alan Bjornsen, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

SUBJECT: INFORMAL MEETINGS WITH LOCAL, STATE, AND FEDERAL AGENCIES IN WYOMING REGARDING THE ENVIRONMENTAL REVIEWS BEING CONDUCTED ON THE MOORE RANCH, NICHOLS RANCH, AND LOST CREEK IN-SITU LEACH APPLICATIONS FOR SOURCE MATERIAL LICENSES (DOCKET NOS. 040-09073, 040-09067, 040-09068, RESPECTIVELY)

During the week of January 12, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff and their contractor staff informally met with various local, state, and federal agencies in Wyoming regarding the environmental reviews being conducted on the Moore Ranch, Nichols Ranch, and Lost Creek In-Situ Leach (ISL) applications for Source Material Licenses. The purpose of these meetings was to discuss any comments or concerns they may have on these projects and to better understand the agency's procedures and regulations and how they fit in with NRC's obligations under the National Environmental Policy Act (NEPA). The following is a summary of each meeting and a list of participants.

CONTACT: Irene Yu, DWMEP/FSME
(301) 415-1951

A. Kock - 2 -

State Historic Preservation Office (SHPO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

Regarding the Nichols Ranch Project, we discussed the proximity to the Pumpkin Buttes, which is designated as a Traditional Cultural Property, and the tribal interest in the Pumpkin Buttes. The SHPO is currently working on a programmatic agreement (PA) with the Bureau of Land Management (BLM) pertaining to the Pumpkin Buttes. We discussed potential best management practices (BMPs) and mitigation strategies to be included in the PA such as painting the buildings a certain color to mitigate the visual effect, keeping the buildings a low profile, and adding a public education component. Regarding the Lost Creek Project, we discussed the presence of tribal artifacts with cultural significance in the nearby town of Bairoil. We also discussed the potential presence of paleontological artifacts in the Great Divide Basin because it was at one time covered with water. The mitigation strategies discussed included data recovery (where a discovery plan would be needed) and a public education component. No tribal concerns were discussed for the Moore Ranch Project. For all three projects, we discussed cumulative impacts and the importance of assessing the impacts of ISL in addition to those for coal-bed methane (CBM), oil and gas (O&G), wind, and/or coal, which are all actively underway in Wyoming. We also discussed the Section 106 process and verified NRC's responsibilities and process to submit the cultural resources information to the SHPO.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Richard Currit, SHPO

Follow-up Items

NRC to talk to BLM about how they want to comment when BLM lands are involved in the Section 106 process. NRC spoke to BLM following the trip about how they want to comment when BLM lands are involved in the Section 106 process. NRC will provide BLM with a copy of the complete cultural resources section of the application for discussion and concurrence prior to submitting the information to the SHPO.

State Engineer's Office (SEO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

We discussed the importance of the ISL wells being constructed well to prevent cross-contamination between aquifers and that the applicant's provide adequate means for the closure of these wells once the facilities are decommissioned so as not to leave a conduit for cross-contamination. We discussed the differences in the roles and responsibilities of the SEO (focused on water quantity) and of the Department of Environmental Quality (DEQ, focused on water quality). The SEO is responsible for well permitting, which is typically done in permit blocks which allow for a certain number of wells to be constructed within a certain tract of acres. The SEO also issues permits for stormwater management impoundments.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
John Harju, SEO
Harry Labonde, SEO

Follow-up Items

None

Bureau of Land Management State Office, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

NRC staff provided an overview of how and why the draft Memorandum of Understanding (MOU) between NRC headquarters and BLM headquarters was developed and the current status of the draft MOU. Having not reviewed the draft MOU, BLM staff expressed their interest in reviewing the MOU and having the MOU signed at the state level instead of at the headquarter level. BLM has an MOU in place with the DEQ and briefly explained how the MOU specifies the roles and responsibilities of each agency and the points of contact. BLM staff provided NRC staff with a copy of their MOU with DEQ and a copy of the new Department of Interior regulations on implementing NEPA to help NRC in their development of an MOU with BLM. BLM staff also stressed the importance of increased communication between them and the NRC. We discussed both BLM and NRC's NEPA responsibilities for the three ISL projects and whether an environmental assessment (EA) or an environmental impact statement (EIS) is more appropriate. BLM staff sees the main issues with ISL to be related to groundwater quality and cumulative impacts. Specifically, they raised the concern of the possible conflict between the reducing nature of CBM and the oxidizing nature of ISL.

Meeting Participants

Patrice Bubar, NRC (via phone)
Irene Yu, NRC
Nancy Barker, VHB
Larry Claypool, BLM
Ed Heffern, BLM
Larry Jensen, BLM
Bob Janssen, BLM
Janet Kurman, BLM
Pam Stiles, BLM

Follow-up Items

NRC to continue to pursue an MOU with BLM.

A. Kock - 4 -

Department of Environmental Quality, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

DEQ staff stressed the importance of increased communication between them and the NRC and requested the development of an MOU with the NRC. Since the DEQ issues the permits for the underground injection wells and the aquifer exemption related to ISL, we discussed in great detail DEQ's requirements from the applicant and the issues they have seen thus far in their review of the three project applications. DEQ Land Quality Division staff will coordinate the comments from all other DEQ divisions for their review of NRC's environmental documents. DEQ Water Quality Division staff provided background on the stormwater and groundwater concerns. Specifically, we discussed the different classes of injection wells and which ones apply to ISL facilities, the construction of wells and how important the construction is to minimizing cross-contamination between aquifers, the viability of ISL in an unconfined aquifer, and groundwater restoration. DEQ Air Quality Division staff provided information on air quality issues in the state. DEQ Industrial Siting Division staff provided information related to the sage grouse core areas and provided NRC with a map showing those areas. DEQ Solid and Hazardous Waste Division staff provided background on radioactive/hazardous waste disposal in the state. Regarding the Lost Creek Project, we discussed the need for increased federal and state agency interaction because the site consists primarily of federal lands. Also, DEQ staff raised some wildlife concerns as the Lost Creek Project site is located near a sage grouse core area.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Carl Anderson, DEQ Solid & Hazardous Waste Division
Mark Conrad, DEQ Water Quality Division
John Corra, DEQ Administration Division
Kevin Frederick, DEQ Water Quality Division
Andrew Keyfaurer, DEQ Air Quality Division
Brian Lovett, DEQ Water Quality Division
Don McKenzie, DEQ Land Quality Division
Darla Potter, DEQ Air Quality Division
Barb Sahl, DEQ Water Quality Division
Chad Schlichtemeier, DEQ Air Quality Division
Tom Schroeder, DEQ Industrial Siting Division
Paige Smith, DEQ Air Quality Division
Lowell Spackman, DEQ Land Quality Division
Ed Heffern, BLM

Follow-up Items

NRC to discuss internally on possible MOU with DEQ. Internal discussions have been held and a call is scheduled with DEQ to discuss this request.

Governor's Planning Office (GPO), Cheyenne, Wyoming – January 13, 2009

Meeting Summary

GPO staff provided an overview of their assistance to several BLM field offices in updating their Resource Management Plans. In addition, we discussed the location of sage grouse core areas and sage grouse conservation initiatives that are being developed or are already underway.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Tom Blickensderfer, GPO

Follow-up Items

None

Bureau of Land Management Field Office, Rawlins, Wyoming – January 13, 2009

Meeting Summary

The status of the Draft Generic EIS for environmental reviews for ISL facilities (GEIS) and the MOU were discussed. It was explained that the NRC would be the lead agency because of their regulation over milling (not mining) operations. The BLM inquired whether the DEQ should be a cooperating agency. The BLM indicated the state has created an MOU format for federal agencies. Typically, an MOU is made with the state and separate agencies are assigned, as applicable. Shirley Basin & Red Desert, where the Lost Creek site is located, has been extensively explored. The effects of ISLs on freshwater aquifers are critical and applicants need to show that leaching will not occur between aquifers. The Cheyenne Office of the DEQ (Steve Engle-hydrologist) will scrutinize the Lost Creek EA for groundwater issues. The Battle Springs aquifer is a major aquifer in the area. ISLs operate under BLM mining laws and these laws address land use issues. A Plan of Operations will be required by BLM for the Lost Creek site. Currently, they are functioning (exploring) under a Notice (<5 acres of disturbance). An issue of concern is fencing. If fencing of the site is proposed, there are public access issues and wild horse routes that may be impacted. In addition, applicants (ISL operators) need to address effects of their ISL operation on grazing leases. The U.S. Fish & Wildlife Service (FWS) recommends that standard BMPs be used. Their principal concerns are for cattle and raptors. Netting would be required over waste ponds, and over mud pits. The BLM plans on meeting with UR-Energy (applicant) on January 27th on the Lost Creek site.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Mark Newman, BLM
Clare Miller, BLM
Patrick Madigan, BLM
Travis Sanderson, FWS

Follow-up Items

NRC to keep BLM Field Offices up to date on status of MOU; BLM to send Environet a copy of the Land Status Map for Wyoming.

Bureau of Land Management Casper Field Office, Casper, Wyoming – January 13, 2009

Meeting Summary

Topics discussed included cumulative impacts, existing coal-related analyses, and hydrology at ISL sites. Specifically, with regards to cumulative impacts, BLM, U.S. Environmental Protection Agency (EPA), and DEQ cooperated on a study of the effects of coal, O&G, CBM, uranium, and wind development in the Powder River Basin. There are several existing coal-related analyses: five coal-related EISs either final or in progress (West Antelope, Wright, and three physical groupings: North, Middle, and South Pods). Chapter 4 in these EISs was recommended as a good resource for NRC's cumulative impacts analysis. Another EIS with good information on cumulative impacts was for Pacific Corporation/Rocky Mountain Corporation's Wind Farm in the northeastern part of the state. BLM's concerns with respect to ISL impacts were about the cross-contamination of groundwater between CBM and ISL and whether NRC was going to require groundwater monitoring. BLM is working on a reliable groundwater model for ISL projects.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Patrick Moore, BLM
Tom Foertsch, BLM
Mike Karbs, BLM

Follow-up Items

None

Sweetwater County (SC), Green River, Wyoming – January 13, 2009

Meeting Summary

Safety and emergency issues were the top concerns raised by Sweetwater County (SC). Site access, particularly on the narrow county roads, was of concern with the Bairoil representatives (trucks, dust, noise, etc.). The proposed routes were of concern, along with road improvements, maintenance, and signage. Of special interest was the amount of radiation that could be expected from trucks carrying product from the facility to the next processing facility. The Sweetwater County Fire Department (SCFD) and emergency personnel were concerned with radiation and potential exposure, construction of the facility, access, materials and waste storage, and emergency plans that the applicant would prepare. The SCFD specifically requested that plans of the facility be available to them in case of an actual emergency. Waste

disposal was an issue of great importance: what types of waste would be generated; how much would be generated; where would the waste be disposed; and what routes would be used to get there. There is also a limited workforce that is available in the SC area. Even unskilled workers are hard to come by. Other issues that were raised included: impacts to Bairoil's municipal water supply well, potential storm water discharges, waste water ponds, utilities, and air quality (dust).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
John Radosevich, SC
Steve Horton, SC
John Barton, SC
Dennis Washam, SC
Wayne Silvers, SC
Judy Valentine, SC
Dennis Claman, SC
Robert Robinson, SC
Tony Riga, Bairoil
Sue Ann Riganco, Bairoil

Follow-up Items

NRC to find out what roads are being proposed for access to the facility. NRC to find out the levels of radiation at various locations throughout the facility, as well as during transportation. NRC to inform applicant that the SCFD would like a hazardous materials inventory.

<u>Fremont County Planning Department, Fremont County, Wyoming – January 13, 2009</u>

Meeting Summary

The county has no zoning laws in effect. Reviews are performed for residential subdivisions. Regarding solid waste disposal, the county operates a transfer station and landfill in Riverton. Regarding highway maintenance in the vicinity of Lost Creek (SC), the county only maintains about ten miles of the Crooks Gap-Wamsutter Road south of Jeffrey City. Beyond that point, the road is poorly maintained.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Price, Fremont County Planning Department

Follow-up Items

None

Casper Planning Department, Casper, Wyoming – January 13, 2009

Meeting Summary

The main points drawn from this discussion were that rental housing is very scarce, especially affordable housing, and that less expensive housing would be available to ISL workers and families in Glenrock, Douglas, and Wright. However, those cities also have a shortage of affordable housing. Also, the Powder River Basin has good roads and the school capacity and retail establishments are sufficient for the present. Fire and police departments are adequately staffed. Medical and hospital facilities are able to provide good service. Additionally, the industry boom-bust cycles are typical, making it hard to maintain available and affordable housing. The population of Casper is about 53,000 (75,000 including suburbs) and the current economic downturn will likely make housing more affordable. Developers are currently building housing for both upper and lower income families.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Craig Collins, Casper Planning Department
Robin Mundell, Casper Planning Department

Follow-up Items

None

Wyoming Community Development Authority (WCDA), Casper, Wyoming – January 13, 2009

Meeting Summary

Discussions centered around the impact of resource extraction, including ISL, on housing. The WCDA was able to provide extensive data on existing housing statewide, and future projections. The main points raised were that rental housing is scarce in the Powder River Basin and Great Divide Basin; single family housing tends to be out of the affordable range; those seeking to move to Wyoming from economically hard-hit areas have a difficult time selling their homes; and the Wyoming economy is doing very well compared to the nation as a whole. Most Moore Ranch and Nichols Ranch workers are expected to live in Casper, Gillette, and other smaller communities such as Wright. The level of healthcare, education, and commercial facilities is generally good. Rawlins would likely be the main base for Lost Creek employees (possibly Wamsutter). There is no office of state planning.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
David Haney, WCDA
Cheryl Gillam, WCDA

Follow-up Items

None

<u>Lander Chamber of Commerce, Lander, Wyoming – January 13, 2009</u>

Meeting Summary

Inquiries were made regarding housing and workforce. There is some limited housing available in Fremont County (Lander Area), but it's pricey. Jeffrey City may be a better bet as there are still houses there from the oil boom in the late 80s/early 90s. The thought was that there would be sufficient skilled labor available due to the slowdown in the oil industry.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Chamber of Commerce Director
Chamber of Commerce Receptionist

Follow-up Items

None

<u>Bureau of Land Management Field Office, Buffalo, Wyoming – January 14, 2009</u>

Meeting Summary

BLM staff explained their responsibilities under NEPA and their review and approval process of Plans of Operations submitted by ISL applicants. BLM staff also provided details on the update to the Buffalo Resource Management Plan, in which they just completed the scoping process. Since no BLM lands are present on the Moore Ranch Project site, BLM staff is not likely to review that application. Regarding the Nichols Ranch Project, BLM staff will provide comments on NRC's environmental documents and request frequent communication with the NRC throughout the environmental review process. BLM staff sees the main issues for the Nichols Ranch Project to be related to cultural resources and tribal concerns since the Pumpkin Buttes was designated a Traditional Cultural Property (TCP) in June 2007. The BLM is in the process of developing a PA for the TCP. BLM staff emphasized the importance of good construction of injection wells and did not seem concerned with CBM operations and ISL operations occurring simultaneously in the same area because of the large distances between CBM wells. BLM has prepared Plan of Development (POD) EISs and a 2003 EIS on CBM and natural gas, which have solid cumulative impacts analyses for the Powder River Basin. FWS staff discussed the locations of sage grouse core areas in the Powder River Basin, the possible need for avoidance of these areas, and the candidate conservation assurances program. FWS staff stated that additional information on sage grouse is present in the Northeast Wyoming Management Plan. FWS staff raised a concern over migratory birds, specifically related to the electrocution of raptors on power poles and they recommended buried power lines or aboveground lines conforming to the requirements set by the Avian Power Line Interaction Committee.

Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Buck Dumone, BLM
Jerry Queen, BLM
Clint Crago, BLM
Tom Bills, BLM
Paul Beels, BLM
Brad Rogers, FWS
Pete Ramirez, FWS

Follow-up Items

NRC to review BLM's POD EISs and 2003 EIS on CBM and natural gas to see if the cumulative impacts analyses can be incorporated into the NRC documents. NRC to also review the Northeast Wyoming Management Plan for sage grouse.

Department of Environmental Quality District 3 Office, Sheridan, Wyoming – January 14, 2009

Meeting Summary

DEQ staff explained their two tier review process of applications, which consists first of a completeness review and then a technical review (150 days to complete). Both the Moore Ranch and Nichols Ranch ISL applications have been through the completeness review and are undergoing the technical review with Moore Ranch to be completed first. DEQ staff's initial assessment of both applications is that additional information is necessary from the applicant and inconsistencies arise in both applications. DEQ staff's main concerns with both projects are cumulative impacts (whether ISL, CBM, and O&G can all occur simultaneously), groundwater quality resulting from unconfined aquifer conditions (effects on drawdown, ability to limit excursions, restoration), and underground injection well viability (which formation to drill into).

Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Mark Rogaczewski, DEQ Land Quality Division District 3
Don Fischer, DEQ Water Quality Division
Glenn Mooney, DEQ Land Quality Division District 3

Follow-up Items

None

Department of Environmental Quality District Office, Lander, Wyoming – January 14, 2009

Meeting Summary

A brief update was presented on the status of the GEIS and the EA for Lost Creek. The topic of requests for additional information (RAIs) was discussed. It was found that the DEQ, in addition to the list of RAIs submitted last summer on UR-Energy's application, was currently preparing a much larger list (200 in addition to the initial 45). The DEQ's primary concern is groundwater impact. The Water Quality Division (WQD) determines the class of use of an aquifer, but the EPA determines the exemption boundary. For deep well injection of wastes, the contact at the WQD identified was John Passehl. The DEQ is the agency that issues the actual mining permit, with the BLM concurring. DEQ, however, is also concerned with surface disturbance. If the total amount of disturbance is less than 5 acres, the DEQ issues a Drilling Notification (similar to the BLM's Notice). If the disturbance exceeds 5 acres, a License to Explore is issued (similar to the BLM's Plan of Operation). Bonding is also required by the DEQ and, in fact, the DEQ is the bond holder, even when BLM land is involved. For bond release, 2 years of successive growing seasons must occur after reclamation. Issues, besides groundwater that were raised during the meeting included the need to address solid waste disposal. This includes a complete characterization of the various waste streams, the disposal facilities intended to be used, and if there is to be any hazardous waste generated. The U.S. Department of Game & Fish (DGF) is concerned with the potential impacts to sage grouse. In particular, there appears to be a lek within the boundary of the Lost Creek site. There is a 1/4-mi exclusion area, as well as a 2-mi limited activity area surrounding each lek. The DGF also has an issue with the installation of overhead utility lines (as roosts for raptors). In addition to groundwater quality, groundwater drawdown is an issue. DEQ is asking the applicant to address potential drawdown outside the boundary of the site (up to 3 mi), and to identify users. The DEQ is also concerned with the fault running through the site, and if the potentiometric surface differs either side of it. Regional (outside the permit boundary) well data is also being asked of the applicant by the DEQ. The DEQ questions the need for such a large permit boundary if the ore body only occupies a portion of the site. A new requirement of the DEQ is the need for the applicant to submit data (including well, and GW data) for the first mine unit to operate at an ISL. This seems to be problematic, in that this information is not normally available until after the NRC issues its license. The DEQ is also requesting the applicant to submit additional cross-sections for the Lost Creek site. DEQ is also requesting a more detailed description of the hydrogeology of the site: thicknesses of the confining units, the multiple sands within the primary production zone in the Battle Spring Formation HJ unit, and deep well injection. Stability monitoring is required after uranium recovery is complete (quarterly monitoring for 12 months, then annually, thereafter).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Amy Boyle, DEQ
Melissa Bautz, DEQ

Carrie Dobey, DGF

Follow-up Items

DEQ WQD to determine the class of aquifer for the HJ unit, as well as the appropriate monitoring well distribution.

Bureau of Indian Affairs (BIA) Wind River Agency, Fort Washakie, Wyoming – January 15, 2009

Meeting Summary

NRC provided a status of the GEIS, the environmental review process the NRC is undertaking, and proposed ISLs in Wyoming. There was more concern over legacy sites than the proposed new uranium recovery facilities in Wyoming. In particular, the conventional mill near Riverton was discussed because of the groundwater plume. While there are no ISL facilities proposed for the Wind River Reservation, it was told us that anytime a new facility is proposed, all the tribes in Wyoming should be notified. The names of two cultural resource contacts were given to us: Amanda White (Northern Arapaho) and Reed Tidzump (Eastern Shoshone). The counties within the state generally send letters to the tribes for concurrence on cultural matters. It was suggested that when cultural resource studies are performed, tribal elders be contacted so that items other than physical features (e.g., spiritual/sacred views) may be identified. The Wind River Reservation has its own environmental commissions (air, water, etc.).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Nation, BIA
Tony Pingree, BIA
Kelly Ferris, BIA
Trisha Cachelin, BIA
John Enos, Shoshone
Steve Babbitts, BIA
Kassel Weeks, WREQC
Don Aragon, WREQC

Follow-up Items

NRC to send copies of draft GEIS (CD) to BIA and Wind River Agency. NRC to send letters to Northern Arapaho and Eastern Shoshone tribes regarding the licensing of the Lost Creek project. The CD and letters were sent in February 2009.

Bureau of Land Management Field Office, Casper, Wyoming – January 15, 2009

Meeting Summary

NRC gave a status of the GEIS and BLM MOU. BLM explained the difference in the types of BLM land. Leasable land, also known as acquired land, is land that the US has bought back the mineral rights. This represents only a small portion of BLM lands. Locatable land is land that

was originally federal-owned, and represents most of BLM lands. BLM was concerned that the GEIS does not distinguish between the two types of land. BLM was pleased to hear that there is progress being made on the MOU, but has a concern about how field office personnel working jointly on a NEPA document with the NRC would be reimbursed for their effort. BLM was also questioning whether the state or field office would participate in the development of the MOU.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Tom Foertsch, BLM
Patrick Moore, BLM

Follow-up Items

NRC to send copies of the proposed ISL Wyoming site map to the Casper Field Office and the State BLM Office. NRC sent the copies of the map in February 2009.

Buffalo Chamber of Commerce (COC), Buffalo, Wyoming – January 15, 2009

Meeting Summary

The COC Board raised the issues of impacts to wildlife (specifically to sage grouse) and socioeconomics (specifically housing capacity) in regards to the potential Nichols Ranch Project. The COC Board stated that Kaycee does not have the housing capacity and services that Buffalo has. The COC Board stated that the County school system has the capacity to handle additional students. RV parks and motels still have ample space in the county for workers who choose not to permanently relocate into the County. The COC Board emphasized that like most of the state, the county's population fluctuates with the industry cycles of booms and busts.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Margaret Dunfee, COC
Various members from the COC Board

Follow-up Items

None

Johnson County Commissioners, Buffalo, Wyoming – January 15, 2009

Meeting Summary

The County Commissioners raised the issues of impacts to socioeconomics, both positive and negative, in regards to the potential Nichols Ranch Project. Specifically, the County

Commissioners mentioned the shortage of housing in Kaycee, the shortage of housing for low-moderate income families in the County, and the poor conditions of Trabing Road (also known as Iragary Road), which is a likely commuter path from Buffalo and Kaycee to the Nichols Ranch Project site. Trabing Road has been heavily utilized by CBM operators and although it is a county-maintained road, the County does not have enough funding currently to upgrade the road. The County Commissioners requested that the path of transport for the yellowcake be described in the NRC's environmental document. We also discussed positive economic impacts from new ISL projects such as the creation of new jobs and the addition to tax base. The County Commissioners stated that emergency response services needed for the Nichols Ranch Project would come from either Buffalo or Kaycee. The County Planner stated that the only local permitting required of the applicant would be for a septic system leach field up to 2,000 gallons in size.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Smokey Wildeman, Commissioner
Gerald Fink, Chairman
Rob Yingling, County Planner

Follow-up Items

None

Campbell County Economic Development Corporation (CCEDC), Gillette, Wyoming – January 15, 2009

Meeting Summary

The discussion focused on the impact of resource extraction, including ISL, on housing, schools and other community facilities, and socioeconomics. The vacancy rate for rental housing has been close to zero for the last four years; 850 rental units in Gillette have recently been built and fully occupied. The local economy is mineral-based and has gone through boom and bust cycles which have discouraged investment in housing. Local government has extended water and sewer lines well beyond city limits to encourage development. Land is being annexed aggressively by the city as a spur to foster residential development. Two new elementary schools have been built and two more are planned.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Michael Surface, CCEDC
Susan Yerke, CCEDC
Brandi Beecher, CCEDC

Follow-up Items

None

Town of Wright, Wright, Wyoming – January 15, 2009

Meeting Summary

A new power plant is being built nearby. O&G extraction and coal mining are active in the vicinity. Almost 200 single family houses have just been built and the town has purchased 113 acres, some of which will be for housing; the land includes water service. It is hard to get developers to come out to a small town of under 5,000 people, although tax credits exist for rural development. There are several private apartments in the community and many employers are building motels and renting rooms to their workers. A new shopping center has been built and the town has one medical clinic. The junior and senior high schools have been combined and capacity is adequate.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Lyle Murdock, Wright Building Official

Follow-up Items

None

Converse County Planning Department Douglas, Wyoming – January 15, 2009

Meeting Summary

In discussing where workers from the Powder River Basin may live, Converse County Planning Department Douglas, Wyoming staff thought that the cities of Glenrock and Douglas would likely home bases for workers for the Nichols Ranch and Moore Ranch projects; Midwest and Wright were also mention as possibilities. Some trailer parks might have vacancies but rental apartments are scarce and expensive. There is the potential for new hotels/motels to be built. There are 130 zoned and platted lots for housing but they are without services. The state has a loan program for first-time home buyers. The current population is about 6,000 people, but the city could accommodate a total of 10,000. Schools are close to capacity in Douglas but Glenrock may have some room.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Forrest Neuerberg, CCPD
Paul Musselman, CCPD

Follow-up Items

None

Converse Area New Development Organization (CANDO) – January 15, 2009

Meeting Summary

CANDO deals primarily with workforce concerns, local economic development, business recruitment and training, and housing. Ranchers are seeking information about energy companies looking for leases on their property. There is a shortage of workers with uranium mining experience. Locally, there is limited housing and Nichols Ranch and Moore Ranch workers would likely face a 1.5 hour commute, which is typical for the area.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Joe Coyne, CANDO
Ed Werner, Consultant to CANDO

Follow-up Items

None

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 17, 2009

Mr. Arlen Shoyo
Tribal Historic Preservation Officer
Eastern Shoshone Tribe
Wind River Agency
P.O. Box 217
Fort Washakie, WY 82514

SUBJECT: MEMORANDUM OF AGREEMENT - ARCHAEOLOGICAL DATA RECOVERY AND TREATMENT LOST CREEK IN-SITU LEACH URANIUM RECOVERY PROJECT

Dear Mr. Shoyo:

An archaeological data recovery plan was prepared by Centennial Archaeological Inc. of Fort Collins, Colorado, for an identified pre-historic site at the Lost Creek In-Situ Leach Uranium Recovery (ISR) Project in northeast Sweetwater County. The plan was submitted to the Wyoming State Historic Preservation Office (SHPO), and they have concurred. Because the U.S. Nuclear Regulatory Commission (NRC) is reviewing the license application to construct and operate the stated ISR, it is considered the lead agency by the SHPO. As such, it is required under Section 106 of the National Historic Preservation Act for the NRC (as lead agency) to enter into a Memorandum of Agreement (MOA) because the pre-historic site is eligible for inclusion in the National Register of Historic Places.

The MOA will be signed by the NRC, the SHPO, the Applicant (UR-Energy USA, Inc.), the Bureau of Land Management, and the Wyoming State Attorney General's Office. The NRC is asking if the Eastern Shoshone Tribe wishes to be a signatory on the MOA.

Please respond in writing to Alan Bjornsen, U.S. Nuclear Regulatory Commission, 11545 Rockville Pike, Rockville, Maryland 20852, or via e-mail at alan.bjornsen@nrc.gov within 7 days of receipt of this letter.

Sincerely,

Patrice M. Bubar

Patrice M. Bubar, Deputy Director
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

F/9

June 30, 2009

Mr. Richard L. Currit
Senior Archaeologist and NEPA Coordinator
Wyoming State Historic Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: TREATMENT PLAN FOR MITIGATIVE EXCAVATION OF PREHISTORIC SITE 48SW16604 FOR THE PROPOSED LOST CREEK ISR PROJECT IN SWEETWATER COUNTY, WYOMING (SHPO FILE # 0708JRD021)

Dear Mr. Currit:

Lost Creek ISR, LLC (LCI), a subsidiary of UR-Energy, Inc. of Denver, Colorado, is proposing to develop a 4,220-acre site about 15 miles southwest of Bairoil in northeastern Sweetwater County, Wyoming, for *in-situ* uranium recovery. In March 2008, LCI resubmitted an application for license to the U.S. Nuclear Regulatory Commission (NRC) to construct, operate, and decommission a source and by-product materials facility at the Lost Creek site. The submittal was made in accordance with the Atomic Energy Act of 1954, as amended, and Title 10 of the Code of Federal Regulations (CFR) (Parts 20, 40, 51, and 70), as well as other applicable laws and regulations, and NRC guidelines. The purpose of this letter is to inform you of NRC's review and concurrence of the treatment plan for the referenced site. A Memorandum of Agreement (MOA) will be executed between the NRC, Bureau of Land Management (BLM) – Rawlins Field Office, Lost Creek ISR, LLC and the Wyoming State Historic Preservation Office regarding the mitigation of the adverse effect, in accordance with 36 CFR Part 800.6(b)(1)(iv) and NUREG-1569, Section 2.4.2. The MOA will be structured in accordance with the guidance outlined in the Advisory Council on Historic Preservation's *Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites* published in the *Federal Register* on May 18, 1999 (Vol. 64, No. 95, p. 27085).

The NRC, as the federal agency that issues licenses to facilities authorizing the possession and use of regulated radioactive materials is currently reviewing the license application for the proposed Lost Creek ISR Project. The NRC has reviewed both the subject treatment plan (Kinneer 2008, *Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming),* and the original Class III inventory report for the project area (Kinneer et al. 2007, *A Cultural Resource Inventory of the Lost Creek Property for the Proposed Lost Creek ISR, LLC Project in Sweetwater County, Wyoming),* and the passed data recovery method approved by BLM, prepared by LCI and its consultant. The NRC concurs with the BLM's determinations of site eligibility and project effect regarding archaeological site 48SW16604, and support BLM's acceptance of the "Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Lost Creek ISR Project in Sweetwater County, Wyoming" and the phased data recovery method proposed. The mitigation document was submitted by the BLM Rawlins Field Office on May 27, 2008, and reviewed by your office on July 24, 2008, stating that a data recovery plan be prepared, and that specific procedures be followed (according to protocol).

R. Currit - 2 -

The NRC can require as a condition of any license issued to LCI, that LCI comply with the MOA and treatment plan. The NRC will reference the treatment plan and MOA in the draft supplemental environmental impact statement to provide an opportunity for public comment. However, the treatment plan will not be available to the public because disclosure of site locations is prohibited under 43 CFR 7.18.

The Lost Creek Prehistoric (48SW16604) site was visited on September 19, 2008, by Reed Tidzump, a member of the Wind River Agency and Tribal Historic Preservation Officer (THPO) for the Eastern Shoshone Tribe. Three other tribes were invited (Northern Cheyenne, Northern Arapaho, and Ute Tribal), but did not attend. The Eastern Shoshone found the proposed treatment plan adequate, meeting the approval of tribal elders. The NRC has maintained communication with Arlen Shoyo, the new THPO for the Eastern Shoshone Tribe.

If you have any questions, or require additional information, please contact Alan Bjornsen at (301) 415-1195, or at alan.bjornsen@nrc.gov.

Sincerely,

***/RA* By Patrice Bubar, Acting For/.**

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

cc: P. Walker, BLM, Rawlins
J. Cash, LCI, Casper
D. McKenzie, DEQ, Cheyenne

October 19, 2009

Mr. Brian Kelly
U.S. Fish and Wildlife Service
Ecological Services Field Office
5353 Yellowstone Road, Suite 308
Cheyenne, WY 82009

SUBJECT: LOST CREEK ISR, LLC, NOTIFICATION OF AN EXEMPTION FROM THE COMMENCEMENT OF CONSTRUCTION REQUIREMENTS IN 10 CFR 40.32(E), LOST CREEK IN SITU RECOVERY FACILITY, SWEETWATER COUNTY, WYOMING (TAC J00595)

Dear Mr. Kelly:

By letter dated July 2, 2009, Lost Creek ISR, LLC (LCI) requested an exemption that would allow them to commence certain activities prior to the U.S. Nuclear Regulatory Commission's (NRC's) completion of its environmental review under Title 10 of the Code of Federal Regulations, Part 51 (10 CFR 51) and the NRC's issuance of a Source Materials License for the Lost Creek uranium *in situ* recovery (ISR) facility in Sweetwater County, Wyoming, under 10 CFR 40. NRC's approval of the exemption would permit LCI to undertake the actions listed below.

1. Leveling and surfacing of the area around the Plant and Maintenance Building
2. Construction of Maintenance Buildings
3. Install household septic systems for the Plant and Maintenance Buildings
4. Install fence around the Plant and Maintenance Building Area
5. Upgrade Existing Road Access from the West to the Plant
6. Upgrade Existing Road Access from the East to the Plant
7. Install Fence for Early Wellfield Area
8. Install Power Line to the Plant and Maintenance Buildings and Drillers Shed
9. Construct a Drillers Shed and Staging Area

These actions do not affect radiological health and safety or common defense and security. As such, NRC has determined that these activities do not require a license.

If approved, the exemption would allow LCI to commence the above site preparation activities before NRC completes its licensing determination. LCI plans on performing this site preparation work, as soon as possible in 2009, and it will continue into 2010. The approval to perform site preparation does not equate to approval of a license to construct, operate and decommission a facility. LCI assumes the risk of completing these activities and then not receiving a license to construct and operate the facility.

Environmental impacts of the site preparation activities, listed above, and construction/operation of the facility will be considered in NRC's environmental impact statement which will be issued after site preparation activities begin. NRC staff will continue to communicate with you regarding important issues for the staff to consider regarding the assessment of site preparation and construction environmental impacts.

B. Kelly 2

NRC staff anticipates completing its review of the exemption request by the end of November 2009. Please respond by November 15, 2009 with any comments or concerns that you may have on this subject. If you have any questions or comments with regard to this request from LCI, or need any additional information, please contact me at 301-415-7182, or, by email, at stephen.cohen@nrc.gov.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

/RA/

Stephen J. Cohen, Team Leader
Uranium Recovery Licensing Branch
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-9068

ARTS. PARKS. HISTORY.
Wyoming State Parks & Cultural Resources

State Historic Preservation Office
Barrett Building, 3rd Floor
2301 Central Avenue
Cheyenne, WY 82002
Phone: (307) 777-7697
Fax: (307) 777-6421
http://wyoshpo.state.wy.us

December 10, 2009

Stephen J. Cohen, Team Leader
Uranium Recovery Licensing Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

re: Lost Creek ISR. LLC, Notification of an Exemption From the Commencement of Construction Requirements in 10CFR 40.32(E), Lost Creek In Situ Recovery Facility, Sweetwater County, Wyoming (TAC J00595) (SHPO File # 0608JEK008)

Dear Mr. Cohen:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project. We have reviewed the project report and find the documentation meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42). We concur with your finding that no historic properties, as defined in 36 CFR § 800.16(l)(1), will be affected by the project as planned.

We recommend the U.S. Nuclear Regulatory Commission allow the project to proceed in accordance with state and federal laws subject to the following stipulation:

> If any cultural materials are discovered during construction, work in the area shall halt immediately, the federal agency must be contacted, and the materials evaluated by an archaeologist or historian meeting the Secretary of the Interior's Professional Qualification Standards (48 FR 22716, Sept. 1983).

This letter should be retained in your files as documentation of a SHPO concurrence on your finding of no historic properties affected. Please refer to SHPO project #0608JEK008 on any future correspondence regarding this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

ARTS. PARKS. HISTORY.
Wyoming State Parks & Cultural Resources

8:30AM

2/1/2010
RDB Rec'd

State Historic Preservation Office
Barrett Building, 3rd Floor
2301 Central Avenue
Cheyenne, WY 82002
Phone: (307) 777-7697
Fax: (307) 777-6421
http://wyoshpo.state.wy.us

January 25, 2010

12/11/09
74FR65804
5

Chief, Rulemaking and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop TWB-05-B01
Washington, D.C. 20555-0001

re: Environmental Impact Statement for the Lost Creek ISR Project in Sweetwater County, Wyoming. Draft Report for Comment (SHPO File # 0608JEK008)

Dear Chief:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project. Review of the document identified several inaccuracies. These are identified below.

Page 3-55, Lines 44-45 indicates that there is a "50-year cutoff for possible inclusion on the NRHP". While the 50 year date is a good rule of thumb, it is not a hard and fast rule which fully excludes sites younger than that for inclusion. Please reference National Register Bulletin 15, "How to Apply the National Register Criteria for Evaluation, Chapter VII, Criteria Consideration G: Properties that Have Achieved Significance Within the Past Fifty Years".

Page 3-57, Lines 30-31. Please note that the State Protocol between the BLM and the Wyoming SHPO only applies if the BLM is the lead federal agency, and does not apply to this undertaking. However, isolated recourses are categorically ineligible to the NRHP throughout the State of Wyoming.

Page 3-59, Line 7. Section 3.9.3 "Historic Properties Listed in the National and State Registers". This should be corrected as the State of Wyoming does not maintain a Register of Historic Places.

Page 4-65, Lines 28-29, in part (emphasis added), discusses eligibility for the NRHP "under criteria in 36 CFR 60.4(a)-(d) and/**<u>or</u>** a Traditional Cultural Properties". Per National Register Bulletin 38, "Guidelines for Evaluating and Documenting Traditional Cultural Properties (TCP)", page 9, "Determining Eligibility: Step by Step", in order for a property to be eligible as a TCP it must be eligible under one of the four criteria of eligibility set for in 36 CFR 60.4. This should be stated clearly in this document.

E-RIDS=ADM-03

SUNSI Review Complete
Template = ADM-013

Cele = A. BJorsen (abb5)

Dave Freudenthal, Governor
Milward Simpson, Director

January 25, 2010
Environmental Impact Statement for the Lost Creek ISR Project
Page 2 of 2

Page 4-65, lines 37-40, addresses discovery situations and notes that (emphasis added) "an NRC licensee would **likely** be required under conditions in its license, to stop work upon discovery of previously undocumented historic or cultural resources etc.". We recommend that the word "likely" be replaced with "shall".

Page 4-64, Lines 43-44, indicates that direct impacts from construction on eligible archaeological sites would be short term. This is factually incorrect. Impacts to archaeological resources, whether mitigated or not, are permanent and irretrievable.

Page 5-16, Lines 7- 10 indicates that "The potential impact to historic and cultural resources would likely be minimized for projects occurring on federal or state lands or which are funded in part by the government since these projects would be subject to the National Historic Preservation Act (NHPA), Section 106 consultation process, and applicable statutes, whereas actions that are on private land pose the threat of irrevocable loss of cultural resources". Be aware that this project is a federal undertaking per 36 CFR § 800.16(y). As such, the requirements of Section 106 of the NHPA apply regardless of land ownership, and minimization/mitigation of adverse effects is required.

Thank you for the opportunity to comment on this document. We look forward to further consultation with your office concerning this project.

Please refer to SHPO project #0608JEK008 on any future correspondence regarding this project. If you have any questions, please contact me at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

August 24, 2010

Ms. Mary Hopkins
Historic Preservation Officer
Wyoming State Historic Office
2301 Central Avenue
Barrett Building
Cheyenne, WY 82002

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Ms. Hopkins:

Enclosed for your signature is the final Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document represents the changes (comments and edits) provided by you and the other Signatories in the draft MOA. Please sign the MOA and return the original of that page to Mr. Alan Bjornsen of my staff at:

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195

On behalf of the NRC Team, I would like to thank you for your input, dedication, and commitment to the process of developing this MOA. Your input and expertise added greatly to the final product. I believe everyone had the opportunity to weigh in, and that the process was fair, consistent, and acted in the best interests of all parties. We could not have done this without your help.

Sincerely,

/RA/

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Mr. Don Gerstein
Senior Assistant Attorney General
Attorney General's Office
123 Capitol Office
200 West 24th Street
Cheyenne, WY 82002

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Mr. Gerstein:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

On behalf of the NRC Team, I would like to thank you for your input, dedication, commitment, and above all else, patience, in crafting this MOA. Your input, counsel, and expertise added greatly to the final product. I believe everyone had the opportunity to weigh in, and that the process was fair, consistent, and acted in the best interests of all parties. We could not have done this without your help.

Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

D. Gerstein 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Ms. Mary Hopkins
Historic Preservation Officer
Wyoming State Historic Office
2301 Central Avenue
Barrett Building
Cheyenne, WY 82002

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Ms. Hopkins:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

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Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

M. Hopkins 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Ivan Posey, Chairman
Eastern Shoshone Tribe
P.O. Box 538
Fort Washakie, WY 82514

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Chairman Posey:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

On behalf of the NRC Team, I would like to thank you for your input, dedication, commitment, and above all else, patience, in crafting this MOA. Your input, counsel, and expertise added greatly to the final product. I believe everyone had the opportunity to weigh in, and that the process was fair, consistent, and acted in the best interests of all parties. We could not have done this without your help.

Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

I. Posey 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Harvey Spoonhunter, Chairman
Northern Arapaho Tribe
P.O. Box 396
Fort Washakie, WY 82514

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Ms. Hopkins:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

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Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Mr. Wayne Heili, Vice President
Mining & Engineering
UR-Energy
5880 Enterprise Drive
Suite 200
Casper, WY 82609

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Mr. Heili:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

On behalf of the NRC Team, I would like to thank you for your input, dedication, commitment, and above all else, patience, in crafting this MOA. Your input, counsel, and expertise added greatly to the final product. I believe everyone had the opportunity to weigh in, and that the process was fair, consistent, and acted in the best interests of all parties. We could not have done this without your help.

Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

W. Heili 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Mr. Patrick Madigan
Office Manager
Rawlins Field Office
Bureau of Land Management
1300 North Third Street
Rawlins, WY 82301

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Mr. Madigan:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

On behalf of the NRC Team, I would like to thank you for your input, dedication, commitment, and above all else, patience, in crafting this MOA. Your input, counsel, and expertise added greatly to the final product. I believe everyone had the opportunity to weigh in, and that the process was fair, consistent, and acted in the best interests of all parties. We could not have done this without your help.

Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

P. Madigan 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Mr. Bill Hill, Deputy State Director
Resource Policy & Management
Bureau of Land Management
State Office
5353 Yellowstone Road
P.O. Box 1828
Cheyenne, WY 82003

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Mr. Hill:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

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Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

B. Hill 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 26, 2010

Mr. Richard Currit, Senior Archaeologist
State of Wyoming
Department of State Parks & Cultural
Resources
Division of Cultural Resources
2301 Central Avenue
Barrett Building
Cheyenne, WY 82002

SUBJECT: MEMORANDUM OF AGREEMENT LOST CREEK IN-SITU URANIUM RECOVERY PROJECT

Dear Mr. Currit:

Enclosed is the final, signed Memorandum of Agreement (MOA) for archaeological data recovery at the proposed Lost Creek In-Situ Uranium Recovery (ISR) Project in Sweetwater County, Wyoming.

This document incorporates the changes, comments, and edits provided by you and the other Signatories during the development of the MOA.

On behalf of the NRC Team, I would like to thank you for your input, dedication, commitment, and above all else, patience, in crafting this MOA. Your input, counsel, and expertise added greatly to the final product. I believe everyone had the opportunity to weigh in, and that the process was fair, consistent, and acted in the best interests of all parties. We could not have done this without your help.

Should you have any further questions regarding this MOA, you may contact Mr. Alan Bjornsen at:

U.S. Nuclear Regulatory Commission
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs
Mail Stop: T-8F5
Washington, DC 20555-0001
(301) 415-1195
alan.bjornsen@nrc.gov

R. Currit 2

Thank you, once again, for your input to this document.

Sincerely,

Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

January 13, 2011

Mr. Reid Nelson, Director
Federal Agency Programs
Advisory Council on Historic Preservation
1100 Pennsylvania Avenue
Suite 803
Old Post Office Building
Washington, DC 20004

SUBJECT: MEMORANDUM OF AGREEMENT REGARDING THE ADVERSE EFFECT DETERMINATION FOR ARCHAEOLOGICAL DATA RECOVERY AT 48SW16604, LOST CREEK IN-SITU URANIUM RECOVERY PROJECT, SWEETWATER COUNTY, WYOMING

Dear Mr. Nelson:

In March 2008, the U.S. Nuclear Regulatory Commission (NRC) received an application from Lost Creek ISR, LLC (LCI) for a source materials license to construct and operate an in-situ leach uranium milling facility at the proposed Lost Creek site. The area of potential effect was surveyed by the LCI's archaeological consultant, Centennial Archaeology, Inc. (CAI) in 2007. Three sites were determined eligible for the *National Register of Historic Places* (NRHP). One site (48SW16604) could be affected by the proposed project. As a result, the NRC prepared a Memorandum of Agreement (MOA) that would implement the LCI's treatment plan for site 48SW16604, if avoidance is not possible.

The Bureau of Indian Affairs was contacted for information on the Wind River Agency Tribes. Subsequent contacts were then made with the Northern Arapaho Tribe and Eastern Shoshone Tribe of the Wind River Reservation, located about 60 miles northwest of the Lost Creek site. Both Tribes were invited to be signatories, and both Tribes decided to participate. Other signatories included the NRC, the Bureau of Land Management Wyoming State Office and the Rawlins Field Office, the Wyoming State Historic Preservation Office, LCI, and the Wyoming State Attorney General.

NRC presented the above information to Thomas McCulloch of your staff via telephone on May 13, 2010, upon which Mr. McCulloch declined to participate in the Section 106 process, as all parties were moving forward with the MOA.

R. Nelson 2

The MOA was signed and executed on October 4, 2010. Each signatory has received a signed copy of the MOA. Enclosed is a copy for your records. Should you have any questions, please contact Mr. Alan Bjornsen at (301) 415-1195 or at Alan.Bjornsen@nrc.gov.

Sincerely,

/RA/
Larry W. Camper, Director
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure:
Memorandum of Agreement

Docket No.: 40-9068

APPENDIX B

PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE LOST CREEK ISR PROJECT IN SWEETWATER COUNTY, WYOMING, AND NRC RESPONSES

CONTENTS

CONTENTS (continued)

Section Page

CONTENTS (continued)

CONTENTS (continued)

CONTENTS (continued)

TABLES

ABBREVIATIONS/ACRONYMS

ACLs	Alternate Concentration Limits
ac	acre
ADAMS	Agencywide Documents Access and Management System
AEA	*Atomic Energy Act of 1954*, as amended
AUM	Animal Unit Month
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
CAA	*Clean Air Act*
CBM	Coal Bed Methane
CEQ	Council on Environmental Quality
CESQG	Conditionally Exempt Small Quantity Generator
CFR	*Code of Federal Regulations*
CWA	*Clean Water Act* (also, *Federal Water Pollution Control Act*)
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
FR	*Federal Register*
FRN	Federal Register Notice
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement
ha	Hectare
HMA	Herd Management Area
ISL	*In-Situ* Leach
ISR	*In-Situ* Recovery
IX	Ion Exchange
LCI	Lost Creek ISR, LLC
LQD	Land Quality Division
MCLs	Maximum Contaminant Levels
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding

ABBREVIATIONS/ACRONYMS (continued)

NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act of 1969*
NHPA	*National Historic Preservation Act of 1966*, as amended
NOA	Notice of Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
POO	Plan of Operations
PVC	polyvinyl chloride
RAI	Request for Additional Information
RCRA	*Resource Conservation and Recovery Act*
RSO	Radiation Safety Officer
SCCA	South Central Conservation Area
SDWA	*Safe Drinking Water Act*
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SERPs	Safety and Environmental Review Panels
SGIT	Sage-Grouse Implementation Team
SHPO	State Historic Preservation Office
TDS	Total Dissolved Solids
UIC	Underground Injection Control
UMTRCA	*Uranium Mill Tailings Radiation Control Act*
USACE	U.S. Army Corps of Engineers
USDW	Underground Source of Drinking Water
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WNV	West Nile Virus
WOS	Wildlife Observation System
WQD	Water Quality Division
WYPDES	Wyoming Pollutant Discharge Elimination System

B PUBLIC COMMENTS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE LOST CREEK ISR PROJECT IN SWEETWATER COUNTY, WYOMING, AND NRC RESPONSES

B.1 Overview

On December 11, 2009, the U.S. Nuclear Regulatory Commission (NRC) staff published a notice in the *Federal Register* requesting public review and comment on the Draft Environmental Impact Statement for the Lost Creek *In-Situ* Recovery (ISR) Project in Sweetwater County, Wyoming, Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach (ISL) Uranium Milling Facilities (SEIS) (74 FR 65808) in accordance with 10 CFR Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions. The NRC staff established February 1, 2010, as the deadline for submitting public comments on the draft SEIS, but due to the number of requests for additional time to review the document, the NRC staff subsequently extended this deadline to March 3, 2010 (75 FR 6066). Twenty-three documents (i.e., e-mail, mail, and facsimiles) were submitted to NRC containing comments on the proposed Lost Creek ISR Project. In addition to the public comment period, the public also had the opportunity to request a hearing [July 10, 2008 (73 FR 39728)]. The deadline to request the hearing expired on September 8, 2008; no hearing requests were made.

B.2 Public Participation

Public participation is an essential part of the NRC environmental review process. This section describes the process for public participation during the NRC staff's development of the SEIS. NRC conducted an open, public SEIS development process consistent with the requirements of the *National Environmental Policy Act of 1969* (NEPA) and NRC regulations. NRC staff met with Federal, State, and local agencies and authorities as well as public organizations as part of a site visit to gather site-specific information. NRC provided an 81-day public comment period (including an extension) for agencies, organizations, and the general public to review the draft SEIS and provide comments.

B.2.1 Notice of Intent To Develop the SEIS

The NRC staff published a Notice of Intent to prepare the SEIS in the *Federal Register* (74 FR 39116) on August 5, 2009, in accordance with NRC regulations.

B.2.2 Public Participation Activities

As described in SEIS Sections 1.4.2 and 1.7.3, NRC staff met with Federal, State, and local agencies and authorities during the course of an expanded visit to the proposed Lost Creek ISR Project site and vicinity. The purpose of this visit and these meetings was to gather additional site-specific information to assist in the preparation of the Lost Creek ISR Project environmental review. As part of information gathering, the NRC staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via email and telephone. Additional opportunities for public participation in the licensing process for the proposed Lost Creek ISR Project are described in Section B.5.8 of this appendix.

B.2.3 Issuance and Availability of the SEIS

On December 11, 2009, the NRC staff published a Notice of Availability of the draft SEIS in the *Federal Register* (74 FR 65808). In this notice, the NRC staff provided information on how to access or obtain a copy of the SEIS. Electronic versions of the SEIS and supporting information were made available through the NRC Agencywide Documents Access and Management System (ADAMS) accessible through the NRC website (http://www.nrc.gov/reading-rm/adams.html). The public may examine and have copied, for a fee, the SEIS and other related publicly available documents from the NRC Public Document Room. Copies of the SEIS were also publicly available at the Carbon County, Fremont County, Rock Springs Branch, Sweetwater County, Wamsutter Branch and Bairoil Branch public libraries.

B.2.4 Public Comment Period

In the draft SEIS Notice of Availability published on December 11, 2009 (74 FR 65808), NRC stated that public comments on the draft SEIS should be submitted by February 1, 2010. Members of the public were invited and encouraged to submit related comments through different media. Electronically, comments could be submitted to the federal rulemaking website. Written comments could be submitted by mail or fax. On February 5, 2010, the NRC staff extended the public comment period to March 3, 2010 (75 FR 6066), in response to public requests for extension submitted in comment letters and emails. The 81-day period for public comments (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. The NRC staff identified 631 comments from 23 documents commenting on the draft Lost Creek ISR SEIS.

B.3 Comment Review Methods

As previously described, NRC staff received 631 comments from 23 documents (i.e., email, mail, and facsimiles) during the comment period. Each of these comments are included in the following comment summaries and addressed in the responses provided. Each comment was individually identified and responded to using a systematic approach, which involved identifying individual comments from the source documents, consolidating comment information into a database, sorting comments by topic, and distributing to and having appropriate NRC staff review and respond to comments.

NRC conducted the public comment period for the Lost Creek draft SEIS simultaneously with the comment period for two other draft SEISs for proposed ISR facilities: Nichols Ranch and Moore Ranch, located in the Powder River Basin of Wyoming. Some commenters provided a single document that included comments for two or three of the proposed projects. Each document NRC received was screened to determine whether it applied only to one project or to multiple projects. For documents that commented on multiple projects, copies of the document were provided to each individual project and treated independently from that point forward. Each document was given a unique number based on the order in which it was received. The prefix “L” was attached to the identification number to indicate that a document was for Lost Creek. For documents addressing multiple projects, commenters had specified which comments applied to the Lost Creek ISR Project. Sometimes comments were specifically directed only to the Lost Creek ISR Project. In other cases, the commenter stated the same comment applied to multiple projects. Only comments regarding the proposed Lost Creek ISR Project, uniquely or jointly, were identified and processed for the Lost Creek ISR Project SEIS. Those comments that the commenter specified for only Nichols Ranch and/or Moore Ranch were not tabulated or processed in the Lost Creek ISR SEIS.

NRC staff reviewed all comment documents and identified, marked, and consecutively numbered individual (unique) comments in each document. Comment numbers followed a two-part numbering system separated by a hyphen. The comment number to the left of the hyphen is the document number. The number to the right of the hyphen is a consecutive unique-count number for each comment identified in a specific document. Table B.3–1 provides lists of all commenter names, their affiliations, and the document number assigned to their comment document. Table B.3–2 provides this same information sorted by comment document number in the first column. A group name was created and used when multiple individuals signed a single comment document. A unique group name was assigned to each document signed by multiple individuals. Table B.3–3 identifies the individuals, and their affiliation, who comprise each unique group. Readers can use these tables to electronically search the report to locate comments submitted by specific individuals or to find individuals associated with comments described in Section B.5.

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 B.5 of this appendix. Following the initial comment identification review, the identified comments were entered into a database that allowed individual comments to be sorted by topic and distributed to staff for further consideration. The NRC staff then continued sorting and reviewing all comments within specific topic categories, developed comment summaries and responses for this appendix, and made changes to the final SEIS, as appropriate, to address the public comments.

Based on the similarity of comments related to a specific topic, as appropriate, the NRC 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. A response has been provided for each comment or group of comments. Each response indicates whether the final SEIS was modified as a result of the comment.

B.4 Major Issues And Topics of Concern

The majority of comments received addressed specific items within the scope of the SEIS. Topics raised included, but were not limited to, a variety of concerns about the purpose, need, and scope of the SEIS; regulatory issues; NEPA-related concerns; the description of the ISL process; land use; groundwater; surface water; ecology; air; historic, cultural, and Native American concerns; socioeconomics; public health concerns; waste management; and cumulative effects.

Other comments addressed topics and issues that are not applicable to the SEIS, including general support or opposition to uranium milling, legacy of past uranium mining and milling, evaluation of the NRC regulatory program or licensing process, comparison of the proposed Lost Creek ISR Project financial assurance to previous restoration funding, compensation requests for loss of private water supplies, environmental impacts at disposal facilities for radioactive byproduct material, and comments not specifically directed toward the SEIS [e.g., comments exclusively directed toward the Generic Environmental Impact Statement (GEIS)].

Table B.3–1. Public Commenter Name with Affiliation and Comment Document Number			
Last Name	**First Name**	**Affiliation**	**Comment Document**
Anderson	Shannon	Powder River Basin Resource Council	L002
Brown	Pat	State of Wyoming Department of Workforce Services	L014
Cash	John	Lost Creek ISR, LLC	L008
Colson	Lisa	Town of Wamsutter	L009
Currit	Richard	State Historic Preservation Office	L005A
Fettus	Geoffrey	Natural Resources Defense Council	L004
Golnar	Steve	City of Rawlins	L007
Group A	Group A	Group A	L017
Group B	Group B	Group B	L019
Group C	Group C	Group C	L020
Jantz	Eric	New Mexico Environmental Law Center	L003
Jantz	Eric	New Mexico Environmental Law Center	L015
Jones	Steve	Wyoming Outdoor Council	L005
Loomis	Marion	Wyoming Mining Association	L021
Molvar	Erik	Biodiversity Conservation Alliance	L010
Pugsley	Christopher	National Mining Association	L016
Ratner	Jonathan	Western Watersheds Project	L001
Rushin	Carol	United States Environmental Protection Agency	L018
Steward	Robert	United States Department of the Interior	L006
Svoboda	Larry	United States Environmental Protection Agency	L022
Throgmorton	David	Carbon County Higher Education Center	L011
Wallace	Cindy	Carbon County Economic Development Corporation	L013
Wilson	Anna	United States Geological Society	L012

Table B.3–2. Comment Document Number with Commenter Name, Affiliation, and Accession Number

Comment Document Number	Last Name	First Name	Affiliation	ADAMS Accession Number
L001	Ratner	Jonathan	Western Watersheds Project	ML100271047 ML100271003 ML100270999
L002	Anderson	Shannon	Powder River Basin Resource Council	ML100271048 ML100271000 ML100270998
L003	Jantz	Eric	New Mexico Environmental Law Center	ML100271050 ML100271001
L004	Fettus	Geoffrey	Natural Resources Defense Council	ML100271002 ML100270998
L005	Jones	Steve	Wyoming Outdoor Council	ML100271687 ML100271688 ML100271689
L005A	Currit	Richard	State Historic Preservation Office	ML 100350395
L006	Steward	Robert	United States Department of the Interior	ML100350397
L007	Golnar	Steve	City of Rawlins	ML100350398
L008	Cash	John	Lost Creek ISR, LLC	ML100610508
L009	Colson	Lisa	Town of Wamsutter	ML100350399
L010	Molvar	Erik	Biodiversity Conservation Alliance	ML100350960
L011	Throgmorton	David	Carbon County Higher Education Center	ML100350961
L012	Wilson	Anna	United States Geological Society	ML100430028
L013	Wallace	Cindy	Carbon County Economic Development Corporation	ML100431304
L014	Brown	Pat	State of Wyoming Department of Workforce Services	ML100540538
L015	Jantz	Eric	New Mexico Environmental Law Center	ML100710107
L016	Pugsley	Christopher	National Mining Association	ML100690165

Table B.3–2. Comment Document Number with Commenter Name, Affiliation, and Accession Number (continued)

Comment Document Number	Last Name	First Name	Affiliation	ADAMS Accession Number
L017	Group A	Group A	Group A	ML100690145
L018	Rushin	Carol	United States Environmental Protection Agency	ML1006901666
L019	Group B	Group B	Group B	ML100850378
L020	Group C	Group C	Group C	ML100621314
L021	Loomis	Marion	Wyoming Mining Association	ML100640058
L022	Svoboda	Larry	United States Environmental Protection Agency	ML100890218

Table B.3–3. Group Names, Individuals in Group, and Affiliations for Comment Letters Generated by Multiple Individuals or Organizations

Group Name	Individuals in Group	Affiliation
Group A	Steve Jones	Wyoming Outdoor Council
	Sophie Osborn	Wyoming Outdoor Council
	Shannon Anderson	Powder River Resource Council
Group B	Geoffrey Fettus	Natural Resources Defense Council
	Cori Lombard	Natural Resources Defense Council
Group C	Donald McKenzie	Wyoming Department of Environmental Quality Land Quality Division
	Kelly Bott	Wyoming Department of Environmental Quality Air Quality Division
	Tom Schroeder	Wyoming Department of Environmental Quality Industrial Siting Division
	Mark Conrad	Wyoming Department of Environmental Quality Water Quality Division
	Carl Anderson	Wyoming Department of Environmental Quality Solid and Hazardous Waste Division
	John Emmerich	Wyoming Game and Fish Department
	Alan Ver Ploeg	Wyoming State Geological Survey
	Jason Fearneyhough	Wyoming Department of Agriculture

B.5 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 response.

B.5.1 General Opposition

Comments: L004-002; L015-037; L015-083

Some commenters found the GEIS (NRC, 2009) "wanting" and noted that the GEIS environmental analysis was deficient in several respects, but did not provide examples or citations. Another commenter stated the character of the data in the GEIS was misleading. One of the commenters stated that NRC should not rely on the GEIS for site-specific analyses.

Response: *The GEIS provides criteria for each environmental resource area to help determine the significance level for potential impacts (e.g., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific conditions at the proposed Lost Creek ISR Project. The GEIS provided a starting point for the NRC NEPA analysis at the Lost Creek site. The environmental review at the Lost Creek site was initiated by the applicant submittal and NRC acceptance of the license application for detailed technical review as described in SEIS Section 1.6.1.*

NRC recognizes that some commenters are not supportive of the development of either the GEIS or the Lost Creek SEIS. NRC held a 103-day public comment period for the draft GEIS from July 28, 2008, through November 7, 2008, at which time members of the public were invited to provide comments; this included eight public scoping meetings. NRC considered and responded to comments received on the draft GEIS in GEIS Appendix G [see Notice of Availability (NOA) published in the Federal Register on June 5, 2009 (74 FR 27052]). Therefore, comments on the GEIS are beyond the scope of the Lost Creek ISR SEIS. No further changes were made to the Lost Creek ISR SEIS beyond the information provided in this response.

Comment: L019-033

One commenter urged the withdrawal of both the draft SEIS and the final GEIS, for failing to meet the requirements of NEPA. The commenter stated the document was legally deficient because it failed to address a number of substantive matters, taking a hard look at the proposed action, considering a reasonable range of alternatives, and analyzing cumulative impacts in the region of the proposed action.

Response: *NRC recognizes some commenters are not supportive of the development of either the SEIS or GEIS. As previously noted, NRC held a 103-day public comment period for the draft GEIS from July 28, 2008, through November 7, 2008, at which time members of the public were invited to provide comments; this included eight public scoping meetings. NRC considered and responded to comments received on the draft GEIS in GEIS Appendix G [see NOA published in the Federal Register on June 5, 2009 (74 FR 27052)]. Therefore, comments on the GEIS are beyond the scope of the Lost Creek SEIS.*

The Lost Creek SEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003) and is consistent with NRC's NEPA implementing regulations in 10 CFR Part 51. SEIS Chapter 2 describes the proposed action and alternatives, and Chapter 5 analyzes the cumulative impact from licensing the proposed Lost Creek ISR Project. No further changes were made to the Lost Creek SEIS beyond the information provided in this response.

For detailed comments and responses on topics related to those expressed in some of the general opposition comments, see the following sections of this comment response appendix: NEPA Process (B5.4); Purpose, Need, and Scope of the SEIS/GEIS (B.5.5); Public Involvement (B.5.8); and History and Legacy of Uranium Mining (B.5.17).

B.5.1.1 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

74 FR 27052. U.S. Nuclear Regulatory Commission. "Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." *Federal Register*. Vol. 74, No. 107. pp. 27,052–27,054. June 5, 2009. NRC (U.S. Nuclear Regulatory Commission).

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

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

B.5.2 General Support

Comments: L007-001; L011-001; L013-001; L014-001; L021-001

Several commenters were supportive of the proposed Lost Creek ISR Project because of the jobs that would be created in the area. Commenters were "pleased" about the work and benefits it would bring into the area, the surrounding counties, and the State of Wyoming. One commenter lauded both the increased tax revenue the project would bring and the increased production of domestically produced uranium to fuel operating U.S. reactors.

Response: *NRC recognizes some commenters support the development of the environmental review for the proposed Lost Creek ISR Project. These comments are beyond the scope of the SEIS; therefore, no changes were made to the SEIS. The socioeconomic impacts of the tax revenue are discussed in SEIS Section 4.11 and Section 7.3.1.*

Comment: L010-002

The commenter supported the phased approach of wellfields as opposed to having all wellfields active at the same time.

Response: *NRC acknowledges this comment. SEIS Section 2.1.1.1 discusses wellfield development. No changes were made to the SEIS beyond the information provided in this response.*

B.5.3 General Environmental Concerns

Comments: L002-002; L005-002

Two commenting organizations stated uranium exploration and production impacts many of their members because these individuals live, work, or recreate in areas where such activities are conducted.

Response: *NRC acknowledges that uranium milling activities may impact individuals who live, work, or recreate in and around the proposed Lost Creek ISR Project site. The environmental review documented in this final SEIS addresses potential environmental impacts covering a variety of resource areas that can affect individuals. Because the comment was general in nature, no changes were made to the final SEIS.*

B.5.4 NEPA Process

B.5.4.1 GEIS/SEIS

Comment: L019-006

The commenter stated that NRC, in its final GEIS (NRC, 2009), provided little more than a cursory response to comments the commenter and others submitted on the draft GEIS. The commenter considered this minimal response meant that NRC did not fulfill its responsibility under NEPA, which requires that Federal agencies respond to comments the public or cooperating agencies submitted. The commenter further stated the NRC responses to comments on the draft GEIS were conclusory and nonresponsive, thereby failing a basic requirement of NEPA and the agency's duty to supplement, modify, or improve its analyses in response to comments.

Response: *NRC disagrees with the commenter that the final GEIS response to comments was inadequate. NEPA requires an agency to have a reasonable response to comments but does not require an agency to accept recommendations or suggestions of other agencies or commenters. An agency is not obligated to conduct new studies in response to issues raised in comments, nor is it obligated to resolve conflicts raised by opposing viewpoints. The standard requires that agencies identify opposing views found in the comments such that differences in opinion are readily apparent and there is a good faith, reasoned analysis in the response. NRC published the final GEIS on June 5, 2009 (74 FR 27052). The final GEIS included Appendix G, which was dedicated to identifying and summarizing comments submitted on the draft GEIS and the NRC responses to those comments. Pursuant to NRC regulations under 10 CFR Part 51 that implement NEPA and specifically 10 CFR 51.91(a), NRC responses took the form of one of the following:*

- *Modification of alternatives, including the proposed action*
- *Development and evaluation of alternatives not previously given serious consideration*
- *Supplementation or modification of analyses*
- *Factual corrections*

- *Explanation of why comments do not warrant further response, citing sources, authorities, or reasons that support this conclusion*

The NRC staff considers its response to comments on the draft GEIS, as documented in the main text and appendices of the final GEIS, to be consistent with NRC responsibilities under its NEPA implementing regulations under 10 CFR Part 51. This comment is beyond the scope of the SEIS; therefore, no changes were made to the SEIS.

Comments: L015-037; L015-038; L015-040

One commenter characterized the NRC staff evaluation of the impacts from spills and leaks on water resources in both the GEIS (NRC, 2009) and the draft Lost Creek ISR SEIS as relying on incomplete and inaccurate data, thus resulting in a misleading impact evaluation in both documents. The commenter also stated NRC had not conducted the requisite site-specific analysis of impacts from spills and leaks at the proposed Lost Creek ISR Project, but rather simply stated the site-specific conditions at the proposed Lost Creek ISR Project site were consistent with the affected environment described in the GEIS and concluded the potential impacts would be SMALL.

Response: *The NRC site-specific analysis of the potential environmental impacts to water resources from spills and leaks is found in SEIS Sections 4.51 and 4.5.2, which considers site-specific information provided in the license application. These sections include the evaluation of impacts on both potential surface water and wetlands resources and on near-surface groundwater resources from spills and leaks during the proposed operations for the Lost Creek ISR Project. This site-specific analysis determined that, for the Lost Creek ISR Project, the significance of potential impacts is expected to be SMALL. The site-specific determination draws on the evaluation found in GEIS Sections 4.2.4 and 4.3.4 wherein criteria are provided to evaluate the significance of impacts to surface water and wetlands. The evaluation criteria for surface water and wetlands resources include size of a spill, success of remediation, use of the surface water for domestic or agricultural purposes, proximity of the spill to surface water, and compliance with storm water and National Pollutant Discharge Elimination System (NPDES) permits the State of Wyoming issued. The GEIS concluded that such impacts could range from SMALL to MODERATE, depending on site-specific conditions. For potential impacts to near-surface groundwater resources, the evaluation criteria included proximity of the shallow aquifer to the surface, use of the shallow aquifer for domestic or agricultural purposes, and connection of the shallow aquifer to other locally or regionally important aquifers. The GEIS concluded that impacts to near-surface aquifers could range from SMALL to LARGE, depending on site-specific conditions.*

As discussed previously, the NRC staff conducted a site-specific evaluation of impacts to water resources from spills and leaks, applying the GEIS criteria at the proposed Lost Creek ISR Project in SEIS Section 4.5. That evaluation determined that such impacts are expected to be SMALL, given the proposed operations and site-specific conditions.

No changes were made to the SEIS beyond the information provided in this response.

B.5.4.2 Adequacy of Impact Assessment

Comments: L017-050; L017-051

The commenter stated the Lost Creek draft SEIS and the GEIS were inadequate for the purposes of NEPA, and that the Lost Creek draft SEIS should be withdrawn, a scoping process begun, and the document subsequently reissued for public comment.

Response: *The NRC staff prepared the Lost Creek draft SEIS consistent with its regulations under 10 CFR Part 51 that implement NEPA and its guidance for conducting environmental reviews as found in NUREG–1748 (NRC, 2003a). Additionally, the GEIS, which this final SEIS supplements [see GEIS Section 1.4.1 (NRC, 2009)], provides a starting point for NRC NEPA analyses for site-specific license applications for new ISR facilities, such as the Lost Creek ISR, LLC application for the proposed Lost Creek ISR Project. GEIS Section 2.11 describes current and former ISR facility operations NRC licensed. The NRC staff used this information in its generic evaluation of potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of ISR facilities in specific geographic regions of the western United States. This final SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions, depending upon the similarity among the proposed facility, activities, and site conditions related to the proposed Lost Creek ISR Project and those for the reference facility evaluated in the GEIS.*

The scope of the Lost Creek SEIS is described in SEIS Section 1.4, and opportunities for public participation are described in Section 1.4.2. No changes were made to the SEIS beyond the information provided in this response.

Comments: L015-009; L017-005

Two commenters stated that the Lost Creek SEIS is fundamentally flawed because NRC has not balanced the need for the project in the proposed location against the potential impacts on the human and natural environment.

Response*: NRC does not analyze the market conditions or business decision of a private entity to submit a license request as part of its licensing decision. The NRC licensing decision is based on the safety evaluation review and environmental review of an applicant license application. The NRC staff prepared the Lost Creek draft SEIS consistent with its regulations under 10 CFR Part 51 that implement NEPA and its guidance for conducting environmental reviews found in NUREG–1748 (NRC, 2003a). NRC regulations under 10 CFR 51.10(b) state that NRC "recognizes a continuing obligation to conduct its domestic licensing and related regulatory functions in a manner which is both receptive to environmental concerns and consistent with the [NRC] responsibility as an independent regulatory agency for protecting the radiological health and safety of the public."*

As a regulatory agency, NRC's "federal action" at Lost Creek is the decision of whether to grant or deny the applicant license request. This purpose and need statement also reflects that NRC is not the implementer or the funding entity for the proposed activity. As such, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location to extract uranium from a particular ore body. No further changes were made to the SEIS beyond the information provided in this response.

Comments: L015-031; L019-007

Two commenters asserted NRC had not taken a "hard look" at the environmental impacts and that the draft SEIS added little, if anything, to the sufficiency of the NRC analysis of environmental impacts from the ISR process. The commenters also stated the SEIS analysis mirrored the final GEIS (NRC, 2009) analysis and that the lack of a discernable difference between the GEIS environmental impact findings and those contained in the draft SEIS was a clear indication that no searching analyses were performed as required under NEPA.

Response: *As described in SEIS Section 1.4.1, this SEIS supplements the GEIS. The GEIS provided a starting point for the NRC site-specific analysis of potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility. The Lost Creek ISR Project would be located in the Wyoming West Uranium Milling Region, one of the four specific geographic regions considered in the GEIS. SEIS Table 1-1 shows the range of potential environmental impacts that may be expected in the Wyoming West Uranium Milling Region based on the GEIS. As shown SEIS Table 1-1, the GEIS concluded that the significance of the expected impacts on certain resource areas (e.g., transportation, groundwater, noise) could range, depending on site-specific conditions.*

The SEIS evaluation of impacts is provided in Chapter 4. That evaluation relied on the description of the proposed Lost Creek ISR Project facility and associated activities (SEIS Chapter 2), and the description of the affected environment at and in the vicinity of the proposed Lost Creek ISR Project (SEIS Chapter 3), and considered the GEIS significance criteria for each resource area in assessing the environmental impacts. For each resource area assessment, the NRC staff compared the site-specific conditions at the proposed Lost Creek ISR Project to the conditions documented in the GEIS and also identified new or significant information that would change the expected environmental impact beyond that described in the GEIS. SEIS Table 2-3 summarizes the significance of environmental impacts for the proposed Lost Creek ISR Project.

No further changes were made to the SEIS beyond the information provided in this response.

Comments: L019-008; L019-012

A commenter stated that NRC should evaluate the potential impact of spills and that the failure to consider spills in the draft SEIS, and more notably in the GEIS, was disappointing. The commenter also stated the potential impacts to groundwater, surface water, and land from spills should be considered in the proper framework, considering the reasonable range of the possible severity of spills.

Response*: The NRC analyses of the potential environmental impacts to land use, surface water, and groundwater from spills associated with the ISR operations proposed for the Lost Creek ISR Project are described in SEIS Sections 4.4.1, 4.5.1.1, and 4.5.2.1. In the GEIS, these impacts are described in Sections 4.3.3, 4.3.4.1, and 4.3.4.2. SEIS Table 1-1 summarizes the significance of resource area impacts from the GEIS. As described in SEIS Section 1.4.1, the SEIS both tiers and incorporates by reference from the GEIS to assess the site-specific environmental impacts. The SEIS analysis found the proposed facility and activities and the site-specific conditions at the proposed Lost Creek ISR Project were comparable to the*

facility, activities, and conditions described in the GEIS. The comparable facility design aspects, activities, and conditions included the following:

- *Engineering controls are in place to detect pressure changes in the wellfield piping system.*
- *Completed wells undergo mechanical integrity testing prior to their placement in service and are subsequently retested every 5 years.*
- *Alarm systems are installed in individual wells and in header houses.*
- *Wellfields are visually inspected daily.*
- *A spill response plan is in place to address accidental spills.*
- *Requirements are implemented to remediate affected areas and to remove contaminated soils for disposal offsite.*
- *The near-surface aquifer at the proposed site is at depth and is separated from the surface by relatively impermeable horizons.*

Furthermore, should a license be issued for ISR operations at the proposed Lost Creek ISR Project, NRC staff would respond to reported incidents at the facility, including spills. NRC would also conduct periodic inspections to determine compliance with applicable regulatory requirements, license conditions, and approved procedures. Potential violations and allegations would be evaluated and addressed through either of the appropriate NRC enforcement or allegation programs.

No further changes were made to the SEIS beyond the information provided in this response.

Comment: L019-028

The commenter stated NRC has the duty to fully explain the science, technology, and techniques used in the ISR process and to fully analyze and assess the environmental impacts of each aspect of the process. The commenter believes an environmental review is impossible without historical data on the success rates of the technologies used in the ISR process. Only by doing so, the commenter stated, can the NEPA requirement of a “hard look” be fulfilled.

Response: *GEIS Chapter 2 (NRC, 2009) provides a detailed description of the ISR process applicable to the evaluation of impacts from proposed ISR facilities. All phases of the ISR facility lifecycle are described, and information on the historical operating experience at ISR facilities is provided with respect to topics of safety significance and of public concern including spills, leaks, excursions, and aquifer restoration. GEIS Chapter 2 describes key aspects of the ISR process common to NRC-licensed ISR facilities to build the foundation for the GEIS impact analyses. GEIS Chapter 2describes significant issues for the proposed ISR sites and their potential environmental impacts rather than provide a detailed description of all aspects of every NRC-licensed facility. Detailed information regarding the specific technologies, equipment, and operational practices and parameters applicable to the proposed Lost Creek ISR Project is provided in the applicant’s license application and summarized in SEIS Chapters 2 and 6; an explanation of how the information in the GEIS applies to the proposed Lost Creek ISR Project is also included. The NRC staff evaluated the adequacy of the license application with respect*

to operational safety and potential environmental impacts and determined that key aspects of the ISR process proposed for implementation at the proposed Lost Creek ISR Project were similar to those described in the GEIS before incorporating by reference into the Lost Creek ISR SEIS relevant GEIS information.

While NRC guidance discusses methods that are considered acceptable to staff, NRC does not prescribe technology or methods that an applicant must use nor is it necessary for NRC to proactively evaluate all available options in either the GEIS or elsewhere before applications are received. Past experience suggests that ISR facilities use similar technology; by focusing on what is common, the GEIS provides a reasonable basis for supporting future ISR license application reviews. If an applicant submits an application that includes unproven technology or methods not analyzed in the GEIS, the NRC review may require additional details and performance data to verify that safety would be maintained and to use such information in the site-specific environmental review. However, the NRC staff has determined that the key aspects of the ISR process proposed for use at the Lost Creek ISR Project were consistent with those described in the GEIS.

No further changes were made to the SEIS beyond the information provided in this response.

Comment: L018-002

The commenter stressed the need for site-specific information in the analysis of all potential impacts associated with ISR projects and that the Lost Creek draft SEIS did not provide adequate information to effectively address key issues.

Response: *As described in SEIS Section 1.4.1, this SEIS was prepared to fulfill the requirement under 10 CFR 51.20(b)(8) to prepare either an Environmental Impact Statement (EIS) or a supplement to an EIS for the issuance of a source material license for a uranium ISR facility. This SEIS supplements the GEIS, which provided a starting point for the NRC NEPA analysis (documented here) of the applicant license application for the proposed Lost Creek ISR Project. The NRC site-specific NEPA analysis used detailed information and descriptions of the proposed ISR facility and activities, and the description of the affected environment at the site and vicinity as contained in the applicant's license application and other relevant resources. For each of the resource areas evaluated in the SEIS, the NRC staff reviewed the information the applicant provided, validated the information as appropriate, and evaluated the impact to the environment in the SEIS.*

No further changes were made to the SEIS beyond the information provided in this response.

Comments: L015-033; L015-045; L018-038

One commenter stated the SEIS is not consistent with its responsibilities under NEPA and Section 309 of the *Clean Air Act* (CAA). The commenter stated that it was rating the SEIS as inadequate (Category 3). The commenter stated that the SEIS should be formally revised and made available for public comment in a supplemental or revised SEIS. Further, the commenter stated that, if its concerns are unable to be resolved, this matter would be a candidate for referral to the Council on Environmental Quality for resolution. Another commenter believes the fundamental contradiction between actual operational data and the NRC conclusions about the magnitude of impacts in both the GEIS and the SEIS is contrary to NEPA. The commenter believes the SEIS is an ad hoc analysis, lacking a coherent and comprehensive regulatory framework. The commenter believes there are no objective, consistent standards by which the

public can judge the NRC site-specific analyses, and further believes the data are inaccurate and therefore, are not sufficient under NEPA.

Response*: NRC recognizes EPA's authorities and responsibilities under NEPA and the CAA to rate draft EISs and refer them to the Council on Environmental Quality (CEQ). NRC has revised much of the text in the SEIS, but disagrees that the final SEIS should be made publicly available for additional public comment. NRC staff disagrees that the SEIS represents an ad hoc analysis, lacking any coherent and comprehensive regulatory framework. As allowed under NEPA, the Lost Creek SEIS both tiers and incorporates by reference relevant information, findings, and conclusions, consistent with the applicant's proposed facility, activities, and conditions at the Lost Creek site and the reference facility description, activities, information, and impact conclusions in the GEIS.*

No further changes were made to the SEIS beyond the information provided in this response.

B.5.4.3 Range of Reasonable Alternatives

Comments: L015-010; L017-002; L017-004

A commenter noted while NEPA does not require NRC to consider every possible alternative to the proposed action, it does require NRC to consider all reasonable alternatives. The commenter stated NRC failed to consider reasonable alternatives by limiting the analysis to only the proposed action and No Action alternatives. Both commenters stated the failure to consider reasonable alternatives was a violation of NEPA. The commenter called for NRC to reevaluate the alternatives within the GEIS and the Lost Creek SEIS.

Response: *The proposed federal action and the purpose and need for the proposed federal action define the range of reasonable alternatives. As a regulatory agency, the proposed federal action for the Lost Creek ISR Project is the NRC decision of whether to grant or deny a license. The purpose and need for the proposed federal action does consider the applicant goals and objectives to extract uranium from a particular location, which helps define reasonable alternatives to the proposed federal action.*

Reasonable alternatives considered in a site-specific environmental review depend on the proposed action and site conditions. As described in SEIS Section 2.1, NRC considered reasonable alternatives including the proposed action, the No-Action alternative (i.e., not approving the license application), and dry yellowcake (uranium recovery and the production of dry yellowcake as the final product). SEIS Section 2.2 describes other alternatives considered and the reason they were eliminated from detailed analysis.

As noted in NUREG–1508 (NRC, 1980), underground mining would have more significant environmental impacts than ISL extraction, and the ore from underground mining would require processing at a conventional uranium mill to produce the final product. Conventional milling would produce significant quantities of tailings (the residual rock materials after uranium removal), which are normally disposed of onsite at the conclusion of the mill operating life (NRC, 1997). NUREG–0706 (NRC, 1980) provides a detailed evaluation of the impacts associated with tailings disposal from conventional uranium milling. The potential environmental impacts of underground mining and conventional milling would be more significant than those from ISR milling at the proposed site. Therefore, underground mining and conventional milling were not evaluated in the Lost Creek ISR SEIS.

While the NRC staff considered reasonable alternatives to the proposed action in the environmental review, the only alternative within the NRC decisionmaking authority is to approve or not approve the license application. The NRC under NEPA would examine a reasonable alternative that the NRC may not have regulatory authority to impose. However in order to be considered reasonable, an alternative must meet the purpose and need of the proposed project. The NRC will not accept a proposed purpose and need if it has been unduly narrowed, but the NRC also allows deference to a business decision of an applicant. If NRC decides to grant the license request, the applicant must comply with the license requirements, NRC regulatory requirements, and any other relevant local, state, or federal requirements to operate its facility. No changes were made to the final SEIS beyond the information provided in this response.

B.5.4.4 References

74 FR 27052. U.S. Nuclear Regulatory Commission. “Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” *Federal Register.* Vol. 74, No. 107. pp. 27,052–27,054. June 5, 2009.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Washington, DC: NRC. June 2009.

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. ADAMS Accession No. ML032250177. Washington, DC: NRC. June 2003b.

NRC. NUREG–1508, “Final Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico.” ML082170248. Washington, DC: NRC. February 1997.

NRC. NUREG–0706, “Final Generic Environmental Impact Statement on Uranium Milling Project M-25.” ADAMS Accession Nos. ML032751663, ML0732751667, ML032751669. Washington, DC: NRC. September 1980.

B.5.5 Purpose, Need, and Scope of the SEIS/GEIS

B.5.5.1 Description of the SEIS/GEIS Purpose and Need

Comments: L015-001; L015-004; L015-005; L015-007; L017-001; L017-003; L017-006; L019-025

Two commenters noted that the statement of purpose and need in the GEIS (NRC, 2009) was too narrow, which resulted in a limited analysis of reasonable alternatives in the Lost Creek ISR SEIS. A commenter stated that because of the construct of the purpose and need in the GEIS, the subsequent Lost Creek ISR SEIS was too narrow and limited the range of reasonable

alternatives to either grant or deny the applicant's licensing request, and thus failed to satisfy the fundamental requirements of NEPA. The commenter went on to note that by limiting the purpose and need scope, only two alternatives in the Lost Creek SEIS were evaluated in detail, which the commenter stated effectively meant that only one alternative, licensing the project, was given serious consideration. The commenter stated the alternatives analysis violates both the letter and spirit of NEPA, and that if NRC had articulated a reasonable and legitimate purpose and need, the range of alternatives considered would likewise have been reasonable. Another commenter stated that NRC should craft a statement of purpose and need in consultation with other involved Federal and State agencies that related the uranium recovery program to broad national objectives within NRC purview, such as "improving remediation of land and water impacts from the recovery of source or byproduct materials" or "ensuring the long-term isolation from the human and natural environment of harmful radionuclides and chemical toxins produced in the nuclear fuel cycle."

Another commenter stated that because of the construct of the purpose and need statement, the applicant had not been required to identify a customer for its product, but rather assumed that such a customer would exist to buy the uranium and that this did not satisfy the NEPA "hard look" requirements. The commenter also disagreed with the NRC statement in the Lost Creek SEIS that NRC does not have a role in the company's business decision to submit a license application. The commenter argued that the purpose and need of the project could not be determined without NRC evaluating whether the project is economically viable at the Lost Creek site for the particular product.

Response: *The statement of purpose and need is found in SEIS Section 1.3 and is derived from the proposed federal action. Under the Atomic Energy Act (AEA), NRC has statutory authority to issue licenses for the possession and use of AEA-regulated radioactive materials and particular activities involving this material. Based on NRC's statutory authority, the proposed federal action is NRC's decision whether to grant or deny a private party's licensing application to conduct ISR operations to extract uranium and produce yellowcake at a particular site. The purpose and need for the proposed federal action does consider the applicant's goals and objectives to extract uranium from a particular location, which helps define reasonable alternatives to the proposed federal action. As a result, NRC limits its analysis of alternatives to accomplishing the objective of extracting uranium from the location of the applicant site, the No-Action alternative, and the dry yellowcake alternative.*

The alternatives to the proposed action are discussed in SEIS Sections 2.1 and 2.2. Section 2.1.2 describes the No-Action alternative (i.e., denial of the license application), and Section 2.1.3 describes Alternative 3 (dry yellowcake), in which dry yellowcake would be produced as the final product. Alternative mining and milling methods (conventional and heap leach), and alternate lixiviants are considered in SEIS Section 2.2.1 and 2.2.2, respectively, but were not analyzed in detail. The evaluation of alternate sites analysis is limited to the occurrence of the subsurface ore body and could consider the placement of the wellfields. SEIS Section 2.1.1.2 was added to this final SEIS to discuss alternative wastewater disposal options. Section 4.14.1.2 discusses the impacts from alternative wastewater disposal options. NRC does not analyze the market conditions or business decision of a private entity to submit a license request as part of its licensing decision. An NRC licensing decision is based on the safety evaluation review and environmental review of the license application.

NRC performs an analysis of alternative energy production methods and alternative sites in its environmental reviews of nuclear power plant licensing actions. In those cases, the proposed action involves the decision of whether to grant or deny the license of an energy production

facility, and the facility could perform this function at other locations. Even in these environmental reviews, NRC notes that the decision regarding energy policy and energy planning, including whether to implement energy options like solar power, conservation, or even nuclear power, are also made by the utility and state and federal (non-NRC) decisionmakers, and NRC does not have authority to make these decisions. If NRC decides to renew or grant an operating license to a nuclear power plant, the decision of whether to operate the nuclear power plant or an alternative is left to the appropriate state, utility, and/or federal entities.

In comparison, an ISR facility does not generate energy and is a fixed site based on the location of the ore body. As a result, alternative energy production methods and alternative site locations are not related to the proposed federal action to decide whether to grant or deny the applicant request for a license to extract uranium from a particular site. NRC has not included an analysis of alternate site locations (outside the applicant's control), alternative energy production methods, or market conditions in the final SEIS.

Section 2.2.3 was expanded, and Section 4.14.1.2 was added to the final SEIS to discuss alternative wastewater disposal options in response to these comments.

B.5.5.2 Use of the GEIS in Site-Specific Environmental Reviews

Comments: L003-004; L015-041

A commenter expressed concern about how information from the GEIS was incorporated into the draft Lost Creek SEIS. The commenter stated a regional description of the affected environment could not substitute for a meaningful description and analysis of the impacts on the environment from the proposed Lost Creek ISR Project. Another commenter stated that because the Lost Creek SEIS was one of three SEISs tiered from the GEIS, analysis of the relationship between each SEIS and the GEIS was warranted; consequently, the commenter expressed concern about how information was incorporated from the GEIS. Additionally the commenter expressed concern that the potential impacts would always seem SMALL when compared to the scale considered in the GEIS and that this approach was potentially negligent and did not adequately represent or analyze the impacts to site-specific resources. The commenter encouraged NRC to remove general statements and comparisons used throughout the SEIS.

Response: *The relationship of the Lost Creek ISR SEIS to the GEIS is described in SEIS Sections 1.1 and 1.4.1. As noted, the SEIS is a supplement to the GEIS. The GEIS provided a starting point for NRC's NEPA analyses of ISR facilities located within the regions evaluated in the GEIS. The Lost Creek ISR SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions concerning potential environmental impacts. SEIS Chapter 3 describes each resource area (e.g., land use, geology and soils, water resources) at a regional level and then provides local and site-specific characteristics. The extent to which NRC incorporated GEIS impact conclusions depended on the consistency among the applicant's proposed facility, activities, and conditions at the proposed Lost Creek ISR Project site and the reference facility description, activities, regional conditions, and information or conclusions in the GEIS. NRC determinations regarding environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are described in SEIS Chapter 4.*

GEIS Sections 1.7.1 and 1.8 provide a general description of the NRC process for reviewing license applications for proposed new ISR uranium recovery projects. An NRC site-specific

environmental review is conducted for each license application. As described in GEIS Section 1.8, each site-specific environmental review will evaluate all information provided in an applicant's environmental report to ensure that sufficient information has been provided to assess environmental impacts. The applicant's environmental report includes a 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 support its decisionmaking. The GEIS does not relieve the applicant of the need to adequately document site-specific information in its application.

The NRC staff initially relies on information the applicant provides as well as information and conclusions from NRC's safety review. NRC staff confirms important attributes of the license application and environmental report through visits to the proposed site location and vicinity; independent research activities; and consultations with appropriate Federal, Tribal, State, and/or local agencies. If the NRC staff finds commonality between site conditions and those evaluated in the GEIS, the staff may incorporate by reference into the site-specific environmental review documentation applicable to portions of or conclusions from the GEIS. The conclusions in the site-specific environmental review documentation must have sufficient technical bases.

GEIS Section 1.8.3 describes the process by which NRC staff uses the GEIS to determine the significance of site-specific environmental impacts. The GEIS provides criteria for each environmental resource area to help determine the significance level of impacts (e.g., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific conditions at the proposed Lost Creek ISR Project to determine the significance of potential impacts. Finally, the NRC staff compared the conditions and activities at the proposed Lost Creek ISR Project site to those described in the GEIS to determine whether the GEIS environmental impact conclusion for a particular resource area could be adopted in the Lost Creek SEIS. The NRC staff determined whether the GEIS impact significance conclusions for a given resource area could be adopted in full, only in part, or not at all. SEIS Chapter 4 describes the extent to which the GEIS conclusions were adopted, including the identification of supporting information and data that form the basis for that determination. No changes were made to the SEIS beyond the information provided in this response.

B.5.5.3 Scope of the SEIS/GEIS

Comments: L004-005; L015-002; L015-035; L015-060

Several commenters expressed concern over the scope of the SEIS and, similarly, the GEIS (NRC, 2009). One commenter stated that certain aspects of the GEIS, including its scope, appeared to be binding upon the SEIS. The commenter further noted that, by improperly limiting the scope of the SEIS, NRC failed to analyze a number of impact areas. Another commenter stated additional comments on the GEIS were appropriate, given the GEIS did not apply to any federal plan or project and did not represent any final NRC regulatory or policy decision, which therefore made it impossible for any member of the public to meaningfully comment on the GEIS in a concrete context. The same commenter noted that despite many public comments on the GEIS urging NRC to consider the impacts of previous uranium mining and milling, NRC deemed that contamination from past uranium mining and milling was outside the GEIS scope. One commenter suggested that NRC should withdraw the Lost Creek ISR SEIS and the GEIS and reissue the documents after a groundwater protection rule has been finalized. One commenter requested that the public have an opportunity to review NRC proposed rulemaking on groundwater protection at ISL facilities and urged NRC to extend the

draft SEIS comment period to allow NRC to promptly release its associated draft groundwater protection rule so it could be reviewed concurrently with the draft SEISs.

Response: *As discussed in SEIS Section 1.4, the NRC staff considers the scope of the GEIS to be sufficient for the purposes of defining the scope of this SEIS. Topics determined to be within scope for the GEIS were also within scope for the Lost Creek SEIS. NRC made this determination based on its review of the applicant-provided information and as a result of meetings with Federal, State, and local agencies and contact with potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via e-mail and telephone (see SEIS Sections 1.4.2 and 1.7.3).*

Concerning public involvement in the GEIS, NRC accepted public comments on the GEIS scope from July 24 to November 30, 2007, and held three public scoping meetings. Additionally, NRC held eight public meetings to receive comments on the draft GEIS, published in July 2008. Comments on the draft GEIS were accepted between July 28 and November 8, 2008. Comments received both during scoping and on the draft GEIS are available through ADAMS on the NRC website (http://www.nrc.gov/readingrm/adams.html). Transcripts of the scoping meeting and draft GEIS comment meetings are available at http://www.nrc.gov/materials /uranium-recovery/geis/pub-involve-process.html. A scoping summary report is provided in GEIS Appendix A (NRC, 2009a). Based on public meeting transcripts and the written comments received during the scoping and public comment period for the GEIS, the NRC staff considers that meaningful and extensive public comments were received on the GEIS.

With respect to the specific comment that contamination from past conventional mining and milling was outside the scope of the GEIS, NRC noted in GEIS Appendix A that such contamination could be considered as part of the analysis of cumulative impacts. SEIS Chapter 5 provides the NRC site-specific cumulative effects analysis. In SEIS Table 5-1, past uranium recovery operations, including conventional mills within the Wyoming West Uranium Milling Region (where the proposed site is located), are identified. The cumulative impacts evaluation in SEIS Chapter 5 has been revised to clarify and improve the transparency of the analysis. Regarding the comment concerning the proposed rulemaking on groundwater protection, this SEIS is based on the regulations in effect at the time of writing. This has been clarified in SEIS Section 1.5. Section B5.9.4 of this appendix describes the status of the proposed rulemaking on groundwater protection.

B.5.5.4 Reference

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Washington, DC: NRC. May 2009.

B.5.6 Scoping Process and Scoping Report

Comments: L015-062; L015-064; L015-065

A commenter stated NRC did not conduct any public meetings regarding the scope of the Lost Creek SEIS in contrast to what was done for the GEIS (NRC, 2009). The commenter stated that instead of public scoping meetings, NRC met with government agencies and groups it considered interested in the SEIS to determine the scope. The commenter stated that the NRC failure to conduct public scoping prevented the public from raising issues, including the cumulative impact of past uranium mining and milling that the commenter stated should be considered in the Lost Creek SEIS.

Response: *NRC conducted a public scoping process for the ISR GEIS, from which the Lost Creek ISR SEIS is tiered. The scoping process included three public scoping meetings, one of which occurred in Casper, Wyoming. NRC considered public comments, along with information on ISR technology and regional information, to identify the scope of the GEIS for ISR facilities. The scoping process was used to identify significant issues to be studied in depth in the GEIS to help evaluate the environmental impacts on various resource areas and to identify other regulatory and consultation requirements for ISR facilities.*

NRC considers the ISR GEIS to be a final environmental impact statement and the environmental reviews for a specific license application to supplement the ISR GEIS. According to 10 CFR 51.92(d), the NRC staff is required to prepare a supplement to a final environmental impact statement in the "same manner as the final environmental impact statement except that a scoping process need not be used." Furthermore, even if a scoping process is conducted, NRC regulations do not require the scoping process to include public scoping meetings [10 CFR 51.26(b)].

NRC staff consulted with multiple Federal, Tribal, State, and local agencies and/or entities during the preparation of the Lost Creek SEIS for consultation purposes and to gather information on issues, concerns, and environmental impacts related to the proposed Lost Creek ISR Project, as described in SEIS Section 1.7.3. NRC staff used information from these interactions and other site-specific information to evaluate whether issues identified during the scoping process for the GEIS were adequate for the Lost Creek ISR environmental review and whether specific GEIS conclusions or findings were applicable to the Lost Creek ISR Project. This information was used to prepare a draft SEIS, which was issued for public comment.

Comments received on the draft SEIS were considered in the development of this final SEIS. In particular, the cumulative impact analysis in SEIS Chapter 5 has been revised in response to public comments received on the draft SEIS and considers past uranium mining and milling.

B.5.6.1 Reference

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

B.5.7 SEIS/GEIS Methods and Approach

B.5.7.1 Consideration of Compliance History in Assessing Impacts

Comment: L015-055

The commenter stated that the NRC conclusion that impacts to groundwater from restoration would be SMALL was arbitrary and unreasonable. Additionally, the commenter requested NRC fully disclose the ISR industry groundwater restoration history and then reconsider impacts to groundwater, regionally and locally, based on that history.

Response: *The NRC conclusions regarding potential environmental impacts to groundwater from aquifer restoration for the proposed Lost Creek ISR Project are provided in SEIS Section 4.5.2.1.3. As described there, NRC analyzed impacts that could result from drawdown, leaks and spills from buried piping, and disposal of liquid effluent via deep well disposal and*

determined that impacts would be SMALL. These impact conclusions are based on facility-specific process descriptions for the proposed Lost Creek ISR Project and site-specific characteristics of the proposed site. To make these impact determinations, the NRC staff reviewed information in the applicant's license application as amended (including the technical and environmental reports), other information and data staff independently collected, and information and data provided in the GEIS.

NRC published a summary of groundwater impacts from ISR operations at operating facilities that is available through ADAMS using the Accession Number ML091770402 (NRC, 2009b). ADAMS is available on the Internet at http://www.nrc.gov/reading-rm/adams.html. No changes were made to the Lost Creek ISR SEIS beyond the information provided in this response.

B.5.7.2 Reliance on Regulatory Compliance To Limit Impacts

Comments: L017-027; L017-030; L017-032; L017-045

The commenter noted that the applicant may not implement best management practices (BMPs) that it views as not being cost effective. There are no assurances that such measures would be instituted, and there is no mention of the applicant's intent to adhere to the Wyoming Game and Fish Department (WGFD) recommendation to avoid surface-disturbing activities and/or disruptive activities in nesting and early brood-rearing habitat. Additionally, NRC does not mention the applicant's intent to adhere to any stipulations involving sage-grouse winter concentration areas. The commenter went on to state that these areas should be identified and mapped and adequate mitigation measures instituted to protect key habitats. The commenter also noted NRC should provide assurances that the applicant intends to implement practices that mitigate the threat of development to raptors.

***Response**: BMPs, mitigation measures, and management actions that avoid or reduce environmental impacts can be imposed through license conditions on the NRC licensee; however, NRC can only establish license conditions within the limits of the authority granted by Congress. NRC also requires licensees to obtain all necessary permits and licenses from the appropriate regulatory authorities prior to operating their facility, and mitigation may be imposed as a requirement established by other agencies through required permits the proposed Lost Creek ISR Project must obtain. Specifically, WGFD (2010) contains recommendations, not regulations, and NRC does not have the statutory authority to require the applicant to abide by these recommendations. However, NRC staff has been working with the Sage-Grouse Implementation Team (SGIT) and its subcommittees to better define State agency roles and to develop guidelines for the ISR uranium industry. If an NRC license was to be granted, WGFD would routinely inspect the Lost Creek ISR facility for compliance with the requirements and conditions of the sage-grouse guidelines, as they are located in a core breeding area, defined in Executive Order (E.O.) 2010-4.*

Regarding measures to protect raptor species, SEIS Section 6.4.2.3 provides details on annual surveys that would be conducted to ensure that identified nests were not disturbed during project activities. Additionally, the applicant must abide by the Bald and Golden Eagle Protection Acts and there is a requirement that any potential takes of bald eagles would be coordinated with the U.S. Fish and Wildlife Service (FWS) to determine whether a bald eagle take permit was appropriate, per the Bald Eagle Take Permit Rule the FWS published on September 11, 2009 (74 FR 46836). The applicant would also have to abide by the Migratory Bird Treaty Act, which provides migratory birds, including some raptor species, protection from

being pursued, hunted, taken, captured, or killed. SEIS Section 4.6.2 was modified in response to this comment.

B.5.7.3 General Comments on GEIS Structure, Methods, and Approaches

Comment: L019-011

This commenter provided comments exclusively on the GEIS (NRC, 2009a), and the comment addressed the general adequacy and role of the GEIS, purpose and need statement, and the alternatives analysis, among others.

Response: *The draft GEIS was published with a Federal Register NOA on July 28, 2008 (73 FR 43795). NRC held a 103-day public comment period for the draft GEIS from July 28, 2008, through November 7, 2008. During this comment period, members of the public were invited and encouraged to submit related comments online, via e-mail, via regular mail, or orally at one of eight public meetings held on the draft GEIS. NRC considered and responded to comments received on the draft GEIS and included these responses in Appendix G of the final GEIS.*

Because the listed comments do not directly apply to the draft SEIS or provide any site-specific information related to the proposed Lost Creek ISR Project, they are not considered further. SEIS Section 1.4.1 describes the relationship between the GEIS and the SEIS. Section 1.4.1 was revised to indicate that NRC responded to comments received on the GEIS submitted during the GEIS comment period and that those responses are contained in GEIS Appendix G.

Comments: L008-023; L022-024

One commenter asked for clarification on how NRC defines environmental impacts. Specifically, the comment stated that the SEIS should provide more information on the reported 60 excursions at three NRC licensed ISR facilities and why none resulted in environmental impacts. Another commenter wanted clarification on what constitutes unavoidable adverse environmental impacts.

Response: *NRC adopted environmental impact classifications from the GEIS (NRC, 2009a) for use in the SEIS. GEIS Section 1.4.3.3 defines and describes these classifications: a SMALL impact is defined as the environmental effects are not detectable or are so minor that they will neither destabililize nor noticeably alter any important attribute of the resource considered; a MODERATE impact is defined as the environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered, and a LARGE impact is defined as the environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.*

GEIS Section 2.11 describes historical operation of ISR uranium milling facilities which includes a discussion of excursions in GEIS Section 2.11.4. The Lost Creek SEIS is a site-specific review of the applicant's proposal to construct, operate, conduct aquifer restoration, and decommission the proposed ISR facility at Lost Creek.

NRC does not define an excursion as contamination that moves into an underground source of drinking water (USDW). Rather, an excursion is defined as an event where a monitoring well in overlying, underlying, or perimeter monitoring well ring detects an increase in specific water quality indicators, usually chloride, alkalinity and conductivity, which may signal that fluids are

moving out from the wellfield and provide an early indication of imbalance in the wellfield flow system to notify operators to take appropriate actions. To date, no excursions from an NRC-licensed ISR facility has contaminated a USDW.

Comments: L008-021; L008-081; L008-132; L020-001; L020-018; L020-019

Two commenters noted the draft SEIS does not contain the most recent hydrological information submitted to the Wyoming Department of Environmental Quality (WDEQ)-Land Quality Division (LQD). As a result, many details in the SEIS regarding Class I injection wells differ from information the applicant provided to the WDEQ-Water Quality Division.

Response: *NRC acknowledges the applicant provided additional hydrological information after the publication of the draft SEIS. The applicant provided additional information to NRC on March 26, 2010 (LCI, 2010), related to open issues in the safety review. This information was incorporated into the final SEIS hydrology analysis, as appropriate. The underground injection control (UIC) permit application submitted to WDEQ on May 28, 2010, and was reviewed and information incorporated into the SEIS as appropriate. The final SEIS was revised to reflect the updated hydrological data described previously and the issuance of five Class I injection wells by WDEQ since the publication of the draft SEIS.*

Comments: L020-013; L020-015

The commenter asserted that many statements and analyses in the draft SEIS are incorporated from the GEIS without additional site-specific analysis. The commenter also asserted that NRC did not adequately analyze additional new information and wondered if new information was truly analyzed.

Response*: For each resource area, SEIS Chapter 4 restates the GEIS assumptions and conclusions. If the assumptions outlined in the GEIS applied to the site-specific conditions at the Lost Creek ISR, then the SEIS adopted the GEIS conclusions for the given resource area. For those resource areas in which the GEIS conclusions could not be adopted, a thorough site-specific review was performed in the SEIS. Identification of new information during the site-specific review does not necessarily result in a different impact conclusion than that in the GEIS. No change was made to the SEIS beyond the information in this response.*

B.5.7.4 References

40 CFR Part 1508. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 1508, “Council on Environmental Quality.” Washington, DC: U.S. Government Printing Office.

73 FR 43795. U.S. Nuclear Regulatory Commission. “Notice of Availability of Draft Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” *Federal Register*. Vol. 73, No. 145. pp. 43,795–43,798. July 28, 2008.

74 FR 46836. U.S. Fish and Wildlife Service. “Eagle Permits; Take Necessary To Protect Interests in Particular Localities.” *Federal Register.* Vol. 74, No. 175. pp. 46,836–46,879. September 11, 2009.

74 FR 27052. U.S. Nuclear Regulatory Commission. “Notice of Availability of Final Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” *Federal Register*. Vol. 74, No. 107. pp. 27,052–27,054. June 5, 2009.

Bald Eagle Protection Act: June 8, 1940, ch. 278, 54 Stat. 250 (16U.S.C. 668 et seq)

E.O. 2010-4, Office of the Governor, Executive Order 2010-4. "Greater Sage-Grouse Core Area Protection." Cheyenne, Wyoming: Dave Freudenthal, Governor, State of Wyoming. August 18, 2010.

Golden Eagle Protection Act: Pub. L. 87-884, Oct. 24, 1962, 76 Stat. 1246.

LCI. "Lost Creek ISR, LLC *In-Situ* Recovery (ISR) Permit Application, TFN 4 6/268, 3rd Round Technical Review Comments." Docket 040-09068. ADAMS Accession No. ML100970200. Casper, Wyoming. March 26, 2010.

Migratory Bird Treaty Act: July 3, 1918, ch. 128, 40 Stat. 755 (16 U.S.C. 703 et seq.).

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009a.

NRC. "Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities." Memorandum (July 10) from C. Miller to Chairman Jaczko, et al. ADAMS Accession No. ML091770402. Washington, DC: NRC. 2009b.

NRC. NUREG–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 the License Renewal of Nuclear Plants." Washington, DC: NRC. May 1996.

WGFD. "Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats." Version 6.0. Cheyenne, Wyoming. Wyoming Game and Fish Department. April 2010.

B.5.8 Public Involvement

Comment: L003-002

The commenter stated the public comment period was insufficient to allow for meaningful participation, which is inconsistent with the purpose and intent of NEPA.

Response: *Public participation is an essential part of the licensing process, and the NRC encourages public involvement. NRC conducted an open, public SEIS development process consistent with the requirements of NRC NEPA-implementing regulations. As described in SEIS Appendix B2.4, NRC extended the initial comment period and the public was provided an 81-day comment period, from December 11, 2009, to March 3, 2010, which exceeds the minimum 45-day comment period required under NRC regulations. No change was made to the SEIS beyond the information provided in this response.*

Comments: L003-005; L015-066

Two commenters stated that NRC should "scrap" the current SEIS, conduct public scoping meetings, and issue another draft SEIS for public comment without reliance on the GEIS for site-specific analysis.

Response: *The public participation process for the draft Lost Creek ISR SEIS is described in Section 1.4.2 of the final SEIS. The Lost Creek ISR SEIS was prepared to fulfill the requirement under 10 CFR 51.20(b)(8) to prepare an EIS or supplement to an EIS for the issuance of a source material license. The GEIS (NRC, 2009) provided a starting point for the NRC NEPA analysis of the Lost Creek ISR Project. The environmental review of the proposed Lost Creek ISR site was initiated by the applicant submittal and NRC acceptance of the license application for detailed technical review, as discussed in Section 1.6.1 of the final SEIS. The NRC environmental review used information the applicant provided [initial application, responses to requests for additional information (RAIs), and subsequent revisions to the application] that was then independently verified and supplemented with site-specific information as appropriate. NRC staff conducted a site visit in January 2009, which included meetings with Federal, State, and local agencies and authorities. NRC staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person, via e-mail, and by telephone. No further changes were made to the Lost Creek ISR SEIS beyond the information provided in this response.*

Comment: L016-015

A commenter stated that if the SEIS provided a more detailed description of the licensing process to include the scoping and public comment meetings on the GEIS, the completion of the Safety Evaluation Report, and license applicant meetings with NRC staff, this would provide members of the public and interested stakeholders with a better understanding of how much the NRC licensing process focuses on transparency and public participation and the extent of the process for protecting public health and safety and the environment on a site-specific basis.

Response: *NRC provides multiple avenues for public involvement in its licensing process. In the NRC license review process, when an application is received, reviewed for completeness, and accepted for detailed review, NRC formally dockets the application and publishes a NOA in the Federal Register, which 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. The NOA published in the Federal Register includes the relevant identifying information for the license application so that an interested member of the public can view the application either electronically through ADAMS or in person by visiting the NRC Public Document Room.*

SEIS Section 1.4.2 describes the NRC staff's efforts to meet with the public; tribes; and Federal, State, and local agencies to gather information for the development of this SEIS. This section also describes the public comment process for the draft SEIS and indicates that a Notice of Opportunity to request a hearing on the proposed Lost Creek ISR project was published in the Federal Register on July 10, 2008 (73 FR 39728). NRC did not receive any requests for a hearing. In addition to the opportunities provided through development of the SEIS, NRC provided opportunities for public input during the staff's safety review. Specifically, the staff held five meetings or teleconferences with the applicant from 2006 to 2010; all of these interactions included an opportunity for the public to listen to the meetings and to ask questions.

This SEIS also describes the opportunities to provide input that occurred throughout the development of the GEIS, from which the Lost Creek ISR SEIS is tiered. As discussed in SEIS Section 1.4.1, NRC accepted public comments on the scope of the GEIS from July 24, 2007, to November 30, 2007, and held three public scoping meetings, one of which was held in the State of Wyoming. During the public comment period on the draft GEIS, NRC held eight public

meetings to receive comments on the draft GEIS; three of these meetings occurred in the State of Wyoming.

Text was added to SEIS Section 1.4.2 to discuss the opportunities for public involvement that were part of the licensing review process.

Comments: L018-026; L018-035

A commenter requested that a draft air quality modeling protocol be circulated among interested air quality stakeholders for comments prior to any modeling. The commenter asked whether there is a public participation process associated with the establishment of, and the NRC decision to approve, alternate concentration limits (ACLs).

Response: *NRC provides multiple avenues for public involvement in its licensing process in the review of an individual ISR facility. For new ISR license applications, such as the Lost Creek ISR application, NRC publishes a Notice of Intent in the Federal Register to prepare a site-specific SEIS and provides information on the scope of the SEIS. NRC also publishes the draft SEIS for public comment and addresses stakeholder comments on the draft in its final SEIS. NRC may also make a draft environmental assessment and accompanying draft finding of no significant impact available for public comment for any related ISR licensing actions that do not require an SEIS.*

A licensee must apply for a license amendment for an ACL. For major licensing actions that may include an amendment request for an ACL, a notice is published in the Federal Register and on the NRC webpage providing an opportunity for the public to comment and an opportunity to request a hearing. Further, NRC performs a safety and an environmental review (typically an environmental assessment) as part of evaluating the adequacy of ACLs.

No changes were made to the final SEIS beyond the information provided in this response.

B.5.8.1 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.9 Regulatory Issues and Process

B.5.9.1 NRC as a Regulatory Authority

Comment: L016-010

The commenter asked for clarification about NRC, its statutory mission under the AEA, and its approach to licensing as an independent regulatory agency. The commenter suggested that all references to the NRC's statutory mission in the SEISs be revised with the following language:

"NRC must license facilities, including ISR operations, in accordance with the AEA and the Commission's implementing regulations to protect public health and safety from potential radiological and nonradiological hazards associated with AEA materials and operations."

Response: *NRC was created after Congress passed the Energy Reorganization Act in 1974, which, along with the AEA of 1954, provides the foundation for NRC's regulatory authority. As an independent regulatory agency, NRC reports directly to Congress. Independent agencies can be distinguished from regular executive agencies by their structural and functional characteristics. NRC has the responsibility to license and regulate uranium ISR facilities through the statutory requirements of the Uranium Mill Tailings Radiation Control Act of 1978 and the AEA, as amended. These statutes require that NRC ensure source material, as defined in AEA Section 11(a), and byproduct material, as defined in AEA Section 11e.(2), is managed to conform to applicable regulatory requirements. The text within the SEIS is correct. No change was made to the SEIS beyond the information provided in this response*.

B.5.9.2 NRC Policies and Practices

Comments: L008-006; L008-108; L008-135; L008-137; L016-018

Commenters stated that it appeared from the language in the SEIS that NRC would be reviewing and approving all wellfield packages, rather than just initial wellfield packages. The commenters went on to note that, in the commenters' opinion, if NRC were to review and approve all wellfield packages, this would be contrary and detrimental to the Commission's policy supporting performance-based licensing and that NRC staff should continue to allow Safety and Environmental Review Panels (SERPs) to review and approve wellfield packages under traditional performance-based licensing as has been done in the past.

Response: *NRC agrees with the need to clarify its position on review and approval of wellfield hydrologic data packages. Historically, NRC reviewed and approved all wellfield packages. During the mid-1990s, the Commission adopted a performance-based approach to licensing. A performance-based regulatory approach is one that establishes performance and results as the primary basis for regulatory decisionmaking, and this approach incorporates the following attributes: (i) measurable (or calculable) parameters (i.e., direct measurement of the physical parameter of interest or of related parameters that can be used to calculate the parameter of interest) exist to monitor the system, including both facility and licensee performance; (ii) objective criteria to assess performance are established based on risk insights, deterministic analyses, and/or performance history; (iii) licensees have flexibility to determine how to meet the established performance criteria in ways that will encourage and reward improved outcomes; and (iv) a framework exists in which the failure to meet a performance criterion, while undesirable, will not in and of itself constitute or result in an immediate safety concern.*

Current Commission policy allows the applicant to use an in-house SERP to review and approve wellfield packages under performance-based license conditions. The SERP is composed of at least three members: one with expertise in management, one with expertise in operations, and the third being the radiation safety officer (RSO). NRC staff, however, has determined that a new licensee with no record of performance must submit its first wellfield package to NRC for review and approval. After NRC approval of an initial wellfield package, a licensee would have a template on which to model future packages. In wellfields where particular geologic features (e.g., faults, thin/missing aquitards) or groundwater flow behavior (e.g., unconfined aquifer, leakage across aquitards) require the characterization of local field data and testing to determine whether ISR operations can meet regulatory requirements, the staff may require review and approval of additional wellfield packages. As a result of the safety review for the proposed Lost Creek ISR Project, NRC has determined the hydrogeological conditions of the Lost Creek Project that would impact excursion control and capture require NRC to impose a license condition whereby NRC will review and approve the Production Area Pump Test reports for all wellfields at the Lost Creek ISR Project. The description in SEIS Section 6.3.1.2 was revised to clarify this issue.

Comment: L017-011

The commenter stated that NRC seeks to adopt a new approach to analyzing impacts that would allow ISR operations in an unconfined aquifer.

Response: *The setting at Lost Creek does not include ISR operations in an unconfined (unsaturated) aquifer; therefore, the SEIS was not revised.*

Comment: L018-034

The commenter asks when in the process would NRC make a decision to set ACLs.

Response: *NRC does not decide when to set ACLs. The applicant would make an internal determination that the concentrations of hazardous constituents are as low as reasonably achievable and would submit a license amendment request to NRC to establish ACLs for those constituents that do not meet the standards in 10 CFR Part 40, Appendix A, Criteria 5B(5) i and ii. This amendment request would be evaluated based on the standards in 10 CFR Part 40, Appendix A, Criterion 5B(6).*

In accordance with 10 CFR Part 40, Appendix A, Criterion 5B(6), NRC would only consider requests for ACLs after a licensee has demonstrated that restoring the constituent at issue to background or maximum contaminant level (MCL) values is not practical to achieve at a specific site. To determine whether a licensee has undertaken “reasonable restoration efforts,” NRC would consider the aquifer restoration methods applied and their efficacy to achieve restoration goals at a specific site. If NRC concludes reasonable efforts were not applied, the licensee would be required to continue restoration efforts until this has been demonstrated before a request for an ACL could be submitted. Additional 10 CFR Part 40, Appendix A, Criterion 5B(6) requirements for ACLs are discussed in SEIS Appendix C. In addition, ACL application review procedures for NRC staff are described in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003b); and NUREG–1724 (NRC, 2000).

No changes were made to the SEIS beyond the information provided in this response.

Comment: L015-003

The commenter stated NRC has never denied a materials license application in its institutional history.

Response: *The statement is false. In the last 2 years, several ISR applications were found unacceptable and returned to the applicant. Even after an application is accepted, if there are enough open (unresolved) issues, the application would be denied. No change was made to the SEIS beyond the information provided in this response.*

B.5.9.3 Adequacy of NRC Regulations and Practices

Comments: L015-032; L015-058; L022-022

One commenter stated the NRC analysis of groundwater restoration and excursions showed that NRC has no coherent framework for regulating ISL operations. The commenter also noted that the NRC staff recognizes that “class of use” is an inappropriate restoration goal and referred to the NRC that concluded Criterion 5B does not provide for restoration to “class of use” standards. The commenter stated that because “class of use” is a restoration standard that is not legally recognizable, it should not be the basis for an analysis of groundwater impacts. Another commenter stated thatthe discussion in the SEIS minimizes the approval process for ACLs making it seem as if this is not a matter of concern. The regulations and NRC practice provide for a rigorous process, license modification, and EA before any single ACL is granted, and the ACL must be protective of both public health and the environment. The license applicant, the decision-maker, and the public should be put on notice about the difficulties in obtaining the ACL. The document should not imply an ACL is the ultimate, practical aquifer restoration.

Response: *NRC has announced its intent to issue a proposed rule specific to groundwater protection at ISR facilities); however, this proposed rule has not yet been published in the Federal Register. NRC regulations require groundwater quality be returned to the standards identified in 10 CFR Part 40, Appendix A, Criterion 5B(5). Those standards are background; the values in the table in 10 CFR Part 40, Appendix A, Criterion 5C (also referred to as MCLs); or an ACL NRC established in accordance with 10 CFR Part 40, Appendix A, Criterion 5B(6). Criterion 5B(5) allows NRC to approve an ACL for groundwater restoration. NRC has in place a rigorous regulatory process to determine whether a licensee may receive approval for ACLs. To request NRC to establish ACLs, the licensee must submit a license amendment application. The licensee must demonstrate that it has attempted to restore hazardous constituents in groundwater to background or the MCL—whichever level is higher. The regulations and criteria used for review of ACL applications are found in 10 CFR Part 40, Appendix A, Criterion 5B(6), and summarized in SEIS Appendix C. The Wyoming “class of use” standard falls within the list of factors in 10 CFR Part 40, Appendix A, Criterion 5B(6)(a)(v–vi) and (b)(vi–vii), and thus may be considered as one factor in evaluating ACL requests for ISR facilities located in the state.*

In considering ACL requests, NRC places particular importance on protecting underground sources of drinking water (USDW). The use of modeling and additional groundwater monitoring may be necessary to show that ACLs in ISR wellfields would not adversely impact USDWs.

Before an ISR licensee is allowed to extract uranium, EPA, under 40 CFR Part 146.4 and in accordance with the Safe Drinking Water Act (SDWA) must issue an aquifer exemption covering the portion of the aquifer in which the uranium-bearing rock is located. EPA cannot exempt the

portion of the aquifer unless it is found that "it does not currently serve as a source of drinking water" and "cannot now and will not in the future serve as a source of drinking water." Because of these criteria, only impacts occurring outside of the exempted aquifer are evaluated. In most cases, the water in aquifers adjacent to the uranium ore zones does not meet drinking water standards. NRC will not approve an ACL if it could impact adjacent USDWs.

Further guidance for the review of ACLs for ISR facilities is being developed in a revision of NUREG–1569, (NRC, 2003). Existing guidance for ACL reviews is contained in NUREG–1620 (NRC, 2003b, Section 4.3).

Appendix C has been included in the final SEIS to provide further information on ACLs.

Comments: L016-012; L016-013

One commenter stated that the NRC description of regulatory programs applicable to ISL operations outside the context of the AEA should be expanded to demonstrate how highly regulated the ISL industry is in the United States. The same commenter further noted NRC should specify all of the regulatory programs that apply to ISL operations and not limit the description in the final SEIS to 10 CFR Part 51 regulations. The commenter noted the SEIS states that ISR operations are subject to the AEA and NEPA with no mention of other statutory programs such as the SDWA, *National Historic Preservation Act* (NHPA), and the *Endangered Species Act*, as implemented in accordance with various state programs. The commenter stated that the final SEIS should clarify the extent of the regulatory oversight for ISL operations. The commenter further noted that multiple agencies oversee ISR operations, often resulting in two or even three layers of financial assurance for each ISR project, and that this assures adequate site-specific decommissioning and decontamination would be performed.

Response: *NRC has to comply with all applicable federal environmental laws and regulations, including its own regulations (in Title 10 of the Code of Federal Regulations) and those promulgated by other federal agencies, to the extent these other laws and regulations would not be inconsistent with other statutory requirements. GEIS Section 1.6 (NRC, 2009a) identifies agencies involved in the management and reviews of a uranium ISR facility, and Section 1.7 describes the licensing and permitting process for an ISR facility. SEIS Section 1.6 discusses the status of licensing and permitting and associated consultations that pertain to the ISR licensing review at the proposed Lost Creek ISR Project. This SEIS was prepared in accordance with NEPA requirements and NRC-implementing regulations at 10 CFR Part 51.*

Furthermore, GEIS Appendix B summarizes other federal statutes, implementing regulations, and Executive Orders potentially applicable for the proposed Lost Creek ISR Project licensing review. The agencies responsible for implementing these programs describe the regulatory programs applicable to ISR operations, and readers should consult the responsible agencies for clarification of their regulations and programs. ISR applicants are ultimately responsible for understanding and complying with all federal, state, and local permits and regulations. No changes were made to the SEIS beyond the information provided in this response.

B.5.9.4 Applicable Rulemaking Efforts

Comment: L004-007; L019-026

One commenter stated NRC has an ad hoc approach to ISR regulation and asserted that the "class of use" restoration standard used in both the GEIS and the Lost Creek ISR SEIS

indicated a fundamental problem with the NRC regulatory framework. The commenter was also concerned that the GEIS (NRC, 2009a) would become the proxy for ISR regulations. The commenter stated NRC does not have regulations specifically relevant to ISR operations but rather has adapted some of the conventional milling regulations to apply to ISR operations and "filled in the remaining gaps with license conditions," the standard review plan for ISR facilities, and the GEIS. Another commenter stated that for NRC to craft an appropriate "Purpose and Need for Agency Action," the agency must work with its federal colleagues at EPA, U.S. Department of Energy, and U.S. Department of the Interior to develop a regulatory framework for uranium recovery cleanup and licensing that protects public health and the environment. The commenter asserted that NRC has refused to issue a draft groundwater protection rule for nearly 5 years, and that it is past time for NRC to develop a coherent set of protective environmental requirements for ISR processes; the commenter stated that developing a draft groundwater rule would be a start.

Response: *NRC has announced it is working on a rulemaking specific to groundwater protection at ISR facilities but that it has not yet been completed. The analysis in the Lost Creek ISR SEIS is based on existing regulations at the time the final SEIS is published. NRC reviews applications using regulations in place at the time of review. This is clarified in SEIS Section 2.1.1.1.4.5.*

As background, NRC (2006) directed NRC staff to focus on eliminating dual regulation of groundwater by NRC and EPA. The Commission stated that NRC should retain its jurisdiction over the wellfield and groundwater under its AEA authority, but should defer active regulation of groundwater protection programs to either EPA or to the EPA-authorized state through the EPA UIC program. The status of ongoing rulemaking activities is provided on the NRC public website at www.nrc.gov.

The statement of the purpose and need is found in Section 1.3 of this final SEIS and is derived from the proposed Federal action. Under the AEA, NRC has statutory authority to issue licenses for the possession and use of AEA-regulated radioactive materials and particular activities involving this material. Based on NRC's statutory authority, the proposed Federal action is NRC's decision whether to grant or deny a private party's licensing application to conduct ISR operations to extract uranium and produce yellowcake at a particular site.

The reader is referred to Section B5.5 of this comment response appendix for additional discussion of the purpose and need for agency action. Because no proposed rule is available to discuss, no changes were made to the Lost Creek ISR SEIS beyond the information provided in this response.

B.5.9.5 NRC NEPA Process Implementation

Comment: L015-059

One commenter stated that absent a sense of the timing, scope, and coverage of the NRC-proposed ISL groundwater rule and associated NEPA process, an early February 2010 date for the close of the comment period on the draft Lost Creek ISR SEIS placed a tremendous burden on the public and arbitrarily separated two documents that should be considered together.

Response: *NRC is currently working on a proposed rulemaking specific to groundwater protection at ISR facilities as described in Section B.5.9.4 of this appendix. At the time of this*

writing, this rulemaking effort is still in progress and no proposed rule has been submitted for public comment.

The Lost Creek ISR SEIS analysis is based upon the current regulations in 10 CFR Part 40. Until and if the proposed rulemaking is made final, license applications will continue to be reviewed and approved in accordance with current regulations.

Section B.5.13 of this appendix discusses extension of the public comment period on the draft Lost Creek ISR SEIS in response to public comments.

No changes were made to the SEIS beyond the information provided in this response.

Comment: L019-002

One commenter noted that without vigorous compliance with NEPA requirements and adherence to strict environmental protections, the history of uranium mining could be repeated.

Response: *NRC understands and recognizes there are serious legacy issues resulting from the decades of uranium mining activities from the 1940s through the 1970s when waste from uranium mines was not cleaned up after mines were closed. NRC regulation of ISR facilities includes ensuring ISR operators take necessary measures to confine mobilized uranium and other constituents within the wellfield where the facility is operating, ensuring monitoring programs are in place to provide early detection of any migration of process fluids away from the wellfield, and enforcing necessary corrective actions to prevent uranium from contaminating adjacent water sources to ensure the public is protected.*

The Lost Creek SEIS was prepared in accordance with NRC regulations at 10 CFR Part 51 that implement NEPA and with NRC guidance in NUREG–1748 (NRC, 2003c). No changes were made to the Lost Creek SEIS beyond the information provided in this response.

B.5.9.6 NRC Licensing Process

Comment: L016-009

The commenter requested that a more complete description of the NRC licensing process be provided for those not familiar with that process. The commenter also stated that the process included NRC review of the entire license application (including the technical and environmental reports) and consultation with the NRC staff conducting the safety review. The commenter further stated that the SEIS should more clearly show the link between the NRC environmental and safety reviews.

Response: *SEIS Sections 1.6 and 1.6.1 describe, in general, the NRC licensing process for the proposed Lost Creek ISR Project. These sections refer to SEIS Section 1.7.1 for a more complete description of the NRC licensing process. Further, as stated in SEIS Section 1.6.1, the NRC detailed technical review of the Lost Creek license application comprises of two parallel reviews: a safety review and an environmental review. The safety review focuses on assessing compliance with the applicable requirements of 10 CFR Parts 20 and 40 and Appendix A to Part 40, while the environmental review is conducted in accordance with the regulations in 10 CFR Part 51. The results of these two detailed reviews support the NRC licensing decision. GEIS Figure 1.7-1 provides a general flow diagram for the NRC licensing process, including the safety and environmental reviews.*

It is common during the detailed technical review of a license application for NRC to request additional applicant information to ensure the application is complete. In some cases, multiple rounds of RAIs are possible. For applications that are not complete, this iterative process is designed to provide the applicant the necessary feedback to supplement the application so it is complete. The public participation process for this is discussed in SEIS Section 1.4.2.

As the commenter indicates, there is some overlap between the safety and environmental reviews. This is most clearly seen in topics such as groundwater resources and protection and radiological dose to workers and members of the public. The NRC staff members conducting the environmental and the safety reviews collaborate as necessary as they conduct these reviews in parallel.

Throughout the SEIS, NRC has used the term "license application" to be inclusive of all aspects of the application, including the applicant technical report and environmental report. The reference sections following SEIS Chapters 2, 3, 4, 5, and 6 reflect the reliance on all aspects of the application, as described previously.

No changes were made to the SEIS beyond the information provided in this response.

Comment: L019-005

One commenter expressed concern that the GEIS (NRC, 2009a) and the draft Lost Creek ISR SEIS gave little attention to the recurring issues with uranium solution mines in the United States and other countries and the long history of evidence that environmental harms do occur. The commenter listed 10 environmental harms that the commenter asserted NRC failed to analyze in the draft SEIS, which included the potential for mining solutions to escape the production areas; adequate placement of monitor wells to detect potential excursions; the location of mine sites too close to water wells used for human consumption; high levels of uranium and other constituents in groundwater outside of the mining zone should an excursion occur; the inability to restore to premining "baseline" conditions at any commercial-scale ISL site; relevant regulatory agencies relaxing their cleanup standards for uranium and other contaminants to complete restoration; the adequacy of financial assurance; the chemical toxicity of uranium on the kidneys; restoration and decommissioning plans not being required; and the release of radon gas from injection well valves exceeding federal limits and, therefore, potentially contributing to unhealthy radon levels in areas where abandoned uranium mines have not been cleaned up. The commenter felt it was incumbent upon NRC to comprehensively address the environmental risks inherent in an expansion of the domestic uranium mining and milling industry and to have sufficient protections in the licensing process to prevent a recurrence of previous environmental harms to the environment and public health.

Response: *NRC evaluated historical information on ISR operations the NRC licensed (see GEIS Section 2.11) and considered this historical information to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility in specific geographic regions of the western United States. The Wyoming West Uranium Milling Region, where the proposed Lost Creek ISR Project would be located, is in one of these geographic regions (see GEIS Section 4.2). The final SEIS tiers and incorporates by reference from the GEIS relevant information, findings, and conclusions to the extent that the applicant's proposed facility, activities, and conditions are consistent with the reference facility activities, information, and impact conclusions described in the GEIS.*

The SEIS considers excursions and groundwater quality impacts on production and surrounding aquifers in Section 4.5.2.1.2.2, which also discusses the placement of monitoring wells. In addition, SEIS Section 6.3.1 describes wellfield groundwater monitoring. The location of nearby wells used for various purposes is described in SEIS Section 3.5.2.3.4. Section B.5.9.8 of this comment-response appendix addresses the issue of groundwater restoration at ISR sites; the decommissioning and reclamation process and associated activities that would occur during this process are discussed throughout the SEIS. The potential release of radon gas at wellheads is considered in both the safety evaluation and as part of the public and occupational health and safety impacts in SEIS Section 4.13. The adequacy of financial assurance is evaluated as part of the NRC safety evaluation rather than as part of the environmental review.

No changes were made to the SEIS beyond the information provided in this response.

B.5.9.7 Groundwater Restoration Criteria and Methods

Comments: L015-020; L015-021; L018-005; L018-028; L018-029; L018-032

Several commenters were concerned with the potential establishment of ACLs as groundwater restoration targets prior to the completion of adequate restoration and that the draft SEIS did not fully assess the operational requirements and constraints associated with restoration activities. One commenter noted the SEIS should evaluate methods that could be used to meet restoration goals for all constituents mobilized during the ISR process. A commenter noted that although the SEIS acknowledged that the water quality goal in the portion of the aquifer where extraction occurs is pre-ISR baseline conditions, the description in the SEIS concluded by stating the demonstration of restoration must comply with the requirements in 10 CFR Part 40, Appendix A, which allows for restoration target values that do not meet the pre-ISR baseline. The commenter noted that although EPA standards in 40 CFR Part 192 allow NRC to utilize this practice, ACLs are above baseline or MCL values.

Response: *Under NRC regulations, the licensee must restore the groundwater quality in the production zone aquifer to the water quality standards listed in 10 CFR Part 40, Appendix A, Criterion 5B(5). Specifically, under Criterion 5B(5), the concentration of a hazardous constituent must not exceed (i) the NRC-approved background concentration of that constituent in groundwater; (ii) the respective MCL value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an alternative concentration limit the NRC established. Under Criterion 5B(6), requests for ACLs would only be considered after a licensee has demonstrated that restoring the constituent at issue to either background or MCL values is not practical to achieve at a given site. Licensees may only propose for NRC consideration ACLs that present no significant hazard. NRC may establish a site-specific ACL for a hazardous constituent if it finds that the proposed limit is as low as reasonably achievable after considering practicable corrective actions, and that the constituent would not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. Additional 10 CFR Part 40, Appendix A, Criterion 5B(6) requirements for ACLs are discussed in SEIS Appendix C. In addition, ACL application review procedures for NRC staff are described in the following documents: January 1996 Staff Technical Position: Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003b); and NUREG–1724 (NRC, 2008a). No changes were made to the SEIS beyond the information provided in this response.*

Comments: L015-049; L015-052

A commenter asserted that the NRC practice of averaging poor groundwater quality with good groundwater quality to characterize preextraction groundwater quality misrepresents the impacts from groundwater restoration. The commenter stated that NRC tied groundwater restoration in the Lost Creek ISR SEIS to the average of poor groundwater quality in the immediate ore zone with good groundwater quality outside the ore zone but within a mine area. The commenter stated that SEIS Table 3-2, which summarizes the water quality in the Lost Creek ISR Project area, gave the impression that the groundwater in the aquifer within the proposed mine boundary exceeded EPA and Wyoming water quality standards for several constituents, but elsewhere in the SEIS NRC disclosed that there were wells with good quality water. For example, the SEIS disclosed that there were either active domestic or stock wells within a 3.2-km [2-mi] radius of the proposed site. The commenter asserted that the practice of averaging good groundwater quality with poor groundwater quality is incomplete and misleading and skewed the impact analysis to minimize potential groundwater impacts from ISR projects in general and the Lost Creek ISR Project in particular. The commenter stated that NRC uses “mathematical artifice” that inflates the preextraction contaminant levels within a proposed project boundary to create the impression that baseline groundwater conditions are poor and that restoration is possible. Finally, the commenter stated that if groundwater quality in and outside of an ore zone was analyzed separately and not averaged, then the adverse impact on groundwater outside of the ore zone would be substantially larger.

Response: *The commenter is referring to the need to establish a baseline for groundwater quality in the proposed license area before ISR operations begin. As part of the site characterization to obtain a license, the applicant is required to determine the average preoperational water quality for all aquifers in, above, below, and outside the proposed area. However, this general preoperational average is not the same as the average baseline water quality of the uranium-bearing aquifer for a specific wellfield. The average baseline water quality for a specific wellfield is determined only from water quality measured in wells installed within the production ore zone aquifer in each licensed wellfield, and it is this specific average that is used to determine groundwater restoration target values in individual wellfields. NUREG–1569 (NRC, 2003a) provides guidance on establishing baseline water quality. Contrary to the comment, the average baseline water quality does not include wells “outside the ore zone.” No changes were made to the SEIS beyond the information provided in this response.*

Comment: L015-054

One commenter stated that the NRC analysis of groundwater impacts from restoration was insufficient and relied entirely on the GEIS framework. As a result, the commenter noted the NRC analysis was limited to consumptive impacts (i.e., water quantity).

Response: *The analysis of groundwater impacts from aquifer restoration at the proposed Lost Creek ISR Project followed the GEIS framework (NRC, 2009a), which considered consumptive groundwater use and impacts from waste management practices during the ISR aquifer restoration phase.*

SEIS Section 4.5.2.1.3 describes the potential environmental impacts on groundwater resources during aquifer restoration, including impacts from groundwater consumptive use and waste management practices and impacts on groundwater quality from transporting restoration fluids through shallow piping. The discussion of groundwater impacts has been expanded to include

a discussion of well injection impacts and a discussion of groundwater gradient and lixiviant plume migration in the event of a wellfield shutdown. The analysis of groundwater impacts relies on applicant-provided information, such as aquifer measurements (e.g., permeability) and the results from aquifer field tests that NRC staff reviews and considers in the site-specific safety evaluation. The groundwater safety evaluation informs the environmental review.

As discussed in the SEIS, the impact from deep well disposal is expected to be SMALL because of the aquifer characteristics of the proposed host formations for deep well disposal and adherence to the WDEQ UIC permit requirements for deep well injection. Finally, NRC staff determined that the impact from aquifer restoration on overall groundwater quality would be SMALL, because groundwater quality in the affected aquifers would be restored to water quality standards that are protective of human health and the environment. The surrounding aquifers would not be impacted.

No changes were made to the SEIS beyond the information provided in this response.

Comments: L015-056; L015-057

The commenter stated it appears NRC evaluates groundwater restoration impacts assuming that if baseline groundwater quality is not achieved, “class of use” quality would be achievable and that this analysis ignores NRC regulations governing ISR groundwater restoration that make no mention of “class of use” as a restoration standard. The commenter stated that NRC regulations mandate that groundwater must be restored to background or the MCLs listed in 10 CFR Part 40, Appendix A, Criterion 5D.

Response: *The commenter is correct that NRC has used “class of use,” a state designation under the SWDA, as a restoration goal. The “class of use” standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003a). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC notified licensees and applicants in NRC (2009b), that the restoration standards listed in NUREG–1569 (NRC, 2003, Section 6.1.3(4) are not consistent with those listed in 10 CFR Part 40, Appendix A. NRC requires licensees to commit to achieve the restoration standards in Criterion 5B(5). A licensee can apply for a license amendment for an ACL only after showing that restoration to the background level or MCL is not practically achievable for a particular constituent. NRC reviews the ACL request using the criteria articulated in 10 CFR Part 40, Appendix A, Criterion 5B(6). The state designation of “class of use” for an aquifer can be one of the factors that is considered during NRC review of the ACL request. Additional Criterion 5B(6) ACL requirements are described in Appendix C.*

Comment: L019-021

A commenter stated that restoration to either background levels or MCL standards is aspirational rather than a reality, and regulators—whether NRC or Agreement States—allow ACLs to be established for some constituents. The commenter asserted that restoration standards are a moving target for all ISR mining sites and that NRC has made it nearly impossible for a reader to analyze environmental impacts because of the lack of a detailed and comprehensive history of ISR restoration operations. The commenter asserted that the issuance of waivers and (aquifer) exemptions should be part of the analysis and that NRC must analyze the impact of the waivers and exemptions from meaningful standards in a

comprehensive way. The commenter stated that by not doing this, both the GEIS and SEIS fail the NEPA "hard look" standard.

Response: *The commenter is correct that, to date, restoration to background water quality for all constituents has proven to be not practically achievable at licensed NRC ISR sites (NRC, 2005, 2004, 2003d). In the past, NRC has applied "class of use," a state designation under the SDWA as described previously, as a secondary restoration goal to approve these restorations. The "class of use" standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2009a). NRC therefore neither treated nor approved the "class of use" standard as an ACL.*

NRC since determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC notified licensees and applicants in Regulatory Information Summary, RIS 09-05, dated April 29, 2009 that the restoration standards listed in NUREG–1569 [NRC, 2009 Section 6.1.3(4)] are not consistent with those listed in 10 CFR Part 40, Appendix A, and the licensee must commit to achieve the restoration standards in Criterion 5B(5).

NRC requires submission of a license amendment for a licensee to request establishment of an ACL for any constituents that do not meet the primary baseline standards. NRC performs a safety evaluation and an environmental review to evaluate the request for the license amendment after the licensee demonstrates it is not practically achievable to restore the wellfield to either background or MCLs for a particular constituent. No changes were made to the SEIS beyond the information provided in this response.

GEIS Section 2.11 (NRC, 2009a) describes historical operation of ISR uranium milling facilities, which includes discussion of aquifer restoration in Section 2.11.5.

The standards in Criterion 5B(5) state the concentration of a hazardous constituent must not exceed (a) the Commission-approved background concentration of that constituent in groundwater; (b) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed or; (c) an alternative concentration limit established by the Commission. The commenter appears to consider the ACL as a "waiver" from the primary restoration goal. It is true that an ACL is not a primary restoration goal, but it will only be considered after a licensee has demonstrated that primary restoration goals are not practically achievable at a specific site. ACLs that present no significant hazard may be proposed by the licensees for Commission consideration. The Commission may establish a site-specific ACL for a hazardous constituent as provided in Criterion 5B(5) if it finds the proposed limit is as low as reasonably achievable after considering practicable corrective actions and the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. A description of the NRC requirements for application, review, and establishment of a site-specific ACL is presented in Appendix C. In addition, ACL application review procedures for NRC staff are available in the following documents: January 1996 Staff Technical Position: Alternate Concentration Limits for Title II Uranium Mills, NUREG–1620 and NUREG–1724. NRC finds the ACL application, review and approval process will provide the "hard look" standard required by NEPA. No changes were made to the SEIS beyond the information provided in this response.

Comment: L019-023

One commenter stated that standards have been repeatedly relaxed because no aquifer has ever been returned to baseline (i.e., premining conditions). The commenter cited an NRC memorandum to the Commission, which stated more than 60 percent of the constituents in 3 ISR mining facilities located in Nebraska and Wyoming were returned to their preoperational concentrations, implying that 40 percent of measured constituents could not be restored to baseline conditions and stated that, "concessions to the licensee were made." The commenter also referred to a study by Southwest Groundwater Consulting that evaluated restoration at *in-situ* uranium mines located in south Texas. This study found that mining operations in south Texas were consistently unable to meet original restoration standards and that more lenient, amended restoration standards were routinely granted.

Response: *The commenter is correct that NRC-approved restorations to date have not met the restoration goal to achieve background water quality for all constituents. In the past, NRC has applied "class of use," a state designation under the SWDA, as a secondary restoration goal to approve these restorations. The term "class of use" referred to in the GEIS (NRC, 2009a) as a standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003a). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC has notified licensees and applicants in NRC (2009b) that the restoration standards listed in NUREG–1569 [NRC, 2003a, Section 6.1.3(4)] are not consistent with those listed in 10 CFR Part 40, Appendix A, and licensees and applicants must commit to achieve the restoration standards in Criterion 5B(5).*

Under Criterion 5B(5), the concentration of a hazardous constituent must not exceed (i) the NRC-approved background concentration of that constituent in groundwater; (ii) the respective MCL value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an ACL NRC established. Under Criterion 5B(6), requests for ACLs would only be considered after a licensee has demonstrated that restoring the constituent at issue to background or MCL values is not practical to achieve at a specific site. Licensees may only propose, for NRC consideration, ACLs that present no significant hazard. NRC may establish a site-specific ACL for a hazardous constituent if it finds that (i) the proposed limit is as low as reasonably achievable after considering practicable corrective actions and (ii) the constituent would not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. Additional 10 CFR Part 40, Appendix A, Criterion 5B(6) requirements for ACLs are discussed in SEIS Appendix C. In addition, ACL application review procedures for NRC staff are described in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003d); and NUREG–1724 (NRC, 2000).

NRC is aware that restored aquifers in Texas have not achieved the primary background restoration standard for some constituents. Texas, however, is an agreement states, has regulatory authority over ISR facilities, and would set the restoration standards for a particular ISR facility in Texas. NRC does not review or approve Texas regulatory decisions at a particular ISR facility. NRC's oversight of the Texas program consists of periodic reviews of the state's entire regulatory program for AEA materials. States have some flexibility in how they implement their regulatory program as long as NRC finds the state program is adequate to protect public health and safety and compatible with NRC's regulatory program. The final SEIS was changed in response to this comment.

Comments: L022-023; L015-048

One commenter questioned the accuracy of the assessment of a SMALL groundwater impact during aquifer restoration because of the potential for permanent degradation to groundwater quality and lack of information on how often NRC approves ACLs. Another commenter believes the NRC unreasonably minimizes the impacts of groundwater restoration at the Lost Creek site and asked about the NRC process for approving ACLs.

Response: *The purpose of aquifer restoration is to achieve the required 10 CFR Part 40, Appendix A, Criterion 5B(5) restoration groundwater protection standards in the wellfield ore zone exempted aquifer to ensure migration of any constituent to the surrounding aquifers will have a negligible impact. The standards in Criterion 5B(5) state the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in groundwater; (ii) the respective value in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (iii) an NRC-established ACL. An ACL is not a primary restoration goal and will only be considered after a licensee has demonstrated that primary restoration goals are not practically achievable at a specific site. Licensees may propose ACLs that present no significant hazard for Commission consideration. The Commission may establish a site-specific ACL for a hazardous constituent as provided in Criterion 5B(5) if it finds that the proposed limit is as low as reasonably achievable after considering practicable corrective actions and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.*

Because NRC approval for proposed ACLs would ensure public health and safety, potential impacts on groundwater would be SMALL during aquifer restoration, even if ACLs are implemented as restoration standards. A description of the NRC requirements for application, review, and establishment of a site-specific ACL is presented in Appendix C. In addition, ACL application review procedures for NRC staff are available in the following documents: January 1996 Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills; NUREG–1620 (NRC, 2003b); and NUREG–1724 (NRC, 2000).

B.5.9.8 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, “Standards for Protection Against Radiation.” Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, “Domestic Licensing of Source Material.” Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, “Domestic Licensing of Source Material.” Appendix A, “Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content.” Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” Washington, DC: U.S. Government Printing Office.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.” Washington, DC: U.S. Government Printing Office.

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 146, “Underground Injection Control Program: Criteria and Standards.” Washington, DC: U.S. Government Printing Office.

40 CFR Part 192. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 192, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings.” Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Washington, DC: NRC. May 2009a.

NRC. “Regulatory Information Summary (RIS) 09-05, 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.” ADAMS Accession No. ML083510622. Washington, DC: NRC. April 29, 2009b.

NRC. “Compliance with 10 CFR 40.42’s Timely Decommissioning Requirements.” Letter (July 7) from K. McConnell, Deputy Director, NRC, to M. Collings, President, Power Resources, Inc. ADAMS Accession No. ML081480293. Washington, DC: NRC. 2008.

NRC. “Regulation of Groundwater Protection at *In Situ* Leach Uranium Extraction Facilities.” SRM to COMJSM–006–001. ADAMS Accession No. ML060830525. Washington, DC: NRC. March 24, 2006,

NRC. “Technical Evaluation Report: Review of Cogema Mining Inc.’s Irigaray Mine Restoration Report, Production Units 1 Through 9.” Source Materials License SUA–1341. ML062570181. Washington, DC: NRC. 2005.

NRC. “Review of Power Resources, Inc.’s A-Wellfield Ground Water Restoration Report for the Smith Ranch–Highland Uranium Project.” ADAMS Accession No. ML041840700. Washington, DC: NRC. June 29, 2004.

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

NRC. NUREG–1620, “Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978.” Final Report. Washington, DC: NRC. 2003b.

NRC. NUREG–1748, “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs.” Washington, DC: NRC. August 2003c.

NRC. “License Amendment 15, Crow Butte Resources *In-Situ* Leach Facility, License No. SUA–1534, Wellfield #1 Restoration Acceptance.” Letter (February 12) and Attachments from D. Gillen to M.L. Griffin. ADAMS Accession No. ML03044055. Washington, DC: NRC. 2003d.

NRC. NUREG–1724, "Standard Review Plan for the Review of DOE Plans for Achieving Regulatory Compliance at Sites With Contaminated Ground Water Under Title I of the Uranium Mill Tailings Control Act." Draft Report. Washington, DC: NRC. 2000a.

NRC. "Commission Memorandum and Order in the Matter of Hydro Resources, Inc." CLI–00–08. ADAMS Accession No. ML003718672. Washington, DC: NRC. May 25, 2000b.

B.5.10 Credibility of NRC

Comments: L004-006; L015-014; L020-020

One commenter questioned NRC's credibility in his/her submitted comments by saying that the NRC is more interested in processing the permit application than doing a thorough analysis of the impacts and disclosing them to the public Another commenter asserted NRC turned a "blind eye" to the cumulative impact from the project. Another commenter stated that the groundwater protection rule had "fallen off the table" for the benefit of an industry that wished to proceed with materials licensing under a less-than-protective regulatory framework.

Response: *NRC acknowledges these summarized comments, which are related to the commenter's views of NRC credibility. NRC is an independent Federal agency that has no ownership of any nuclear or ISR facility. NRC regulates licensees by conducting a thorough and independent review of each application for a license consistent with its congressional mandate and NRC regulations for performing safety and environmental reviews. NRC notes that (i) the analysis of cumulative impacts in SEIS Chapter 5 was revised in response to public comments; (ii) the commenter concerns regarding the analysis of groundwater impacts are addressed in Section 5.9.7 of this comment response appendix; and (iii) the status of the proposed rule with new standards applicable to ISR facilities is discussed in Section B5.9.4 of this comment response appendix. No changes were made to the SEIS beyond the information provided in this response.*

B.5.11 Federal and State Agencies

B.5.11.1 Roles of Federal, Tribal, State, and Local Agencies

Comments: L006-001; L006-002

One commenter stated that the Rawlins Field Office of the U.S. Bureau of Land Management (BLM) has jurisdiction or authority over most of the land for the proposed Lost Creek ISR Project. BLM will be conducting its own review of the surface management plan of operation submitted pursuant to the 43 CFR 3809 regulations for BLM administered lands within the project area, and will adopt by reference salient information submitted to and published by the NRC's licensing process. The commenter went on to state that the Wyoming State Office of the BLM provided comments on the NRC's draft GEIS (NRC, 2008) and acknowledged that the roles and responsibilities of NRC and BLM under different regulatory frameworks are duly recognized.

Response: *NRC recognizes that BLM administers the majority (85 percent) of the proposed Lost Creek site. Since more than 2 ha [5 ac] of land surface would be disturbed during project development, the applicant would need to submit a Plan of Operations (POO) to the BLM, pursuant to 43 CFR Part 3809, and that application would be subjected to BLM's own NEPA analysis (see 76 FR 7877, February 11, 2011). Both agencies have exchanged information to*

aide in the development of its respective NEPA documents. NRC's coordination efforts with BLM are discussed in SEIS Section 1.7.3.1, which was revised to clarify BLM's responsibilities and NRC's coordination efforts with BLM on this review.

Comments: L006-004; L016-008

One commenter stated the NRC did not recognize BLM as a formal NEPA cooperating agency for developing the environmental document for Lost Creek ISR. Two commenters stated that the final SEIS should be updated to reflect finalization of the Memorandum of Understanding (MOU) between NRC and BLM. One commenter further noted that the MOU would allow the NRC and BLM to work closely together in review of uranium ISR projects in States where the NRC has primacy for licensing and the BLM has administrative responsibilities for surface management and/or minerals. The same commenter also stated the intent of the MOU is to improve interagency communications; facilitate the sharing of special expertise and information; and coordinate the preparation of studies, reports, and environmental documents. One commenter stated that in preparation of the Final SEIS, NRC staff needs to update the DSEIS tables and charts detailing applications or requests that have been filed by the license applicant.

Response: *SEIS Section 1.7.3.1 describes NRC's coordination with BLM during the preparation of the SEIS. As the commenter indicated, the MOU between NRC and BLM was finalized November 30, 2009 (75 FR 1088). BLM was not a cooperating agency on the Lost Creek ISR SEIS due in part to the difference in timing of the applications to the NRC and BLM. No further changes were made to the SEIS in response to this comment beyond those changes identified in this response.*

Comment: L016-019

One commenter stated WDEQ conducts detailed reviews of all ISR wellfield packages in Wyoming. Additionally, the commenter considers that NRC's review of one or more multiple wellfield packages is unnecessary and duplicative.

Response: *To confirm that the hydrogeology of a proposed site is suitable to ISR operations and these operations will not impact the public health, safety, and environment, NRC may require that a licensee provide some or all wellfield packages for NRC review and approval prior to lixiviant injection. Because these comments address details about the NRC licensing and the State of Wyoming permitting processes, NRC considers the comments to be beyond the scope of the Lost Creek ISR SEIS and requires no change to the final SEIS.*

Comment: L017-021

The commenter stated there is a lack of coordination between Federal agencies and believes that Federal agencies which have jurisdiction should become cooperating agencies, thereby producing only one document (one EIS).

Response: *NRC and BLM are conducting separate environmental reviews for the proposed Lost Creek ISR project due in part to the difference in timing of the applications to the NRC and BLM. However, NRC and BLM entered into an MOU on November 30, 2009, prior to issuance of the NRC draft SEIS, which will affect the preparation of subsequent NEPA reviews for those activities occurring on Federal (BLM) land. The purpose of the MOU is to define the cooperative relationship between the agencies during each agency's preparation of NEPA documents related to the extraction of uranium and thorium on public lands administered by BLM. The*

MOU provides a framework for this cooperative relationship and identifies the responsibilities of each agency. The intent of the MOU is to improve interagency communications, facilitate the sharing of special expertise and information, and coordinate the preparation of studies, reports, and environmental (NEPA) documents associated with NRC licensing actions and the BLM administration of public lands (75 FR 1088).

Because the Lost Creek licensing action preceded the MOU, BLM is not an official cooperating agency. However, NRC and BLM have shared information on this project. In addition to NRC preparing a NEPA document (the SEIS) for the licensing action, BLM is also preparing a NEPA document for the POO that is required because of the amount of land that is to be disturbed.

Comments: L022-003; L022-009; L022-012

The commenter stated that the SEIS fails to acknowledge that other agencies' requirements are needed before the project can move forward under the following considerations: (i) if evaporation ponds are to be used, a CAA permit under 40 CFR Part 61, Subpart W would be required (EPA); (ii) if UIC wells are used, there would be coordination with EPA; and (iii) if there is a finding of nonjurisdiction by the U.S. Army Corps of Engineers (USACE) for the ephemeral channels affected by the proposed project, this must be coordinated with EPA.

Response: *NRC agrees with the commenter that other permits and approvals need to be acquired before the facility can be constructed and operated. The status of other such permits and approvals is summarized in SEIS Table 1-2. Evaporation ponds, while an alternative to liquid effluent disposal, would not be used at Lost Creek. The applicant's proposed action is to dispose of liquid effluent via UIC wells. With regard to a determination of nonjurisdiction for the ephemeral channels affected by the proposed action, the applicant received a jurisdictional determination from USACE reflecting that the ephemeral channels are nonjurisdictional. SEIS Sections 3.5.1.2 and 4.5.1.2 were revised to reflect the USACE jurisdictional determination.*

Comment: L008-093

The commenter stated that industrial aspects associated with the use of hazardous chemicals are regulated by the Wyoming Occupational Safety and Health Administration (OSHA), whereas SEIS Section 4.13.1.2.3 states that this is performed by the Wyoming State Mine Inspector.

Response: *Wyoming OSHA, which includes the State Mine Inspector, regulates industrial aspects of hazardous chemical use. SEIS Sections 3.12.3 and 4.13.1.2.3 were revised to accurately identify the regulator in response to this comment.*

B.5.11.2 Effects of Changes to Federal or State Regulations on the SEIS

Comments: L020-002; L020-003; L020-004; L020-005; L020-133

One commenter noted EPA has made revisions to the National Ambient Air Quality Standards (NAAQS) for lead and nitrogen dioxide and has proposed revisions to the primary sulfur dioxide NAAQS and the 8-hour standard for ozone. Additionally, the commenter stated the State of Wyoming has not adopted all NAAQS, as is stated in the SEIS. The commenter clarified that the State of Wyoming has developed stricter standards for annual and 24-hour sulfur dioxide, but has not yet entered into rulemaking to revise the standards for annual fine particulate or 24-hour fine particulate. However, the commenter stated that the SEIS should still note these standards.

Response: *SEIS Section 3.7.2 has been revised to reflect EPA revisions to the NAAQS for lead and nitrogen oxide. This section has been modified to reflect the stricter Wyoming standards for annual and 24-hour sulfur dioxide. NRC reanalyzed air quality impacts in Chapter 4 to reflect these EPA and Wyoming standards.*

NRC does not reflect proposed standards in the SEIS. The SEIS is written to reflect the regulations in effect at the time of its writing. Should the proposed standards be finalized in the future, NRC would reflect the final air quality standards in future environmental reviews, as appropriate.

Comments: L017-035; L017-036

The commenter stated NRC did not incorporate new (December 29, 2009) guidance on sage-grouse habitat management that applies to all activities occurring on Wyoming public lands. The commenter further stated that the proposed project must “go through” the Wyoming BLM’s new “Greater Sage-Grouse Project Authorization Screen.”

Response: *The new (December 29, 2009) guidance on sage-grouse was issued 18 days after the draft SEIS was noticed for public comment. The final SEIS has been revised to incorporate the changes that have occurred since the December 2009 guidance. Furthermore, NRC staff has been in regular communication with the Wyoming SSIT, whose charter was to finalize the guidance and the core area maps. SEIS Sections 3.6.3 and 4.6.1.1.4 were revised in response to this new information.*

B.5.11.3 Clarification of Other Federal/State Regulations and Practices

Comment: L005A-007

The commenter stated the proposed Lost Creek ISR Project is subject to the requirements of NHPA Section 106 because it is a federal undertaking per 36 CFR 800.16(y). The commenter stated that the requirements of Section 106 apply regardless of land ownership and that minimization/mitigation of adverse effects is required.

Response: *NRC agrees with the commenter that the proposed Lost Creek ISR Project is a federal undertaking per 36 CFR 800.16(y) and is, therefore, subject to the requirements of NHPA Section 106. A federal undertaking is defined as a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with federal financial assistance; and those requiring a federal permit, license, or approval. The NRC has concluded the Section 106 process for this undertaking with the development and execution of a Memorandum of Agreement (MOA) among the NRC, Wyoming SHPO, the applicant, BLM, the Wyoming State Attorney General’s Office, the Eastern Shoshone and Northern Arapaho Tribes, and the NRC.*

The section that the commenter references analyzes cumulative impacts to historic and cultural resources within the vicinity of the proposed Lost Creek ISR Project. The discussion of cumulative impacts includes federal undertakings as well as nonfederal projects and activities, per 36 CFR 800.16(y). NRC notes that NHPA Section 106 may not apply to all projects or activities discussed in this section of the SEIS. No changes were made to the SEIS beyond the information provided in this response.

Comment: L020-023

One commenter stated that the reclamation plan will need to comply with the BLM Wyoming Reclamation Policy and that it should be described in an appendix to the SEIS, including measures to monitor success and revegetate where needed.

Response: *NRC will not require preparation of a reclamation plan; therefore, a reclamation plan has not been included as an appendix to the SEIS. However, as the commenter notes, since BLM land is involved with the proposed action, the applicant will have to comply with the applicable BLM regulations. The BLM Rawlins Field Office is currently reviewing LCI's Plan of Operations for the proposed Lost Creek ISR Project.*

B.5.11.4 References

40 CFR Part 61. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 61, "National Emission Standards for Hazardous Air Pollutants." Washington, DC: U.S. Government Printing Office.

75 FR 1088. U.S. Nuclear Regulatory Commission. "Notice of Availability of a Memorandum of Understanding Between the Nuclear Regulatory Commission and the Bureau of Land Management." *Federal Register*. Vol. 75. p. 1,088. January 8, 2010.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities—Draft Report for Comment." Washington, DC: NRC. June 2008.

B.5.12 Cooperating Agencies and Consultations

Comment: L020-017

The commenter suggested that NRC should have made a more concerted effort to provide documentation, to the public so that it could receive meaningful comments.

Response: *As described in Bin 5.8 in this comment-response appendix, NRC provides multiple avenues for public participation in its licensing process beyond the NEPA process. Upon receipt of a license application, NRC publishes a Notice of Availability (NOA) of the license application in the Federal Register. The NOA includes the relevant identifying information for the license application so that an interested member of the public can view the application either electronically [at www.nrc.gov/reading-rm/adams.htl] or in person by visiting NRC's public document room.*

Comments: L022-005; L022-007

The commenter suggested it would be appropriate to include, under "1.7.2 *National Historic Preservation Act of 1966* (NHPA) Consultation," a reference to coordination with tribes. In addition, the commenter questioned the date of a letter cited on page 1-11 of draft SEIS.

Response: *SEIS Section 1.7.3.3, discusses the NRC's Section 106 consultation efforts with the Eastern Shoshone and Northern Arapaho. Copies of consultation letters sent to each tribe are included in SEIS Appendix A. Both tribes are Signatories to the Memorandum of Agreement (MOA) regarding the implementation of a mitigation plan for potential disturbance of a National Register-eligible prehistoric site on the proposed Lost Creek license area.*

Comment: L022-008

The commenter stated that no rationale is provided for the selection of these nine tribes for consultation.

Response: *SEIS Sections 1.7.3.3 and 3.9.2.1.1 have been revised to include information that discusses NRC's consultation efforts with Native American Tribes.*

B.5.13 SEIS Schedule

Comments: L001-001; L002-001; L003-001; L004-001; L005-001

Several commenters requested the comment period on the Lost Creek ISR SEIS be extended to provide interested stakeholders sufficient time to review the SEIS adequately. Some commenters referred to the large size of the draft Lost Creek ISR SEIS and the need for more time to read and collect referenced information. Commenters also noted the comment period overlapped with seasonal holidays in December, thus reducing the time to review the document.

Response: *On December 11, 2009 (74 FR 65804), the NRC staff published a Federal Register notice requesting public review of and comment on the "Draft Environmental Impact Statement for the proposed Lost Creek ISR Project in Sweetwater County, Wyoming, Supplement 3 to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities." In publishing the Notice of Availability for the draft SEIS, the NRC staff stated that the public comment period closed on February 1, 2010. On February 5, 2010, the NRC staff published a notice in the Federal Register (75 FR 6068) extending the public comment period to March 3, 2010, in response to public requests for extension received via comment letters and e-mail. As described in SEIS Appendix B2.4, the 81-day period for public comment (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. By letter and e-mail, 23 organizations submitted 631 comments on the Lost Creek ISR SEIS. No change was made to the SEIS beyond the information provided in this response.*

Comment: L006-003

The commenter stated that there was neither adequate time nor resources to dedicate to the review of the document and therefore no comments are being submitted by the Wyoming BLM.

Response: *The 81-day period for public comment (i.e., from December 11, 2009, to March 3, 2010) exceeds the minimum 45-day comment period required under NRC regulations. By letter and e-mail, 23 organizations submitted 631 comments on the Lost Creek ISR SEIS. No change was made to the SEIS beyond the information provided in this response.*

B.5.13.1 References

74 FR 65804 U.S. Nuclear Regulatory Commission. "Notice of Availability of Draft Environmental Impact Statement for the Lost Creek *In-Situ* Recovery (ISR) Project in Sweetwater County, WY; Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." *Federal Register.* Vol. 74, No. 237, pp. 65,804–65,806. December 11, 2009.

73 FR 39728. U.S. Nuclear Regulatory Commission. “Notice of Application for a New Uranium Recovery Facility and Opportunity To Request a Hearing.” *Federal Register.* Vol. 73, No. 133. pp. 39,728–39,731. July 10, 2008.

B.5.14 ISR Process Description

B.5.14.1 Overview

Comment: L015-026

One commenter expressed concern that NRC conducted an analysis of impacts from excursions related to ISR uranium recovery from unconfined aquifers. The commenter believes this is contradictory to an NRC position from the GEIS that ISR technology can only be used in confined aquifer systems.

Response: *The GEIS (NRC, 2009a) is not an NRC requirement, nor does it constitute an agency policy either for or against a particular type of aquifer or uranium ore geometry. As stated in the text box in GEIS Section 2.1, the “[h]ydrogeologic (formation) geometry must prevent uranium-bearing fluids (i.e., lixiviant) from vertically migrating.” Although this type of isolation may best be achieved by the presence of confining, low-permeability layers such as shale or clay both above and below the uranium-bearing horizon, the GEIS does not identify a specific type of geometry that must exist for a license to be granted. Instead, the applicant defines the wellfield boundaries “…based on the geometry of the specific uranium mineralization” (GEIS Section 2.1), and NRC evaluates the potential impacts from the proposed approach. The impact analysis presented in SEIS Section 4.5.2 is based on the hydrogeologic information for the proposed Lost Creek ISR Project site. In addition, the NRC staff is conducting a detailed technical review of the applicant license application to evaluate whether the proposed Lost Creek ISR facility can be operated in accordance with applicable NRC regulations in 10 CFR Part 40. No change was made to the SEIS beyond the information provided in this response.*

B.5.14.2 Gaseous or Airborne Particulate Emissions

Comments: L018-015; L018-016; L018-023;

One commenter stated the air quality analysis is not adequate, because detailed emission inventories for drill rig engines, fugitive dust, and facility operations are not presented. The commenter indicated the emission inventories are needed so that it can evaluate compliance with the CAA regulations, including emissions sources and whether they comply with applicable CAA permit requirements.

Response: *The draft SEIS included emissions estimates for fugitive dust but did not provide detailed drilling rig or operational emissions estimates. In response to public comments, NRC staff updated the SEIS with additional information on the fugitive dust calculations and provided emissions estimates for diesel-powered drilling and construction equipment. Diesel emissions calculations are summarized in a new Appendix D in the final SEIS. The staff also provided more details regarding emissions from facility operations in SEIS Section 2.1.1.1.6.1. SEIS Section 4.7 was revised to incorporate the air quality impact analysis and by reference the revised emissions information that was added to Section 2.1.1.1.6.1. The more detailed emissions estimates support the conclusions in the GEIS and SEIS that ISR facilities are not major sources of airborne emissions and draft SEIS impact conclusions were not changed.*

More detailed comments and responses related to air emissions and potential impacts are provided in Section B5.24 of this appendix.

B.5.14.3. Historic Operational Experience: Spills and Leaks

Comment: L015-036

The commenter stated that the water resource impact analysis relies heavily on the leak and spill surveys presented in two documents that are incomplete and inaccurate. The two documents the commenter identified are the GEIS and NRC (2009b).

Response: *The water resources impact analysis in SEIS Sections 4.5.1 and 4.5.2 is based on site-specific information provided in the license application, information and data staff independently collected, and information and data from the GEIS and NRC (2009b). As part of the NRC safety review, the staff developed a numerical model to evaluate the effect of the fault on groundwater flow during operations, the potential for historic wells (i.e., drillholes or boreholes) to be a preferential flow path, anisotropy in the aquifer hydraulic properties that could result in preferential flow paths, and the ability of the confining units to inhibit flow to surrounding aquifers. The GEIS and NRC (2009b) memorandum were not intended to provide an exhaustive list of site-specific information, but rather an understanding of the types and magnitudes of impacts encountered at NRC-licensed facilities. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L015-039

One commenter stated that for water resource impacts, NRC acknowledges the record of ISR operations spills and leaks to a certain extent. The commenter provided the example of the Smith Ranch Project as support for his concern over the limited explanation.

Response: *The NRC conclusions regarding the potential environmental impacts to water resources for the proposed Lost Creek ISR Project are provided in SEIS Sections 4.5.1 and 4.5.2. These impact conclusions are based on facility-specific process descriptions for the proposed Lost Creek ISR Project and site-specific characteristics at the proposed site. In determining impact conclusions, NRC staff reviewed information the applicant provided in its license application, as amended (including the technical and environmental reports), information and data staff independently collected, and information and data provided in the GEIS. GEIS Section 2.11 presents a historical description of ISR operations (including the Smith Ranch Project), and Section 2.14 provides reference to specific facilities in Wyoming, Nebraska, and New Mexico. The intent of the information in these GEIS sections was to inform the reader of issues that historically resulted in potential impacts at ISR facilities and to provide a range of conditions that may be expected for each of the four ISR phases. Because the SEIS description is considered appropriate, no changes were made to the Lost Creek SEIS beyond the information contained in response to this comment.*

Comment: L015-044

The commenter stated NRC conclusions regarding groundwater impacts disregard the operational history of other ISR operations that have used the same or similar leak detection and well integrity programs as those for the proposed Lost Creek ISR Project. The commenter provided the example of the Smith Ranch Project as support for his/her concern.

Response: *The NRC conclusions regarding the potential environmental impacts to groundwater for the proposed Lost Creek ISR Project are provided in Section 4.5.2.1. These impact conclusions are based on facility-specific process descriptions for the proposed Lost Creek ISR Project and site-specific characteristics at the proposed site. In coming to these impact determinations, NRC staff reviewed the applicant-provided information, other information and data staff independently collected, and information and data provided in the GEIS. GEIS Section 2.11 presents an historical description of ISR operations (including the Smith Ranch Project), 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 ISR facilities and provide a range of conditions that may be expected for each of the four phases of ISR activities considered in the GEIS. No further changes were made to the SEIS beyond the information provided in this response.*

Comments: L010-020; L017-014; L019-010; L020-032

One commenter stated that spills and leaks are common at ISL mines and complete cleanup has proved impossible in the past. Another commenter stated that even small spills that are quickly contained can have a cumulative negative impact on the environment. Another commenter stated that the SEIS should explain how soils, groundwater and surface water impacts by spills, leaks, and releases of chemicals, petroleum products and produced water will be restored.

Response: *Potential impacts to surface waters and groundwater may result from spills or leaks of vehicle fuel, engine lubricants, chemicals, and process liquids. In addition, the failure of pipeline fittings or valves, or failures of well mechanical integrity could result in lixiviant leaks and spills, which could impact water quality in shallow aquifers. Leakage from planned storage ponds could also undermine the water quality in surface aquifers. To mitigate these potential impacts, the applicant is required to obtain a general Wyoming Pollutant Discharge Elimination System (WYPDES) permit and implement a Storm Water Pollution Prevention Plan to protect surface waters from contamination due to spills and leaks. Furthermore, 10 CFR Part 40, Appendix A requires the applicant to implement detection monitoring and corrective action programs to protect groundwater from leakage of hazardous constituents. SEIS Sections 4.4.1.2 and 6.3.2 were revised to further clarify the information.*

B.5.14.4 Requests for Detailed Information About All ISR Facilities

Comment: L001-002

One commenter stated that his/her organization had not received all of the reports and analyses it requested.

Response: *NRC considers this request to be beyond the scope of the SEIS.*

Comment: L015-051

One commenter stated that instead of disclosing the average groundwater concentrations, the SEIS should provide all groundwater sampling data and written lab reports, including details like constituent concentrations and sampling data and locations. The commenter stated that if this information was not available, the SEIS should disclose that fact.

Response: *As described in NRC guidance (NRC, 2003), an applicant, in support of its application, must provide site baseline information, including groundwater quality at and in the vicinity of the site. An NRC-accepted list of constituents to be sampled for determining baseline water quality is provided in this guidance as well as a method for the applicant to propose a list of constituents that is tailored to a particular location. NRC guidance dictates that to determine background groundwater quality conditions, at least four sets of samples, spaced sufficiently in time, should be collected and analyzed for each constituent. The applicant provided this summary groundwater quality information in SEIS Section 3.5.2. Detailed information, such as the type the commenter requested is contained in the applicant's Environmental and Technical Reports (LCI, 2008a,b). Because the SEIS description is considered appropriate, no changes were made to the SEIS beyond the information provided in this response.*

B.5.14.5 References

LCI. "Project Environmental Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming—Application for US NRC Source Material License (Docket No. 40-9068)." ML081060507. Casper, Wyoming: LCI. 2008a..

LCI. "Lost Creek ISR Project Technical Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming, Application for U.S. NRC Source Material License (Docket No. 40-9068)." ML081060507. Casper, Wyoming: LCI. 2008b.

NRC, NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Vols. 1 and 2. Washington, DC: NRC. June 2009a.

NRC. "Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities." Memorandum (July 10) from C. Miller to Chairman Jaczko, et al. ADAMS Accession No. ML091770402. Washington, DC: NRC. July 10, 2009b.

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

B.5.15 Financial Surety

Comment: L016-021

The commenter requested that the SEIS explanation of financial assurance be more descriptive, noting that financial assurance is a key component of ISR facility licensing and has been a contentious issue in the past. Examples the commenter provided of additional topics to be incorporated were (i) the types of financial assurance instruments available to licensees, (ii) how financial assurance cost estimates are developed, (iii) when a financial assurance cost estimate needs to be approved and posted with the agency, and (iv) when the cost estimate is to be updated. The commenter considered financial assurance an excellent example of a mitigation measure to protect against a licensee's potential financial difficulties.

Response: *The Lost Creek SEIS describes financial assurance in Section 2.1.1.1.8 which references both 10 CFR Part 40, Appendix A, Criterion 9 and SEIS Section 2.10 that provides the detail the commenter requested. Furthermore, the NRC staff reviews financial surety in detail as part of its safety review of the license application (conducted in parallel with the environmental review).*

NRC uses the term "financial surety" in the Lost Creek SEIS to be consistent with its use in 10 CFR Part 40, Appendix A, Criterion 9. The term "surety instruments" is used to refer to mechanisms (e.g., surety bonds, cash deposits, and irrevocable letters of credit) for holding the funds deemed sufficient to cover the costs of site decommissioning and restoration. SEIS Section 2.1.1.1.8 was revised in response to this comment to direct the reader to 10 CFR Part 40, Appendix A and GEIS Section 2.10 (NRC, 2009) for further details about financial assurance.

Comment: L019-024

The commenter stated that the draft SEIS failed to analyze the applicant financial assurance and decommissioning plans and lacked a comparison of the current applicant's financial assurance and decommissioning plans with previous restoration funding in terms of dollars, plan, and likely results.

Response: *The evaluation of applicant financial assurance and of an applicant decommissioning plan is considered as part of the NRC's safety review. Financial assurance is described in SEIS Section 2.1.1.1.8, which states that an initial surety estimate is required to cover the first year of operation and that NRC and WDEQ would require annual revisions to the surety estimate to reflect existing operations and planned construction or operation the following year. A detailed review of the initial surety estimate is part of the NRC safety evaluation. The commenter's request for a comparison to previous restoration funding is beyond scope of the SEIS, which is to evaluate the environmental impacts of the proposed action to construct, operate, conduct aquifer restoration, and decommission the proposed Lost Creek ISR Project. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L022-011

The commenter was concerned that the NRC bonding amount may not be adequate for the ISR facilities given the major costs of remediating groundwater or cleaning up a site should a company go bankrupt. The commenter felt this posed a potential liability to the government and would impact NRC resources and EPA Superfund should a company go bankrupt.

Response: *NRC considers financial surety to be an important issue that the applicant must address for any site-specific license. SEIS Section 2.1.1.1.8 describes financial surety and refers to the regulations in 10 CFR Part 40, Appendix A, which require an applicant or licensee to set aside sufficient funds prior to operations to cover the costs for a third party to conduct decommissioning, reclamation of disturbed areas, waste disposal, and groundwater restoration. A surety arrangement is made to cover these costs in the event of licensee default. To terminate an NRC license, a licensee is required to develop a site-specific decommissioning plan that NRC must review and approve before decommissioning can begin. The NRC staff review of the decommissioning plan comprises both a safety and environmental review. The licensee would address financial surety as part of the site-specific review for the decommissioning plan. NRC annually reviews a licensee's financial surety estimate to assess the effects from inflation, expansions in operations, changes in engineering design, completion of decommissioning activities, and experience in aquifer restoration. NUREG–1569 describes how to estimate the costs (NRC, 2003). No changes were made to the SEIS beyond the information provided in this response.*

B.5.15.1 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Vols. 1 and 2. Washington, DC: NRC. June 2009.

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

B.5.16 Alternatives

Comments: L015-006; L015-008

One commenter stated that the Lost Creek SEIS was inadequate because it did not evaluate a reasonable range of alternatives, other than to approve or reject the application to produce a yellowcake slurry.

Response: *NEPA requires Federal agencies to consider alternatives to their proposed federal actions as well as to assess their environmental impacts. Alternatives can be divided into two classes: primary alternatives, which are alternatives that can substitute for the agency-proposed action to accomplish the action in another manner, and secondary alternatives, which allow the proposed action to be carried out in a different manner.*

Reasonable alternatives for a particular federal action are defined by the proposed federal action and the purpose and need for the proposed federal action. As a regulatory agency, the proposed federal action for the site is an NRC decision to either grant or deny the license application of a private party. The purpose and need for the proposed federal action does consider the applicant goals and objectives to extract uranium from a particular location, which helps define the reasonable alternatives to the proposed federal action.

Reasonable alternatives considered in a site-specific environmental review depend on the proposed action and site conditions. As discussed in SEIS Section 2.1, NRC considered reasonable alternatives, including the No-Action alternative, not approving the license application, and approving the application. SEIS Section 2.2 provides a discussion of alternatives that were considered but were eliminated from detailed study and the reasons for their elimination. These alternatives included conventional mining and milling, conventional mining and heap leaching, siting another ISR facility location, alternate lixiviants, and alternate wastewater treatment methods. These alternatives were eliminated from detailed study because they either would not meet the purpose and need of the proposed project or would cause greater environmental impacts than the proposed action. SEIS Section 2.1.1.2 discusses alternative wastewater disposal methods.

If NRC decides to grant the license request, the applicant must comply with the license and any other relevant local, state, or federal requirements to operate its facility.

Comments: L018-001; L018-010

A commenter noted that the consideration of only Class I UIC injection wells as the waste disposal method was inadequate. The commenter noted that other waste disposal alternatives, such as treatment and disposal via a Class V injection well and treatment and discharge to surface waters under an NPDES permit, and other potential wastewater disposal methods, such as land disposal and evaporation ponds, should have been considered in the SEIS.

Response: *In response to public comments, the final Lost Creek SEIS was revised to expand the discussion of alternative wastewater disposal options that the applicant did not propose. SEIS Section 2.1.1.2 describes the previously referenced waste disposal options, Table 2-2 compares the options, and SEIS Section 4.14.1.2 describes the potential impacts from implementing the alternative wastewater disposal options.*

COMMENT: L019-027

One commenter stated NRC should reevaluate the alternatives analysis in both the GEIS and the Lost Creek SEIS. The commenter stated the agency fails to consider any meaningful alternatives other than approval or rejection of the application.

Response: *The purpose and need of the proposed action is to permit the applicant to recover uranium from the ore body located at the Lost Creek site. The Lost Creek site-specific environmental review considered reasonable alternatives that would meet the purpose and need of the proposed action and site characterization information from the license application and tiered from and incorporated by reference information and conclusions in the GEIS based on their applicability to the Lost Creek site.*

No changes were made to the SEIS beyond the information provided in this response.

B.5.17 History and Legacy of Uranium Mining

Comments: L019-001; L019-003

The commenter expressed concerns about longstanding impacts from past uranium activities. These past legacy issues have caused mistrust in new proposals for uranium milling.

Response: *NRC staff understands and recognizes there are serious legacy issues from decades of mining and milling activities from the 1940s through the 1970s when waste from uranium mines was not cleaned up after the mines/mills were shut down. In 1978, Congress promulgated statutes that required cleanup of the abandoned mills with specific roles for DOE, NRC, and EPA. Since 1978, NRC has regulated uranium recovery (milling) facilities but not uranium mining or abandoned uranium mine sites. Historically, with NRC oversight, the ISR and milling industry has not had these same legacy issues. For a more complete description of the legacy issue, see GEIS Appendix G, Section G5.17 (NRC, 2009).*

B.5.17.1 Reference

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Vols. 1 and 2. Washington, DC: NRC. June 2009

B.5.18 Land Use

Comment: L020-131; L020-115; L020-116

The commenter stated that the site impact analysis related to livestock grazing in the Lost Creek SEIS is not adequate and is oversimplified. The commenter added that livestock grazing should be analyzed as a stand-alone resource. The SEIS does not address site-specific impacts to the individual livestock grazing allotments, livestock operations, and individual permittees on these allotments.

Response: *The Lost Creek SEIS is tiered from the GEIS (NRC, 2009), which considered livestock grazing as an attribute of land use and concluded that the principal impact on the use of the land for cattle grazing would be the loss of grazing land that would be fenced off for the duration of the project. These fenced areas would include the processing plant, which would cover an area of 4.0 ha [10 ac], and the 6 wellfields, which would cover an area of 99 ha [244 ac]. The impact from loss of grazing land was determined to be SMALL because only about 6.7 percent of the Lost Creek project area would be used for the plant, roads, and wellfields. As shown in SEIS Figure 2-6, each of the wellfields have an elongated shape of approximately 0.8 km [0.5 mi] in length and 0.2 km [0.125 mi] in width. Moreover, the six welfields would be constructed and operated sequentially over a period of 7 to 8 years, meaning that only a small area would be fenced at a time and, therefore, restricted from use for cattle grazing at any given time. The detailed schedule for restricting access to cattle grazing would need to be agreed upon among the ISR facility operator, BLM, and the ranchers holding grazing leases on affected lands. Similarly, and consistent with the GEIS determination, compensation or other mitigation measures for the loss of grazing land would be resolved among the ISR facility operator, BLM, other surface owners, and the grazing permit holders. The GEIS identified mitigation measures such as the relocation of livestock and water, alternate rangeland development and use on nearby public or private land, purchase of hay or additional grazing rights, or compensation to ranchers for the loss of grazing or pasture land (NRC, 2009).*

No changes were made to the SEIS beyond the information provided in this response.

B.5.18.1 Ownership Issues, Surface, and Mineral Rights

Comment: L020-136

A staff member of the WDEQ Industrial Siting Division indicated that the Industrial Siting Council may require a permit for the ISR facility.

Response: *As described in SEIS Section 1.6.2, a new uranium in-situ recovery milling site would need several permits from WDEQ. NRC acknowledges that (i) the Lost Creek ISR Project may require a permit from the WDEQ Industrial Siting Division if the construction costs exceed $175.5 million and (ii) some types of businesses require a Section 309 permit regardless of the cost of construction.*

B.5.18.2 Amount of Land Affected and Type, Degree, and Duration of Potential Impacts

Comment: L020-025

The commenter indicated that the construction design should account for natural features of the land (i.e., topography and drainage) so natural drainage would not be disrupted.

Response: *It is part of good engineering and BMPs that site construction be designed and conducted to minimize disruption to and avoid blockage of natural surface water drainage features. The following paragraph provides examples that illustrate how the applicant construction design and planned activities consider the natural features of the land to help minimize impacts to natural surface water drainage features.*

Temporary access roads to be constructed at the proposed Lost Creek ISR Project would cross ephemeral channels at seven locations. Both existing and new crossings would be improved or constructed without the use of culverts where feasible, perpendicular to the direction of flow, at the natural streambed elevation, and without the use of fill material. Steeply incised channel banks may be graded to create gently sloping approaches to channel crossings, and proper sedimentation and erosion control, such as silt fences and hay bales, would be used to minimize sedimentation into the channels. Disturbed soil would be reseeded. Power lines would cross overhead above six ephemeral channels, and the pole placement would be outside the channels. Because the ore body is perpendicular to the direction of surface drainage, some wells would be installed in an ephemeral channel. The applicant would drill the wells during the dry season, and erosion and sedimentation control measures would be implemented while the wells were being drilled to minimize impacts. Upon the wells being removed from service, loose soil would be stabilized by reseeding and mulching. Polyvinyl chloride pipelines that bisected ephemeral channels would be buried perpendicular to the channels during the dry season with small excavating equipment. Excavated soil would be used to backfill the pipeline trenches to restore the natural channel to its preexisting grade. Finally, the processing plant would be built in an upland area away from ephemeral channels. (LCI, 2008)

No change was made to the SEIS beyond the information provided in this response.

Comments: L020-030; L020-042

The commenter suggested that during drilling operations, portable tanks should be used to contain drilling mud and other fluids instead of excavating mud pits in the ground. This would reduce surface disturbance and reclamation costs and would also reduce risks of contamination and erosion.

Response: *Alternatives for managing drilling mud could include lining the mud pits with an impermeable membrane, offsite disposal of drilling mud and fluids, the use of portable tanks or tubs to contain drilling mud, or well-established pitless drilling methods and closed-loop drilling systems that would reduce or eliminate the impact from mud pits. The applicant is proposing the use of mudpits during wellfield construction and drilling activities. Mudpits typically remain open for less than 30 days and the applicant would follow the WDEQ-LQD guidelines on topsoil and subsoil management at uranium ISR facilities. The NRC staff concluded that impacts to soils would be small based on the limited size of the wellfield areas, the applicant's proposed topsoil removal and stockpiling activities, and the short duration of mud pit usage and pipeline trenching. The use of other methods to manage drilling mud was discussed in an NRC*

teleconference with the applicant, who explained that the volume of mud and drill cuttings that would be generated from boreholes hundreds of feet deep would exceed the capacity limit of portable tanks. Therefore, the NRC staff concluded the use of portable tanks would not be practicable for the disposal of drilling muds.

No change was made to the SEIS beyond the information provided in this response.

Comments: L020-117; L020-124

The commenter indicated that the SEIS does not clearly indicate the acreage that will be fenced off, preventing access for livestock grazing and wildlife and therefore reducing the availability of forage.

Response: *SEIS Sections 2.1.1, 3.2, 4.2, and 5.2 provide information on the amount of land that would be disturbed over the life of the proposed Lost Creek ISR Project. Impact due to the loss of some grazing land and forage to cattle, wild horses, and other wildlife was determined to be SMALL because only about 6.7 percent or 115 ha [285 ac] of the proposed project area {1,722 ha [4,254 ac]}, would be disturbed by the plant, ponds, new access roads, and the six wellfields. The fenced land would include the processing plant, inclusive of storage yards and 2 storage ponds covering an area of about 6 ha [14.8 ac] and the six wellfields covering a combined area of 99 ha [244 ac]. However, because the wellfields would be developed sequentially, the 99 ha [244 ac] would not be fenced at the same time, permitting grazing to occur until a wellfield was developed. The new access roads would not be fenced, and the applicant estimated they would cover an area of approximately 13 ha [31 ac].*

No changes were made to the SEIS beyond the information provided in this response.

Comment: L020-119

The commenter suggested that the Summary of the Environmental Impacts in the Executive Summary include a full analysis of how impacts to vegetation and temporary displacement would affect cattle grazing.

Response: *The Executive Summary of the Lost Creek SEIS summarizes the magnitude of the environmental impact for each resource category evaluated in the SEIS by phase of the proposed action. The detailed analysis describes the grazing allotments in the proposed project area in Section 3.2.1, and the analysis in Section 4.2 concludes the impact from all phases of the proposed action on the existing grazing leases would be SMALL, because the total area to be disturbed {99 ha [244 ac]} represents a small fraction (less than 0.002 percent) of the more than 100,000 acres of grazing land surrounding the proposed Lost Creek ISR Project.*

No changes were made to the SEIS beyond the information provided in this response.

Comment: L020-120

The commenter indicated SEIS Section 1.4.3 should have details on livestock grazing, invasive species, and vegetation.

Response: *The purpose of SEIS Chapter 1 (including Section 1.4.3) is to provide background information on the proposed action and to explain why the action requires a SEIS. Section 1.4.3 identifies those areas in the SEIS that required a detailed analysis based on tiering from*

the GEIS. Specific resource descriptions and impact determinations on livestock grazing, invasive species, and vegetation, for example, are found in the land use Sections 3.2.1 and 4.2.1, and in the ecology Sections 3.6.1.1 and 4.6.1.1.1, respectively.

No changes were made to the SEIS beyond the information provided in this response.

Comment: L020-121

The commenter indicated that wild horses were omitted as animals that would be affected by some loss of forage by fencing off a portion of the land and that such loss of forage is creating potential conflicts between livestock, wild horses, and wildlife.

Response: *Wild horse are discussed in SEIS Section 3.2.1, which describes rangeland and notes that the Stewart Creek herd management area (HMA) and the Lost Creek HMA overlap with the proposed Lost Creek ISR Project area. NRC staff describes impacts to wild horses and mitigating factors in SEIS Section 4.2.1.1, and Section 4.6.1.1.12. These discussions describe wildlife management measures and potential impacts to big game. The discussion note that the potential for conflicts between livestock and wild horses would be small because wild horses are highly mobile and more transitory than cattle. Wild horses would be expected to occupy areas away from human disturbance and areas that are fenced to seek forage in open rangeland.*

No changes were made to the SEIS beyond the information provided in this response.

Comments: L020-122; L020-125; L020-126

The commenter indicated there were no discussions of mitigation measures to address the impact to livestock from fencing on leases, from allotments, and to the culture of livestock grazing. As an example of mitigation, the commenter cited alternative pastures and relocation of livestock.

Response: *NRC staff described a range of possible mitigation measures for the loss of grazing land, including relocation of livestock, alternate rangeland development and use of nearby public or private land, purchase of hay or additional grazing rights, or compensation to ranchers for the loss of animal unit months in SEIS Section 3.2.*

The schedule for and sequencing of access restriction to certain fenced off portions of land (i.e., the wellfields) for cattle grazing would be coordinated among the Lost Creek ISR facility operator, BLM, and the ranchers holding grazing leases on the affected lands and are beyond the scope of the Lost Creek SEIS and not enforceable by NRC. Therefore, no information on methods, locations, and costs for relocating cattle is considered in the SEIS. Moreover, mitigation measures or compensation are private matters coordinated and resolved among the proponents listed previously.

No changes were made to the SEIS beyond the information provided in this response.

Comment: L020-123

The commenter mentioned that dust outside of the restricted areas could alter the forage quality and affect the health of grazing animals.

Response: *NRC staff modified SEIS Section 4.2.1.1 to describe the impact from dust outside the restricted areas and mitigation measures that could be implemented.*

B.5.18.3 Mitigation and Reclamation Issues

Comment: L016-016

The commenter stated the draft SEIS structure indicates that aquifer restoration is separate from the surface reclamation stage of the ISR facility lifecycle. The commenter seeks clarification on whether 10 CFR 40.42, “Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas,” can be applied to groundwater restoration. The commenter also seeks clarification on the timeline in which a decommissioning plan is required to be submitted to NRC.

Response: *According to the Commission decision regarding Hydro Resources, Inc. (NRC, 2000b), NRC staff is required to review a decommissioning plan prior to issuing a license. NUREG–1569 (NRC, 2003, Section 6.5) contains NRC staff guidance for reviewing decommissioning plans. NRC (2003, Sections 6.1 through 6.4) addresses the decommissioning/restoration activities to be included in the application including groundwater restoration, soils reclamation, building decommissioning, and post-decommissioning surveys. Therefore, the intent of the aforementioned Commission decision and NUREG–1569 is to review a decommissioning plan that addressed full facility buildout for the life of the facility.*

Unlike other facilities, the precise as-built conditions are unknown prior to operations because continued exploration may result in alterations to proposed wellfields. Such alterations affect the required wellfield infrastructure. Therefore, a more detailed decommissioning plan would be required 12 months prior to decommissioning a facility or a portion thereof. This plan would comply with 10 CFR 40.42.

As stated in letters to licensees dated July 7, 2008 (NRC, 2008), the timeliness and decommissioning regulations apply to ISRs; therefore, alternate schedules must be submitted if restoration/decommissioning would require more than 2 years. Because the timeliness in decommissioning rule applies to not only entire facilities but portions thereof, restoration schedules apply to individual wellfields. No changes were made to the SEIS beyond the information provided in this response.

Comments: L020-014; L020-051

The commenter indicated that NRC appeared to have underestimated reclamation issues due to specific conditions in the Great Divide Basin and lacked detailed site-specific analyses.

Response: *The commenter did not provide any rationale or examples to support its impression that NRC underestimated the reclamation issues in the Great Divide Basin because of its dry climate, poor soil, and short growing season. The NRC staff reaffirms that it considered the site-specific environmental conditions to analyze the impacts on environmental resources, mitigation measures, and reclamation measures. A licensee would implement its required decommissioning and reclamation activities after NRC approval of its detailed Decommissioning Plan. In addition, BLM and WDEQ would review and comment on this plan. For reclaiming surface disturbances in particular, the licensee-proposed activities would include, for example, regrading to the approximate preconstruction topography, restoring drainages, replacing salvaged soil, seeding, and reestablishment of vegetation. These reclamation activities would*

be performed in accordance with specific BLM and WDEQ agreements and requirements, which would consider the dry climate, poor soil, and short growing season found in the Great Divide Basin.

No changes were made to the SEIS beyond the information provided in this response.

Comments: L020-021; L020-022; L020-024

The commenter indicated that NRC did not seem to have a good understanding of environmental and reclamation issues or what the BLM requirements are for reclamation and monitoring of surface disturbance. The commenter added that NRC addressed these issues as if the proposed project was located on fertile land with abundant precipitation. The commenter suggested NRC should investigate reclamation efforts from other mining or energy projects in the area to better estimate the length of time impacts and costs of reclamation.

Response: *NRC does have a good understanding of environmental and reclamation issues at the proposed Lost Creek ISR Project and has been in continual communication with BLM staff on the topic of reclamation.*

At the time of decommissioning, the licensee would implement its required decommissioning and reclamation activities after NRC approval of the licensee's detailed Decommissioning Plan. Both BLM and WDEQ would have the opportunity to review and comment on this plan, including the schedule of these proposed activities. In particular for reclaiming surface disturbances, the licensee-proposed activities, such as regrading to the approximate preoperations topography, restoring drainages, replacing salvaged soil, and revegetating, would be carried out in accordance with BLM and WDEQ requirements and their agreement. With respect to schedule and in accordance with 10 CFR 40.42, the licensee would be required to complete site decommissioning within 2 years after approval of the Decommissioning Plan or as otherwise specified in the Plan. WDEQ and BLM would also have the opportunity to review and issue their agreement on the schedule.

Regarding the estimated costs of reclamation, NRC staff evaluates reclamation costs in its safety evaluation—not as part of the environmental review. As stated in 10 CFR Part 40, Appendix A, Criterion (9), a licensee is required to cover and guarantee the costs of decommissioning and reclamation. NRC and WDEQ-LQD require that a licensee annually revise the cost estimates. Therefore, WDEQ-LQD has ample opportunities to review, make suggestions, and agree on the estimate of the final costs of decommissioning and reclamation.

No changes were made to the SEIS beyond the information provided in this response.

Comment: L020-028

The commenter indicated that alternatives to minimize surface disturbance and topsoil removal need to be analyzed, and pipelines should be located along roads to minimize such disturbance.

Response: *As described in the Lost Creek SEIS, various measures and options were considered to minimize surface disturbance and soil removal. First, the applicant considered the smallest amount of land needed to construct the plant and related construction and the topsoil to be stripped would be stockpiled for reuse following WDEQ-LQD guidelines. Topsoil and subsoil to be excavated at other areas (e.g., well pad, mud pit, pipeline trenches and crossing) would be replaced where removed, whenever possible. Where evident and practical,*

topsoil and subsoil would be segregated and the subsoil would first be placed in excavations followed by topsoil; the surface would then be regraded and reseeded. Also, the construction of the six wellfields would be phased over several years which would reduce soil disturbance because it would not occur simultaneously in all wellfields. Most pipeline connecting header houses with the processing plant would be laid in trenches that would not parallel site access roads.

During the decommissioning phase, all roads at the proposed Lost Creek ISR site, with exceptions to be determined later by various parties (BLM, licensee, state, ranchers), would be reclaimed by removing road surfacing materials culverts, recontouring, preparing the soil, and reseeding. Other areas within the license area, such as the wellfields, header houses, and pipeline and well areas, would be reclaimed by regrading the ground surface to the approximate preconstruction topographic contours, reestablishing natural drainage, replacing salvaged soil, and revegetating those areas.

These examples illustrate mitigation measures that would be implemented along with other accepted BMPs during the construction and decommissioning phases to minimize and mitigate impacts to surface and soil disturbances.

No changes were made to the SEIS beyond the information provided in this response.

B.5.18.4 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, “Domestic Licensing of Source Material.” Washington DC: U.S. Government Printing Office.

LCI. “Project Environmental Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming—Application for US NRC Source Material License (Docket No. 40-9068).” ML081060507. Casper, Wyoming: LCI. 2008.

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Vols. 1 and 2. Washington, DC: NRC. June 2009.

B.5.19 Transportation

Comments: L010-029; L010-030

Regarding the proposed conversion of the Lost Creek road from a two-track to an engineered gravel road, the commenter suggested the road be required to be restored back to a two-track road. The commenter indicated the Red Desert has a surplus of engineered roads that contribute to habitat fragmentation and disturbance of wildlife. The commenter suggested it was unlikely the county would have funds to maintain the road after decommissioning and it would be subject to erosion.

Response: *The NRC staff agree with the commenter that end-of-project restoration of the engineered road that the applicant proposes to develop for site access would help to mitigate the potential impacts from leaving the road in place. The applicant proposes to reclaim all roads unless approval for leaving a specific road is obtained for post-extraction use. Because the road is located on land managed by BLM, the ultimate fate of the engineered road would be decided by BLM as described in Section 4.3.1.4 of the SEIS. The NRC staff expect that if there is no proposed use nor proposed maintenance for the road at the end of the project that*

approval would not be granted for the road to remain in place, and it would be reclaimed as proposed, however, the applicant's future plans as stated are uncertain.

The SEIS considered the potential impacts of road surface erosion on surface water and on wildlife from habitat fragmentation in SEIS Sections 4.5.1.1.1 and 4.6.1.1, respectively. The SEIS also considered impacts from road disturbance on geology and soils (Section 4.4) and on visual and scenic resources (Section 4.10). Because of the uncertain future status of the road, the NRC staff assumed that the road would remain in place after facility operations ceased as described in Section 4.5.1.1.1. The discussion in SEIS Section 4.6.1.1 focused on disturbed land generally and indicated disturbed areas would be reclaimed unless approved by the relevant agencies. Because the majority of the proposed 115 ha [285 acres] of land area disturbed by the proposed action (LCI, 2010) would be reclaimed, recontoured, and reseeded, the potential impact of leaving the road in place is expected to be small, but would contribute to the total area of existing and future roads in the region.

In response to this comment, the NRC staff reviewed and clarified, as appropriate, the final SEIS impact analysis sections on transportation (Section 4.3.1.4), geology and soils (Sections 4.4.1.1; 4.4.1.4), surface water (Section 4.5.1.1.1), ecology (Section 4.6.1.4), and visual and scenic resources (Section 4.10.1.4) with regard to the uncertain status of access road reclamation and the potential impacts.

In response to the commenter's request that NRC require the road to be reclaimed, unless there was a radiological safety issue associated with the road reclamation, NRC would not have the authority to require a licensee to execute a specific road reclamation option. Therefore, the NRC cannot require the applicant to reclaim the road in a particular manner as requested by the commenter.

Comment: L020-011

One commenter stated that the Wyoming Department of Transportation district engineer would determine transportation routes.

Response: *The comment is not specific, to the Lost Creek draft SEIS as Section 3.2.2 describes hunting and other recreation activities in the region and there is no Section 3.3.2 in the draft SEIS. Because the comment was not specific to the material in the SEIS no changes were made to the SEIS in response to the comment.*

Comments: L020-056; L020-070; L020-072

One commenter suggested the transportation impacts were trivialized because the SEIS did not account for hauling all waste generated from all phases including construction, operations, restoration, and decommissioning. The commenter also expressed the view (referring to Executive Summary p. xvii, in particular) that the volume of contaminated soil could be significant. The commenter also indicated the SEIS did not provide the frequency at which solid wastes will be transported from the facility to a permitted solid waste disposal facility.

Response: *Section 2.1.1.1.7 of the draft SEIS described the estimated magnitude of traffic generated by the proposed action for construction and operations phases. In response to this and other comments, annual and total waste volume estimates for the decommissioning phase were added to Section 2.1.1.1.6.3 (solid waste) and decommissioning waste shipment estimates were added to Section 2.1.1.1.7 (transportation). The decommissioning waste*

volumes were based primarily on information submitted in the applicant surety estimate (LCI, 2010), which includes a complete accounting of decommissioning costs, including costs to excavate contaminated soil and ship the soil to a licensed facility for disposal as byproduct material. The waste volumes include estimated contaminated soil volumes that could be generated under plant facilities and header houses from leaks and spills during operations, however, the majority of solid byproduct material and uncontaminated solid waste generated during decommissioning would be from the removal of equipment from wellfields, demolition of facilities, and pond decommissioning. Because a significant proportion of the decommissioning waste is from wellfields and the wellfields are planned to be decommissioned using a phased approach over a six-year period, the expected annual average daily waste transportation equates to less than one shipment per day to transport material to an offsite disposal facility. NRC staff calculated that the annual average daily shipping activity for decommissioning activities is comparable to the applicant's estimate for truck traffic during construction and operations that was summarized in the draft SEIS in Section 2.1.1.7 (referring to approximately two to five trucks per week). Because the proposed decommissioning activities do not overlap with construction or operations phases, the overall magnitude of expected average annual daily traffic generated by the proposed action has not changed based on the addition of more detailed estimates generated in response to these comments. As mentioned previously in this comment response, SEIS Sections 2.1.1.1.6.3 and 2.1.1.1.7 were revised.

Comments: L020-118; L020-127

One commenter indicated that the analysis does not identify secondary impacts from increased traffic including dust, forage palatability, noxious weeds, and wildlife and livestock impacts. The commenter recommended including these potential impacts. In another comment, the same commenter noted that the SEIS does not mention dirt roads generating dust and reducing forage production, decreasing animal unit months, and increased tooth wear and lung disease in ungulates.

Response: *In response to the comment, the NRC staff provided additional information on secondary impacts including road dust and potential livestock and/or wildlife kills in the Executive Summary. Noxious weeds are addressed as ecological impacts in SEIS Section 4.6. Regarding the recommendation to discuss road impacts on forage productivity and livestock in the surface water and wetlands section, the NRC staff further clarified the description of secondary impacts from road dust in the transportation impact analysis (Final SEIS Section 4.3) to consider potential impacts on forage and livestock.*

Comment: L022-019

Regarding the transportation impact analysis in the draft SEIS (Page 4-6), one commenter questioned the conclusion of SMALL to MODERATE impacts based on the low volume of traffic because no emission inventory numbers were provided.

Response: *The transportation impacts on p. 4-6 of the draft SEIS to which the commenter refers are summarized conclusions from the GEIS rather than site-specific impact conclusions. While EPA did not specify to what emissions it was referring, the NRC staff assumed the commenter was referring to fugitive dust emissions from unpaved road traffic. In response to this comment, additional information on fugitive dust emissions was added to SEIS Section 2.1.1.1.6.1 and to the air quality impact analysis in SEIS Section 4.7. In response to other comments, the NRC staff has also added emissions estimates to Appendix D for nonroad diesel-powered construction equipment. Emissions from road vehicles were not included in the*

air quality impact analysis, because vehicles are required to be manufactured to meet emissions standards and the magnitude of road vehicle traffic associated with the proposed action is low and not expected to contribute significantly to air quality impacts.

B.5.19.1 References

LCI. "Lost Creek Project, Clarifications to TR, Docket No. 40-9068, TAC No. LU0142." Letter (May 14) from J. Cash to T. Palmateer Oxenberg, NRC. Casper, Wyoming: Lost Creek International, LLC. 2010.

LCI, 2008. Lost Creek ISR, LLC. Lost Creek Project Technical Report, Volumes 1 through 4 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket No. 40-9068). March 2008. ADAMS Accession Nos. ML081060503, ML081060504, ML081060505, ML081060507; ML081060510. Casper, Wyoming: Lost Creek International, LLC.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Vols. 1 and 2. Washington DC: NRC. June 2009

B.5.20 Geology and Soils

B.5.20.1 Soil Disturbance Concerns

Comment: L020-029

The commenter suggested vegetation should be mowed rather than bladed to minimize soil disturbance.

Response: *Although the practice of mowing vegetation rather than blading to minimize soil disturbance is not feasible for the proposed construction activities that require topsoil excavation, the applicant has identified that soil disturbance at the proposed project area would be limited to about 1 percent of the total license area {approximately 24 ha [58 ac] out of 1,705 ha [4,220 ac]}. The applicant identified mitigation measures to minimize soil impacts, including reestablishing temporary or permanent native vegetation as soon as possible after disturbance, in accordance with WDEQ guidelines, and implementing BMPs to retain sediment within the disturbed areas. No change was made to the SEIS beyond the information provided in this response.*

B.5.20.2 Characterization of Producing and Confining Units

Comments: L010-023; L022-014

Two commenters were concerned that the shale layers directly above and below the production aquifer were too thin in some places to provide vertical confinement and that this condition would increase the potential for contamination of other aquifers during uranium recovery and restoration activities. For example, one commenter stated that uncertainties about the thickness of confining beds for the HJ production horizon contribute to the potential for a major plume leak or large site restoration effort. Another commenter noted that the applicant had reported leakage of water from the target formation during pressure tests, which might be attributed to the thin nature of the shale layers.

Response: *The GEIS (NRC, 2009) stated that confining layers (aquitards) directly above and below a production zone aquifer limit the potential for a vertical excursion from the aquifer into another aquifer. For the proposed production zone (HJ horizon) at the Lost Creek ISR Project area, the overlying Lost Creek Shale and the underlying Sage Brush Shale are regionally extensive but are subject to local thinning, with potential effects on their ability to provide vertical confinement of the HJ horizon. The Lost Creek Shale has a maximum thickness of about 14 m [45 ft] but thins to about 1.5 m [5 ft] in some locations, and the Sage Brush Shale is as much as 23 m [75 ft] thick in some parts of the proposed production area but thins to about 3 m [10 ft] in many locations. The NRC staff conducted independent numerical modeling studies to evaluate the potential influence of thinning on the degree of confinement provided by the shales during ISR operations as part of the safety evaluation. For the predicted flows, the Lost Creek Shale and Sage Brush Shale provided adequate confinement except for simulations of horizontal excursions near the fault where the additional overpressure resulted in a slight vertical breakthrough of the confining layers. However, a horizontal excursion large enough to produce such a breakthrough would be detected by routine monitoring and subject to remediation before loss of vertical confinement, reducing a potential impact. SEIS Section 4.5.2.1.2.2 was revised to provide additional information about thinning of the shale layers and the associated mitigating factors that would reduce the impact in the event of an excursion.*

Comment: L015-028

The commenter stated that the environmental analysis should consider water quality in the UPPER, MIDDLE, and LOWER HJ horizons as separate aquifers, which are not confined from each other.

Response: *For production purposes, the applicant divided the mineralized unit of interest, the HJ horizon, into three uranium-rich subhorizons, which are designated as the Upper, Middle, and Lower (HJ) subhorizons. In some locations, the thin confining layers of mudstone, shale, or siltstone between subhorizons are not present (LCI, 2008a, Plate 3.4-1b). Where multiple subhorizons are present in an ISR operations area, the applicant plans to use dedicated sets of wells to separately produce from each subhorizon (LCI, 2008b, Section TR 3.2.2). As described in SEIS Section 4.5.2.1.2.2, NRC staff examined the environmental impact of ISR operations on local water users of the production aquifer outside the exempted zone and concluded that the environmental impact on water quality in the HJ horizon would be SMALL. As the commenter noted, the HJ subhorizons are not confined from each other over large distances; as a result, it is the subhorizons that collectively comprise the HJ horizon aquifer. NRC staff determined that the water quality data are sufficient to support the groundwater impact evaluations in the SEIS. Therefore, no change was made to the SEIS beyond the information provided in this response.*

B.5.20.3 Fractures and Faults

Comment: L020-114

The commenter stated there are potentially active faults in the permit area and that these features should be taken into consideration during the planning of the project.

Response*: The proposed license area is transected by a set of subparallel normal faults that are described collectively as the Lost Creek Fault. Vertical displacement of mineralized horizons and confining layers in the subsurface along the Lost Creek fault set varies across the proposed license area from as much as 24 m [80 ft] to near zero. Regionally, there are two active fault systems in the vicinity of the proposed license area. The Chicken Springs fault*

system is located about 9.6 km [6 mi] east of the proposed license area, and the South Granite Mountain fault system is located about 22 km [14 mi] northeast of the proposed license area. The Wyoming State Geological Survey has determined that the most recent activity on the Chicken Springs fault system has occurred within the past 12,000 years. The most recent seismic activity associated with the Lost Creek Fault is undocumented; historical records do not link any recent activity to this fault nor is there surface expression of the fault that would be likely if there was recent activity. On the United States Geological Survey 500-year probabilistic seismic hazard map of Wyoming (LCI, 2008b, Figure 3.4-6), the estimated peak horizontal acceleration in the proposed license area for a random fault is approximately 6.5 percent of gravitational acceleration. This means that there is a 10 percent chance that a regional earthquake of magnitude 6.5 could occur in the next 50 years. An earthquake of this magnitude would result in only minor damage to a dwelling (e.g., cracked plaster and broken dishes according to the Modified Mercalli Scale). SEIS Section 3.4.1 was revised to describe active faults in the vicinity of the proposed license area and the associated level of seismic hazard.

Comments: L010-022; L017-009; L017-010

Two commenters were concerned that contaminated fluids could migrate across the fault in the project area, complicating production and aquifer restoration efforts and resulting in pollution of a potable aquifer. One commenter was concerned that boundary conditions for the fault were uncertain in the production horizon and could contribute to the potential for a major plume leak and site restoration effort. The commenter stated that the fault would complicate the ability of the operator to control flows of lixiviant and would complicate aquifer restoration efforts. Another commenter noted that although the fault appeared to provide a barrier to groundwater flow in some tests, it was not impervious to flow and should not be relied on to protect against cross contamination of a potable aquifer. The same commenter stated that fluid migration along the fault would occur in response to potentiometric changes due to drill holes, drilling operations, and ISR recovery procedures.

Response: *The applicant identified a set of en echelon, subparallel, normal fault segments, collectively described as the fault that extends in an east–west direction across much of the project area. The applicant initially described the fault as a "scissors fault" due to opposite senses of displacement among the fault segments. The faulting has displaced the uranium-bearing sandstones and confining layers in the subsurface by as much as 24 m [80 ft] in some locations. The NRC staff agrees that the hydrogeologic properties associated with the Lost Creek fault segments are a site-specific structural feature that could affect groundwater aquifers during ISR operations and restoration activities. The applicant has conducted pumping tests in the vicinity of the fault and observed that water levels in the observation wells on the opposite side of the fault were not significantly affected by pumping, indicating the fault acted as an effective barrier to groundwater movement. The applicant identified additional testing that would be required in the proposed production units, prior to initiating ISR production activities, to better define the impact of the fault on local hydrological characteristics (LCI, 2008b, Section 3.2.7.3). NRC staff conducted independent numerical modeling as part of the safety evaluation to evaluate the potential influence of the fault on groundwater flow during site operations. Based on the modeling results and review of the applicant's groundwater pump test data, the NRC staff concludes that under normal operating conditions, the fault generally acts as a hydrologic barrier to fluid migration. However, for production units located closest to the fault, modeling predicted that the potential for fluids to migrate preferentially along or across the fault plane would increase under imbalanced pressure conditions, such as during excursions. To address the additional environmental and safety concerns related to uncertainties about the effect of the fault on ISR production and restoration activities, the applicant would need to*

provide additional characterization of the local hydrological characteristics in the vicinity of the fault, and increased monitoring of production units that abut the fault would be necessary (e.g., installation of additional, more closely spaced monitoring wells on the opposite side of the fault to detect horizontal or vertical excursions and allow for prompt mitigation). In response to these comments, SEIS Section 4.5.2.1.2.2 was revised to provide additional information about the potential for fluid migration near the fault during the ISR operation phase.

B.5.20.4 References

LCI. "Project Environmental Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming—Application for US NRC Source Material License (Docket No. 40-9068)." ML081060507. Casper, Wyoming: LCI. 2008a.

LCI, 2008b. Lost Creek ISR, LLC. Lost Creek Project Technical Report, Volumes 1 through 4 (Revision 1), South-Central Wyoming. Application for US NRC Source Material License (Docket No. 40-9068). March 2008. ADAMS Accession Nos. ML081060503, ML081060504, ML081060505, ML081060507; ML081060510. Casper, Wyoming: Lost Creek International, LLC.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Vols. 1 and 2. Washington, DC: NRC. June 2009.

B.5.21 Groundwater Resources

B.5.21.1 General Concerns About ISR and Groundwater Contamination

Comments: L010-021; L015-022; L015-046; L015-047; L015-050; L017-013; L017-015; L018-030; L018-031; L019-004; L019-020

Several commenters questioned the assumptions in the GEIS and SEIS for the conclusions of SMALL to MODERATE groundwater impacts from groundwater restoration. The concerns included (i) an applicant's inability to achieve premining conditions and its impact on the surrounding aquifers and (ii) lack of description on how often NRC, or its agreement states, approves ACL limits for groundwater constituents. One commenter asserted that NRC must admit aquifers are permanently contaminated by ISR facilities and conduct the environmental assessment accordingly. The commenter also suggested that NRC should perform a historical analysis of the groundwater restoration at ISR sites.

Response: *Under the federal UIC program, the ISR production aquifer must receive an exemption from EPA that the aquifer, or part of the exempted aquifer, is not now and would never be a source of drinking water and, thus, would no longer be protected under the SDWA. Hence, groundwater in exempted aquifers cannot be considered as a source of drinking water supply even after restoration.*

NRC licensees are required to return water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in the regulations, the concentration of a hazardous constituent must not exceed (i) the Commission-approved background concentration of that constituent in the groundwater; (ii) the respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the

constituent is below the value listed; or (iii) an alternate concentration limit as established by the Commission.

To establish the preoperational nonradiological and radiological groundwater baselines within the proposed license area boundaries and adjacent properties, the applicant would be required to collect samples over a period of at least 1 year from at least four sets of groundwater samples sufficiently spaced in time. To establish the baseline water quality for a specific wellfield within the license area, an acceptable set of samples should include all wellfield perimeter monitor wells, all lower and upper aquifer monitor wells, and at least one production/injection well per acre in each wellfield. Baseline samples are collected with a sampling density of not less than 1 for 16,187 m^2 [4 ac]. Because the applicant is required to collect baseline water quality before ISR operations begin, the baseline sampling procedure outlined previously would provide adequately unbiased preoperational groundwater quality measures at the proposed ISR site. Wellfield groundwater monitoring at the proposed Lost Creek ISR Project, including preoperational and baseline wellfield groundwater sampling, is described in SEIS Section 6.3.1.

These standards are implemented during aquifer restoration to ensure protection of public health and safety in compliance with 10 CFR Part 40, Appendix A, Criterion 5B(5) for protection of groundwater and USDW in surrounding nonexempted aquifers. The applicant is required to provide financial sureties to cover planned and delayed restoration costs in compliance with 10 CFR Part 40, Appendix A, Criterion 9. NRC reviews financial sureties annually. Although the goal of groundwater restoration is meeting baseline values or MCLs, whichever is greater, it is recognized under the EPA standards and NRC regulations that ACLs can be used in circumstances where achieving those standards is impracticable or impossible. ACLs must present no substantial present or potential hazard to human health or the environment. NRC requirements for application, review, and establishment of a site-specific ACL are described in Appendix C.

All ISR restorations completed under the NRC regulations have met approved restoration standards. Examples of successfully completed groundwater restorations or delayed restoration activities are provided in NUREG–1910 (AUTHOR, YEAR, Section 2.11.5). Licensees are also required to establish routine regional aquifer monitoring programs as a license condition. The data from those monitoring programs do not show impacts to USDWs attributable to an ISR facility (NRC, 2009a).

No changes were made to the SEIS beyond the information provided in this response.

Comment: L022-013

The commenter stated that the SEIS (p. 3-18) information on the Class I wells is inadequate. The commenter claimed the SEIS assumes the Mesa Verde formation is a suitable injection zone because of its depth. However, the commenter asserted that the depth of a formation is not the criteria to determine the use of Class I wells. The commenter further asserted that Class I wells can generally only be used to inject below the lowermost USDW. The commenter stated that it is unclear from the information provided in the SEIS why it is believed that this formation is below the lowermost USDW.

Response: *Draft SEIS Section 3.5.2.1, referenced by the commenter, does not determine the Mesa Verde formation as the lowermost USDW nor does it assume the Mesa Verde formation is a suitable injection zone because of its depth. Rather it mentions depth and elevated total*

dissolved solids (TDS) concentration as general conditions that may render the aquifer water unsuitable for human consumption. SEIS Section 3.5.2.4 states that the applicant has proposed five injection wells into the Fort Union Formation and received Class I UIC permits for the wells from WDEQ. WDEQ has applied the necessary criteria to determine the suitability of the proposed injection formation. SEIS Sections 3.5.2.1 and 4.5.2.1.2.3 were revised to reflect updated information regarding the depth of the Mesa Verde formation.

B.5.21.2 Site Characterization

Comment: L015-029

The commenter stated that NRC evaded meaningful analysis of the Lost Creek project's groundwater impacts by dismissing the overlying FG aquifer's and the underlying UKM Sand's water quality as bad, even though this conclusion is based on average quality, and not well specific data inside and outside of mineralized areas.

Response: *As part of the site characterization to obtain a license, the applicant is required to determine the average preoperational water quality for all aquifers in, above, and outside the proposed area. The general preoperational average is not the same as the average baseline water quality of the uranium-bearing aquifer for a specific wellfield. The general preoperational water quality is described in SEIS Section 3.5.2.3.3. The applicant established preoperational groundwater quality based on sampling data collected over four seasons spanning 2006 and 2007 and historical sampling conducted in the 1970s and 1980s. These samples were obtained for water quality testing from multiple wells completed in the production aquifer and the surficial, overlying, and underlying aquifers. This method has been used in the past and is adequate for defining -the license-area baseline information should any impacts (e.g., spills or leaks) occur during the operational life of the project. The applicant will be required to demonstrate that any residual impacts to environment meet the pre-operation quality or are protective of human health and the environment prior to license termination.*

It should be noted that the data quality objectives for the preoperational data differ slightly from those for baseline data at a particular wellfield. The baseline data for a wellfield is more specific and the evaluations for potential impacts to the surrounding aquifers are on a well-by-well basis.

B.5.21.3 Aquifer Exemption and Baseline Water Quality

Comments: L008-003; L016-011; L022-015

One commenter briefly clarified the definition of aquifer exemption and explained the criteria EPA use in designating exempt aquifers. A second commenter requested a more detailed description of these criteria in the SEIS, and a third commenter noted the description for aquifer exemption designation is incomplete in the SEIS.

Response: *EPA issues an aquifer exemption. The EPA criteria for an aquifer exemption are found in 40 CFR 146.4. The draft SEIS included 40 CFR 146.4(a) and (b) in the description of aquifer exemption criteria. The regulation states that an aquifer, or a portion thereof, may be determined to be an "exempted aquifer" if it meets the following criteria: (i) it does not currently serve as a source of drinking water; and (ii) it cannot now and will not in the future serve as a source of drinking water; or (iii) the TDS content of the groundwater is more than 3,000 and less than 10,000 mg/L, and it is not reasonably expected to supply a public water system. A USDW, as defined in 40 CFR 144.3, is an aquifer or its portion that (i) supplies any public water*

system or contains a sufficient quantity of groundwater to supply a public water system and (ii) currently supplies drinking water for human consumption, or (iii) contains fewer than 10,000 mg/L TDS; and (iv) is not an exempted aquifer. Section 4.5.2.1.2.3 of the final SEIS was revised to reflect this regulation.

B.5.21.4 Control of Operational Impacts and ISR Solutions: Excursions, Drawdowns, Monitoring, and History

Comments: L015-053; L015-54

The commenter noted that the analysis of groundwater impacts from the restoration activities as described in the SEIS is insufficient. The quality impact analysis is largely based on the GEIS analysis, which only had a single paragraph addressing groundwater impacts to the Wyoming West Uranium Milling Region and did not mention the failure of ISR operations to restore groundwater to premining conditions. The site-specific analysis for the Lost Creek SEIS was limited to consumptive use impacts.

Response: *As stated in the response to comment L019-022, the impact analysis of an individual wellfield is based on a detailed background sampling program for that specific wellfield. These impacts are expected to be common to all ISR facilities and are addressed in the GEIS (NRC, 2009b), assuming the physical setting and methods used are similar. Consumptive water use impacts are dependent on site-specific conditions, and thus a “typical” impact is difficult to define. Consequently, the SEIS impact analysis on consumptive use should be more specific and substantial than the analysis on quality.*

Based on the history of ISR operations, the impacts to the surrounding aquifer at any ISR facility have been found to be and are expected to continue to be negligible. After restoration is completed, the water quality within the ore zone aquifer would meet Appendix A, Criterion 5B(5) groundwater protection standards, which are protective of all USDWs.

Comment: L015-027

One commenter claimed the new NRC approach for analyzing impacts from ISL operations in an unconfined aquifer is insufficient.

Response: *NRC staff notes that none of the operations proposed in the application for the proposed Lost Creek ISR Project would involve recovering uranium from an aquifer under unconfined conditions, therefore, no modification was made to the SEIS in response to this comment.*

Comment: L015-030; L022-018

The commenter asserted that NRC did not meaningfully evaluate potential excursions from the HJ layer to the underlying aquifer at the Lost Creek site. The commenter stated that by fiat NRC evaded evaluating the potential impacts to the underlying, good quality aquifer and the alternatives and mitigation measures that would follow from such an analysis. Another commenter stated NRC failed to provide information on the potential for, and magnitude of, releases into the groundwater from the facility and the difficulty in cleaning up such releases.

Response: *NRC staff initially relies on information the applicant provides as well as information and conclusions from a separate detailed safety review by NRC staff. SEIS Section 4.5.2.1*

describes the environmental impacts from ISR operations in the HJ layer of the Battle Spring Formation. The commenter is correct in stating that the SEIS did not include a comprehensive technical analysis of ISR operations in the HJ layer. This analysis can be found in the NRC safety evaluation of the Lost Creek ISR license application. The safety evaluation includes an extensive review of ISR operations in the HJ layer, which was provided in the applicant's technical report. Specifically, NRC reviewed the field tests the applicant provided to demonstrate the field behavior of the HJ horizon. NRC staff also performed independent calculations using a groundwater flow modeling to evaluate flow behavior during the ISR production and restoration phases at Lost Creek. Finally, NRC performed an excursion scenario simulation to demonstrate excursion behavior and excursion capture in the HJ layer. The applicant would also be required to provide NRC with its Wellfield Hydrologic Test Data package to verify the field behavior of the HJ Horizon at a specific mine unit. Operations in the HJ layer would not commence until NRC has reviewed and approved this wellfield package to ensure the operations in the Lost Creek HJ layer can be conducted safely and to minimize environmental impacts. No change was made to the SEIS beyond the information provided in this response.

Comment: L015-034

The commenter noted NRC did not disclose that its analysis of the excursion impacts to the upper and lower HJ, FG, and UKM horizons represented a significant policy and technical shift from prior environmental analyses.

Response: *The NRC excursion impact analysis was not a policy or technical shift. NRC policy is that an ISR operation will not impact any USDW. The impact analysis includes an environmental review of the excursion monitoring program to ensure site-specific conditions permit the timely detection and correction of an excursion. The unique features of the setting (i.e., the Lost Creek Fault and vertical anisotropy of the HJ Horizon) required additional scrutiny by NRC staff. SEIS Section* 4.5.2.1.2.2 *was revised to clarify the conditions at the proposed Lost Creek ISR Project site.*

Comments: L015-013; L017-007; L018-036

One commenter noted that a significant consideration is whether or not contaminated groundwater can be contained or, if not contained, escapes into aquifers that serve as regional water supplies and permanently pollute an entire aquifer. A second commenter noted that NRC did not require an alternative site for the facility or extensive additional testing that would conclusively demonstrate that the lixiviant will not migrate to the surficial aquifer that provides potential drinking water and water for livestock. This commenter also noted similar considerations exist for the lack of characterization of surface water flows at the site. A third commenter requested a thorough analysis of the potential impacts of a lixiviant excursion on aquifers outside the exempted uranium recovery zones, including effects on groundwater restoration estimates.

Response: *The primary goal for NRC staff in performing a safety review is to evaluate a proposed ISR facility to ensure its operation will be protective of human health and the environment. NRC staff does not determine the location for an ISR facility; its location is based primarily on the location of the natural geologic deposits. However, once an application for a specific location is submitted for review, staff evaluates that particular setting to establish that the fluids can be contained. Past history of existing facilities has shown that production fluids can be contained but unplanned spills, leaks or excursions do occur. NRC staff has developed*

a system of "defense in depth" where features of the facility design (e.g., dual liner systems for man-made ponds, wellfield bleeds resulting in negative pressure or inflow to the wellfield) are the primary control on impacts to worker and public health and safety and the environment but also requires monitoring for the early or timely detection of an unplanned release.

As far as surface water flows, the NRC did require that the applicant characterize the surface water flow regime. The regime consists of ephemeral streams which are dry throughout most of the year. The quality is consistent with surface water runoff. This information forms a basis for the future should any incident happen that affected the surface water flow regime and/or channel. As part of the NRC safety review, the applicant estimated and the NRC staff verified that the data used to estimate peak flows at the Lost Creek ISR Project were applicable to the site. The results of this analysis showed that peak surface flows would not be sufficient to inundate significant areas within the proposed project area.

Excursions at ISR facilities may be caused by an imbalance in the injection and production rates in the ore production aquifer which enables fluids to move away from the production zone; leaks in well casing; and leakage through overlying and underlying aquitards. To detect an excursion outside the production zone or to overlying and underlying aquifers, the licensee is required to use a monitoring well ring around the production aquifer and monitoring wells in the overlying and underlying aquifer. These monitoring wells are sampled biweekly for excursion parameters. If an excursion is detected and confirmed by sampling, corrective actions must be taken to retrieve the excursion which involve modifying the injection and recovery rates in the affected area until the excursion is mitigated. Sampling of the well on excursion will also be increased to every seven days. A written report describing the excursion event, corrective actions taken, and the corrective action results must be submitted to NRC within 60 days of its confirmation. If an excursion is not corrected within 60 days of its confirmation, the licensee must stop injecting lixiviant into the wellfield until the excursion is retrieved or provide an increase in the surety amount to NRC satisfaction to cover the projected cost of correcting or cleaning up the excursion (NRC, 1998, 2003). SEIS Section 4.5.2.1.2.2 has been revised to clarify potential site-specific impacts to hydrology at the proposed Lost Creek ISR Project.

B.5.21.5 Exploratory Drillholes, Abandoned Wells, and Old Mines

Comment: L017-016

The commenter was concerned that many drill holes on the site have not been properly plugged and abandoned. Poorly plugged boreholes potentially can allow lixiviant excursion between aquifers during ISR operations and can hinder restoration activities. The commenter wanted all drill holes to be properly plugged and abandoned before initiating ISR operations.

Response: *The draft SEIS stated that poorly plugged or abandoned drill holes provide the potential for vertical migration of fluids out of the production zone and into other aquifers. In addition to wells that would be completed and eventually plugged and abandoned over the life of ISR operations at the Lost Creek site, the applicant identified in LCI (2008, Attachment 2.6-2) that more than 800 historic borings have been completed within 3.2 km [2 mi] of the proposed project area, including 161 known abandoned or cancelled wells. NRC staff noted in the safety review that many of the historic plugging procedures for drillholes (i.e., boreholes) in the Battle Spring Formation were based on the Battle Spring Formation being a single aquifer, which is inconsistent with the applicant designation of individual aquifers (e.g., the HJ aquifer) within the Battle Spring Formation for ISR operations. To mitigate the possible impact of historic*

abandoned drillholes (boreholes) serving as potential flow paths for vertical excursions, the applicant needs to ensure that any abandoned drillhole or well in the vicinity of a production unit has been properly plugged before ISR operations can commence. In response to the comment, SEIS Section 4.5.2.1.2.2 was revised to provide additional information about the presence of historic plugged and abandoned drillholes in the proposed project area and to describe how the potential effect of fluid migration in poorly plugged wells could be mitigated prior to initiating ISR operations in individual production units.

B.5.21.6 Drawdown

Comments: L017-012; L022-021; L022-025

Several commenters expressed concern that the proposed Lost Creek ISR Project would lead to excessive drawdown in the water table. A commenter noted that NRC should reassess the potential for excursions. The measures to identify excursions of uranium and lixiviant in the SEIS are inadequate, given the unconfined nature of the aquifer, and the only way to control excursions is to overproduce the aquifer, which would significantly depress the water table. The lowering of the water table would result in substantial impacts to the surrounding groundwater resources. Another commenter requested clarification on the mitigation measures to prevent excessive drawdown due to pumping (SEIS, p. 4-32). The commenter requested information related to (i) duration of the mitigation measures adopted and (ii) measures taken in case the water levels in the wells do not recover. The commenter also requested information on how the drawdowns during and after restoration will be mitigated (SEIS, p. 4-37).

Response: *NRC staff notes that none of the operations proposed in the application for the proposed Lost Creek ISR Project would involve uranium production from an aquifer under unconfined conditions. Nevertheless, the comment is still applicable for the confined or semiconfined aquifer by replacing the water table with potentiometric surface.*

The comments involve two issues: the control of excursions, which in most cases should be a short-term phenomenon (i.e., during production and restoration operations), and the long-term drawdown potentially affecting surrounding groundwater resources. For the control of excursions, the NRC staff concern is that an adequate water column exists in the production aquifer for short-term corrective actions. As part of the NRC safety review, the applicant has made commitments that would be included as a license condition, if a license was issued, to maintain an adequate water column should an excursion event occur. The long-term drawdown impacts on the surrounding aquifers are addressed in SEIS Section 4.5.2.1.2.2.

SEIS Section 6.3.1.2 describes the applicant proposal to monitor water levels in wells within, above, and below the production aquifers that could be affected by the proposed Lost Creek ISR Project. Potential impacts to these wells due to excessive drawdown would be mitigated by increasing pumping capacities, providing pumps that stop flow in response to extraction unit groundwater withdrawals, or drilling new wells to a deeper level. SEIS Section 4.5.2.1.2.2 describes (i) the specific wells that could be impacted by the production and restoration operations and (ii) corresponding mitigation measures. The duration of the mitigation measures throughout the operations phase is described in SEIS Section 4.5.2.1.2.1.

B.5.21.7 Miscellaneous Groundwater Comments

Comment: L019-022

The commenter stated that for groundwater restorations at past ISR facilities, not all parameters met the primary goal for restoration (i.e., baseline levels or MCLs). The commenter stated that a proper environmental assessment is not possible because the GEIS or SEIS is lacking a comprehensive analysis of all ISR facility restorations and that NRC should not be issuing an ISR license.

Response: *The commenter is correct that restorations NRC approved to date have not met the restoration goal to achieve background water quality for all constituents. In the past, NRC has applied "class of use," a state designation under the SDWA, as a secondary restoration goal to approve these restorations. "Class of use" referred to in the GEIS as a standard for restored groundwater quality was based on restoration standards provided in NUREG–1569 (NRC, 2003). NRC has determined that the primary and secondary restoration standards in NUREG–1569 are inconsistent with the restoration standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). NRC has notified licensees and applicants in Regulatory Information Summary, RIS 09-05, dated April 29, 2009,that the restoration standards listed in NUREG–1569, [NRC,2003, Section 6.1.3(4)] are not consistent with those listed in 10 CFR Part 40, Appendix A, and licensees and applicants must commit to achieve the restoration standards in Criterion 5B(5).*

Reports that address the issue of restoration effectiveness and impacts are available in NRC (2008, 2009). The GEIS and SEIS incorporated existing reviews of restorations into their analyses. The results from these studies support the position that approved restorations are protective of the surrounding aquifers. No changes were made to the SEIS beyond the information provided in this response.

B.5.21.8 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office

40 CFR Part 144. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 144, "Underground Injection Control Program." Washington, DC: U.S. Government Printing Office. 2003.

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 144, "Underground Injection Control Program: Criteria and Standards." Washington, DC: U.S. Government Printing Office. 2003.

LCI. "Lost Creek ISR Project Technical Report, Volumes 1 through 3 (Revision 1), South-Central Wyoming, Application for U.S. NRC Source Material License (Docket No. 40-9068)." ML081060507. Casper, Wyoming: LCI. 2008.

NRC. "Staff Assessment of Groundwater Impacts from Previously Licensed *In-Situ* Uranium Recovery Facilities." Memorandum (July 10) from C. Miller to Chairman C. Jaczko, et al. ADAMS Accession No. ML091770402. Washington, DC: NRC. 2009a.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Vols. 1 and 2. Washington, DC: NRC. June 2009b.

NRC. NUREG/CR–6870, "Consideration of Geochemical Issues in Groundwater Restoration at Uranium *In-Situ* Leach Mining Facilities." Washington, DC: NRC. 2008.

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

B.5.22 Surface Water Resources

B.5.22.1 Surface Water Resources and Ecology

Comment: L020-132

The commenter agreed with the SEIS conclusion of minimal impact to aquatic resources because the proposed project would occur in ephemeral drainages. The commenter also agreed that the proposed mitigation measures, compliance with applicable regulations and permits, and use of BMPs should reduce construction and operation impacts to surface waters.

Response: *NRC acknowledges the comment. No changes were made to the SEIS in response to this comment.*

B.5.22.2 Watersheds, Perennial Streams, and Stream Flow

Comment: L020-033

The commenter requested that the lengths of the main ephemeral drainages, channel gradients, and watershed areas in the proposed project area should be quantified.

Response: *SEIS Section 3.5.1.1 quantifies the areas of the three subwatersheds within the proposed project area. These subwatersheds drain into the Battle Spring Draw and two other unnamed tributaries. Because these channels are ephemeral, the potential impacts from all phases of the proposed Lost Creek ISR Project would be SMALL. Thus, NRC staff determined that the description of ephemeral drainages provided in the SEIS is sufficient to support the environmental impact analysis. Therefore, no additional information is necessary in the SEIS.*

B.5.22.3 Impacts to Surface Drainages and Surface Water

Comment: L010-026

The commenter stated that the location of some well sites in drainage channels, as the SEIS indicates, would violate floodplain management requirements of E.O. 11988.

Response: *E.O. 11988 defines a floodplain as "the lowland and relatively flat areas adjoining inland and coastal waters." This definition does not describe the streams within the proposed Lost Creek ISR Project area. Stream channels in the proposed Lost Creek ISR Project area are typically incised with trapezoidal cross sections and steep side slopes. Also, E.O. 11988 requires regulatory agencies to take action to reduce the risk of flood loss and minimize the impact of floods on human safety, health, and welfare. The applicant received a letter from USACE stating that all surface waters in the Lost Creek license area are considered nonjurisdictional (nonjurisdictional waters are not Waters of the U.S. and are not regulated under federal law). The arid regional climate results in seasonal flows fed mostly by springtime snowmelt and occasional rainfall events. Thus, ephemeral flow conditions and the steeply incised channel morphology result in the containment surface flows within existing stream banks, which minimizes the occurrence of flooding. Furthermore, the applicant has proposed to implement several measures to mitigate potential impacts of locating wells in ephemeral stream channels, including constructing wells during the dry season and installing erosion and sedimentation control features. Because confirmation and clarification are provided in this response with information already in the SEIS, no changes to the Lost Creek SEIS were made beyond the information provided in this response.*

Comment: L010-027

The commenter stated the location of wellpads in drainage channels will increase erosion, sedimentation, and the risk of downstream transport of potential spills at the wellsite. The commenter requested NRC to prohibit siting wellpads in stream channels.

Response: *The proposed Lost Creek ISR Project area contains numerous ephemeral and meandering stream channels and washes. It may be necessary to install wells in ephemeral channels. However, the applicant has committed to ensuring that runoff from disturbed areas meets WYPDES permit guidelines for storm water management and sediment reduction. The applicant also proposed several measures to mitigate the potential occurrence of erosion, sedimentation, and downstream transport of potential spills at the wellsites. These mitigation measures may include (i) constructing wells during the dry season; (ii) holding all drilling fluid in a temporary pit, which would be emptied and cleaned upon completion of well installation; and (iii) using diversion swales and rip rap to protect wellheads from storm water flows. No changes to the Lost Creek SEIS were made beyond the information provided in this response.*

Comment: L015-011

The commenter stated there are surface water flow issues the SEIS dismisses, even though it is clear that surface water flow may be substantial.

Response: *As described in SEIS Section 3.5.1.2, ephemeral stream channels and a seasonal pond (the Crooked Well Reservoir) are the only surface water features within the proposed Lost Creek ISR Project area. The principle functions of these features are conveyance of storm water runoff and groundwater recharge. In addition, the Crooked Well Reservoir provides seasonal drinking water for local wildlife and livestock. By definition, an ephemeral stream conveys water for only a short time period, after snowmelt and after precipitation events. Runoff from rainfall and snowmelt are therefore the main sources of ephemeral stream flow. SEIS Section 2.1.1.1.2.3 indicates at least three culverts would be constructed at ephemeral stream crossings in order to upgrade an existing two-track dirt road to an all-season, gravel-surfaced road that would serve as the principal access to the proposed project site. In addition, SEIS Section 4.5.1.1.1 describes the design criteria for access roads where stream crossings without*

culverts may be feasible. Because of the lack of stream gauging data for the ephemeral streams in the proposed Lost Creek ISR Project area, the culverts would be sized to convey peak flows estimated by regression models developed from the basin characteristics of the region surrounding the project area. This modeling approach is a standard analysis technique used to support hydrologic design in ungauged watersheds. NRC staff considers this approach suitable and sufficient given the arid conditions of the proposed Lost Creek ISR Project area and the limited role of the surface water features with respect to the ISR project phases. NRC staff considers this comment to be adequately addressed in the SEIS; therefore, no changes were made in response to this comment.

Comments: L015-077; L020-043; L020-045

One commenter noted that NRC did not address how the impacts of livestock grazing in the form of surface water contamination and erosion may interact with surface water impacts from the ISR project. Another commenter noted that discharges from wells and pipelines onto the land surface or channels would require WDEQ permits.

Response: *Any potential spills or discharge to surface water features (which may have direct or indirect impacts on livestock grazing) during construction and operation would be regulated under the Construction and Industrial NPDES permit. The applicant is required to obtain the NPDES permit from WDEQ before ISR operations begin. No changes to the SEIS were made beyond the information provided in this response.*

Comment: L020-026

The commenter indicated that runoff that would cause erosion should be avoided by appropriately designing roads, pipelines, and other structures.

Response: *NRC staff finds that for the proposed Lost Creek ISR Project, the information on construction design and planned construction activities the applicant provided would account for the presence and characteristics of the natural features of the land so natural drainage would not be disrupted and surface runoff from roads, pipelines, corridors, and other structures would not be concentrated to potentially cause additional erosion.*

No changes to the Lost Creek SEIS were made beyond the information provided in this response.

Comment: L020-044

The commenter stated that the scope, nature, and extent of surface water impacts associated with well installation in ephemeral channels would be LARGE and not SMALL as given in the Lost Creek SEIS.

Response: *Based on the CEQ regulations and NRC environmental review guidance, the SEIS assigns SMALL impacts to cases where environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the environmental resource. Precipitation experienced at the proposed Lost Creek ISR Project site averages less than 25 cm [10 in] annually, including snowfall. With limited regional precipitation, slow rate of snowmelt, ephemeral stream flow, and moderate channel gradients, it is unlikely that wells placed in stream channels would destabilize or noticeably alter any surface water attribute. Also, the short duration of well installation activities imply that surface water*

impacts of well installation in ephemeral channels would be temporary. Furthermore, the applicant has proposed to implement several measures to mitigate potential impacts of locating wells in ephemeral stream channels, including constructing wells during the dry season and installing erosion and sedimentation control features. These factors would result in small surface water impacts associated with well installation in ephemeral channels. No changes to the Lost Creek SEIS were made beyond the information provided in this response.

B.5.22.4 Regulatory Process Related to Surface Water

Comments: L010-025; L020-012; L020-038

Two commenters stated that surface waters in the proposed Lost Creek ISR Project area should be protected as required by state law (i.e., Wyoming Constitution) regardless of statutory designation as Waters of the United States. One commenter cited presidential E.O. 11990, requiring protection of wetlands regardless of their clean water act status.

Response: *NRC staff acknowledges the comments. Although the ephemeral streams in the proposed Lost Creek ISR Project area are not Waters of the United States, SEIS Section 4.5.1 describes the potential impacts to all surface waters and wetlands. The text in SEIS Section 4.5.1.1.1 was revised to reflect this observation.*

Comments: L015-012; L017-008

The commenters stated the SEIS ignores the lack of stream gauging data within the proposed project area and the SEIS does not include an alternative that conditions licensing on proper characterization of surface water flows within the project site.

Response: *As described in SEIS Section 3.5.1.2, ephemeral stream channels and a seasonal pond (the Crooked Well Reservoir) are the only surface water features within the proposed Lost Creek ISR Project area. The primary function of these features is conveyance of storm water runoff and groundwater recharge. In addition, the Crooked Well Reservoir provides seasonal drinking water for local wildlife and livestock. By definition, an ephemeral stream conveys water for only a short period during and after precipitation events. Runoff from rainfall and snowmelt are, therefore, the main sources of ephemeral stream flow. SEIS Section 2.1.1.1.2.3 indicates at least three culverts will be constructed at ephemeral stream crossings in order to upgrade an existing two-track dirt road to an all-season, gravel-surfaced road that will serve as the principal access to the project site. In addition, SEIS Section 4.5.1.1.1 describes the design criteria for access roads where stream crossings without culverts may be feasible. Because of the lack of stream gauging data for the ephemeral streams in the proposed Lost Creek ISR Project area, the culverts would be sized to convey peak flows estimated by regression models developed from the basin characteristics of the region surrounding the proposed project area. This modeling approach is a standard analysis technique used to support hydrologic design in ungauged watersheds. NRC staff considers this approach suitable and sufficient given the arid conditions of the proposed Lost Creek ISR Project area and the limited role of the surface water features with respect to the ISR project phases. NRC considers this comment to be adequately addressed in the SEIS; no changes were made to the SEIS in response to this comment beyond the information provided in this response.*

Comment: L020-041

The commenter stated that though rip rap or diversion swales could be used to protect the well heads, any stream flows forced to go around these structures will cause energy to be redirected elsewhere in the channel, resulting in excessive erosion.

Response: *The proposed Lost Creek ISR Project area contains numerous ephemeral and meandering stream channels and washes, and it may be necessary to install wells in ephemeral channels. However, the applicant has committed to complying with WYPDES permit guidelines for storm water management and sediment reduction. Furthermore, the applicant has proposed to construct wells during the dry season, thereby reducing the likelihood of potential adverse impacts from storm flows and erosion. No changes to the Lost Creek SEIS were made beyond the information provided in this response.*

B.5.22.5 Surface Water and Spills

Comments: L020-039; L020-040

The commenter stated that the placing of well heads in an ephemeral channel will result in increased erosion and increased risk of breached infrastructure and subsequent release of lixiviant or other fluids.

Response: *The proposed Lost Creek ISR Project area contains numerous ephemeral and meandering stream channels and washes, and it may be necessary to install wells in ephemeral channels. However, the applicant has committed to ensuring that runoff from disturbed areas meet WYPDES permit guidelines for storm water management and sediment reduction. The applicant has proposed several measures to mitigate the potential occurrence of erosion, sedimentation, and downstream transport of potential spills at the wellsite. These mitigation measures include constructing wells during the dry season; holding all drilling fluid in a temporary pit, which would be emptied and cleaned upon completion of well installation; and using diversion swales and rip rap to protect wellheads from storm water flows. No changes to the Lost Creek SEIS were made beyond the information provided in this response.*

B.5.22.6 Impacts of Operations and Aquifer Restoration on Surface Water

Comment: L015-042

The commenter stated the SEIS disregards the proximity of mining operations to surface water flows.

Response: *The SEIS does not disregard the proximity of mining operations to surface water flows. Rather, SEIS Section 4.5.1.1.2 references the analysis in GEIS Section 4.2.4.1.2, which lists proximity of operations as one factor affecting the potential impact of spills to surface waters. This GEIS (NRC, 2009) analysis describes various available measures for mitigating potential surface water impacts associated with ISR operations, including (i) implementing flow monitoring and spill response procedures; (ii) implementing a WDEQ-issued storm water pollution prevention plan; and (iii) complying with a WYPDES permit if discharging treated wastewater to a surface water body. The applicant has committed to mitigating potential impacts to surface waters by implementing a spill prevention and control plan, ensuring that runoff from disturbed areas meets WYPDES permit guidelines for storm water management, and completing appropriate reclamation practices in a timely manner. SEIS Section 4.5.1.1.2*

describes the measures that would be taken to prevent and remediate spills, as well as to manage storm water runoff. Because these site-specific conditions and the applicant commitments for the proposed Lost Creek ISR Project area are consistent with the GEIS analysis, the SEIS has adopted the impact conclusions from the GEIS. No additional changes to the SEIS are necessary beyond the information presented in this response.

Comment: L020-050

The commenter stated that placing wells within highly erosive ephemeral channels creates unacceptable risk to groundwater and surface water quality.

Response: *Precipitation, including snowfall experienced at the proposed Lost Creek ISR Project site, annually averages less than 26 cm [10 in] annually. With limited precipitation, a slow rate of snowmelt, and moderate channel gradients, it is unlikely that wells placed in stream channels would destabilize or noticeably alter any surface water flows. Also, the relatively short duration of well installation activities implies that surface water impacts of well installation in ephemeral channels would be temporary. Furthermore, the applicant has proposed to implement measures to mitigate potential impacts of locating wells in ephemeral stream channels, including constructing wells during the dry season and installing erosion and sedimentation control features. These factors would result in SMALL surface water impacts associated with well installation in ephemeral channels. No changes to the Lost Creek SEIS were made beyond the information provided in this response.*

B.5.22.7 Reference

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities—Draft Report for Comment.” Washington, DC: NRC. June 2009.

B.5.23 Ecology

Comment: L008-086

The commenter questioned whether black-footed ferrets are present in the project area.

Response: *Section 3.6.3.3 of the applicant’s ER (LCI, 2008) states that a black-footed ferret survey was not required. Additionally, no prairie dog colonies, which are preferred ferret habitats, are present within the proposed Lost Creek ISR Project area. The BLM documents states only one population of black-footed ferrets currently exists in Wyoming, and that is in the Shirley Basin, about 120 km [75 mi] east-northeast of the proposed Lost Creek ISR site (BLM, 2005). The distribution map (Map 1) in the BLM document indicates that records of black-footed ferrets have not been documented in the proposed project area. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L008-087

The commenter noted that Ute ladies-tresses are not mentioned in the environmental report and the commenter believes the species should not be evaluated in the SEIS.

Response: *SEIS Appendix A contains a letter dated November 12, 2008, from the U.S. Fish and Wildlife Service (USFWS) in response to an NRC request for information on threatened and endangered species that could occur in the proposed Lost Creek ISR Project area. The*

USFWS listed the Ute ladies-tresses orchid as a species that may occur in Sweetwater County, and could potentially occur on or near the proposed project. For that reason, NRC considered Ute ladies'-tresses in SEIS Section 3.6.3. No changes were made to the SEIS beyond the information provided in this response.

Comment: **L017-042**

The commenter expressed concerns about the reliability of raptor surveys and that raptors would not receive adequate protection because active nests were not found in the project area during the baseline biological surveys conducted for the proposed project.

Response: *According to the environmental report (LCI, 2008), the applicant searched WGFD publications and the internal WGFD Wildlife Observation System (WOS) of the proposed license area for reported raptor observations within the proposed project area and within a 1.6-km [1-mi] buffer zone. Review of the WOS, provided as Attachment 3.6-1 in the environmental report, states that observations were reported for raptors in the area queried between 1982 and 2003. The applicant also obtained information regarding raptor nest surveys conducted in 1993 and 1994 that included the proposed Lost Creek site from the Sweetwater Uranium Facility Environmental Report (Shepard Miller, 1994). As described in the Lost Creek environmental report, a raptor nest survey of the entire proposed Lost Creek ISR Project area and a 1.6-km [1-mi] buffer zone was conducted in April and June of 2006, and April, May, and June of 2007, that identified new nests and provided the status on nests previously identified by BLM and WGFD. The surveys were conducted according to BLM protocols. Based on this information, NRC concludes the survey methods used to conduct raptor surveys meet regularly practiced standards and that an adequate survey was conducted.*

Appendix F provides timing restrictions to protect wildlife including raptors. The applicant has committed to follow exclusion periods according to WGFD and BLM guidelines (LCI, 2008, 2009). NRC revised SEIS Section 3.6.1.2.4 to clarify the information regarding raptor surveys that the applicant conducted during baseline biological studies for the proposed project.

Comment: L017-043

The commenter expressed concern about the timing of future raptor surveys.

Response: *SEIS Section 4.6.4.2 states that the applicant would conduct raptor surveys using WGFD protocol using WGFD or BLM biologists, or third-party consultants approved by BLM. Monitoring of known raptor nests will be completed annually between April and July to document nest status and observations (LCI, 2008). No changes were made to the SEIS beyond the information provided in this response.*

Comment: L020-095

The commenter provided information regarding additional reptile and amphibian species that could be present within the project area.

Response: *SEIS Section 3.6.1.2.8 was revised to include reptile and amphibian species in response to this comment.*

Comment: L020-096

The commenter clarified the WGFD common name used for the lark bunting.

Response: *SEIS Sections 3.6.3 (Table 3-7) and 4.6.1.1.5 were revised to reflect the common name lark bunting in response to this comment.*

B.5.23.1 Concerns About Evaporation Ponds

Comment: L010-003

The commenter supports the use of netting and fencing around storage ponds to minimize potential impacts to birds.

Response: *NRC staff recognizes that netting and fencing around storage ponds are effective measures in minimizing impacts to wildlife. In addition, these measures are consistent with regional recommendations by land and wildlife management agencies. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L017-033

The commenter noted NRC does not describe the possibility of West Nile Virus impacting sage-grouse.

Response: *NRC staff recognizes that West Nile Virus (WNV) is a disease that causes sage-grouse mortality. According to the South Central Sage-Grouse Conservation Plan, the potential population effect of WNV on sage grouse is unknown at this time, although several mortalities have been documented throughout Wyoming (South Central Sage-Grouse Working Group, 2007). Initially, the high altitude and dry climate were thought to preclude WNV from impacting sage-grouse in the South Central Conservation Area (SCCA), where the Lost Creek ISR facility would be located. However, five radio-collared sage-grouse, from a study that originated in northwest Colorado, died from WNV at altitudes above1,830 m [6,000 ft]. One grouse died from WNV in Wyoming near Pine Mountain, southwest of the SCCA, about 160 km [100 mi] southwest of the proposed Lost Creek Project site. No changes were made to the SEIS beyond the information provided in this response.*

B.5.23.2 Noxious Weeds

Comment: L020-128

The commenter recommended that halogeton (*Halogeton glomeratus) be included as a noxious weed that could occur in the project area.*

Response: *SEIS Section 4.6.1.1.1.1 was modified to include halogeton* (*Halogeton glomeratus) as a noxious weed.*

B.5.23.3 Concerns About Sage-Grouse

Comments: L010-005; L010-006; L017-026; L017-029; L020-091

Commenters pointed out that the proposed project will not comply with the recommendations outlined in the Governor's Sage-Grouse Implementation Team's (SGIT) Core Population Area

Strategy, the Governor's (E.O. 2008-2), the BLM National Sage-grouse Habitat Conservation Strategy, and the WGFD's Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats.

Response: *Section 4.6.1.1.4 states that the proposed project may not comply with all the development recommendations established by BLM or with the most recent Wyoming Governor's E.O. 2010-4 described in SEIS Section 3.6.3. The E.O. was signed in August 2010 after the Draft SEIS was published and after the closing date for public comments. The NRC is not bound by the Governor's E.O. or SGIT recommendations. The applicant worked with WDEQ, WGFD, and BLM Rawlins Field Office to develop a Wildlife Protection Plan and Wildlife Monitoring Plan that will meet the conservation objective for core areas (LCI, 2010). On July 30, 2010, WGFD stated in a letter to the applicant that the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Addendum OP-A6-A). Staff revised SEIS Section 4.6.1.1.4 and developed Appendix F to include details regarding the applicant plans to mitigate impacts to sage-grouse.*

Comment: L010-007; L010-009; L010-010; L019-014; L020-107

One commenter expressed their concern that constructing more than one well per square mile would decrease the habitat function for sage-grouse. The commenter expressed the view that the impact of an operating ISR well is similar to that of a gas well and that the proposed project exceeds the recommended threshold of well densities presented in the November 2009 WGFD-published Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats. Due to the recommended density exceedence, the commenter asserts that impacts from the proposed Lost Creek ISR Project to sage-grouse would be LARGE. Two commenters believe NRC underestimates the potential impacts to sage-grouse. One commenter observed that the WGFD did not concur with the NRC conclusion that impacts to sage-grouse from the proposed project could not be mitigated to have a SMALL impact. Another commenter reiterates the need to protect this sensitive species and its habitat.

Response: *In the November 2009 WGFD-published Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats, recommended threshold and mitigation specifications included that well pad densities should not to exceed an average of 1 pad per 259 ha [640 ac]. Further, WGFD recommended that the number of well pads within a 3.2-km [2-mi] radius of the perimeter of an occupied sage-grouse lek should not exceed 11. As described in SEIS Section 3.6.1.2.3, 11 leks were observed within 6.4 km [4 mi] of the proposed Lost Creek ISR Project boundary, which are particularly important habitat because birds often return to the same leks and nesting areas each year.*

As described in SEIS Section 3.6.3, the Wyoming Governor issued the most recent sage-grouse core area protection guidance in the August 2010 Executive Order after the Draft SEIS was published and after the comment response period ended (E.O. 2010-4). Core areas serve as high quality habitat for sage-grouse nesting and brood-rearing and necessary to maintain sage-grouse populations. The core area stipulation recommendations presented in E.O. Attachment B include maximum disturbance stipulations that recommend limiting "surface disturbance" to 5 percent of "suitable sage-grouse habitat" per an average of 259 ha [640 ac]. For all development activities in a sage-grouse core areas, the E.O. recommends that the amount of suitable sage-grouse habitat be analyzed using a Project Impact Analysis Area (PIAA) process. The PIAA process to determine the amount of suitable sage-grouse habitat that may be disturbed involves identifying all occupied leks within a 6.4-km [4-mi] perimeter around the project boundary. All leks within the 6.4-km [4-mi] perimeter are identified as

affected leks. A 6.4-km [4-mi] radius is then placed around each of the affected leks. The area within the 6.4-km [4-mi] boundary of each of the affected leks and the area within project boundary is considered in the PIAA. Once the PIAA is determined, a disturbance analysis and habitat assessment are completed to determine the existing and allowable suitable habitat disturbance {no more than 5 percent suitable sage-grouse habitat" per an average of 259 ha [640 ac]}.

Because the stipulation recommendations were finalized after the applicant submitted their license application, the applicant did not calculate the PIAA prior to the publication of the draft Lost Creek ISR Project SEIS. However, the applicant completed a disturbance evaluation following the PIAA process as suggested by WGFD (LCI, 2010, Attachment OP-6, Addendums OP-A6-A and OP-A6-B). The results of the applicant analysis indicate that less than 1 percent of the PIAA would be disturbed by the proposed Lost Creek ISR Project, which is less than the E.O. 2010-4 stipulation recommendation maximum allowable disturbance of 5 percent. Based on the PIAA results, the staff concludes that the impact to suitable sage-grouse habitat would be SMALL. However, other impacts to sage-grouse including increased traffic noise near occupied leks, planned road upgrades and transmission line installation activities within 1 km [0.6 mi] of active leks, and planned operations and reclamation during recommended timing restriction periods would be a MODERATE impact to sage-grouse.

The applicant also prepared a Wildlife Protection and Wildlife Monitoring Plan (LCI, 2010, Attachment OP-6) that was developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD. The monitoring plan describes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A).

SEIS Section 4.6.1.1.4 of the SEIS analyzed the potential impacts to sage-grouse with respect to surface occupancy, seasonal use, transportation, overhead line, noise, and vegetation removal. This analysis used the information (i) contained in the GEIS to the extent applicable to the specific site, (ii) from the site visit, and (iii) from meetings with the BLM, FWS, WDEQ, SHPO, Sweetwater County, Bureau of Indian Affairs (BIA), and other potential stakeholders. NRC staff considered the information provided in this response and changed the expected level of impact to protected species from SMALL to MODERATE during the construction and decommissioning ISR phases. The SEIS was revised to include additional analysis of sage-grouse in SEIS Section 4.6.1.1.4 and SEIS Table 2-3 was updated to reflect this change to the expected level of impact to sage-grouse.

Comment: L010-008

The commenter expressed concern about overhead transmission lines and suggested that powerlines be buried within 4.8 km [3 mi] of active sage-grouse leks and within 0.4 km [0.25 mi] of active prairie dog colonies.

Response: *As described in SEIS Section 2.1.1.1.2.5, the proposed Lost Creek ISR facility would be serviced by electric power from an overhead transmission line off the Crooks Gap-Wamsutter Road. A 3,300- m [10,800-ft] long 34.5 kV overhead line would connect the Rocky Mountain Power Company's line to a metering point on the western boundary of the*

proposed project area. Two active sage-grouse leks are within 1 km [0.6 mi] of the proposed transmission line between the western project boundary and Crooks Gap-Wamsutter Road (LCI, 2010, Attachment OP-6, Figure OP-A6-2). Executive Order Attachment B recommends that overhead lines should be at least 1 km [0.6 mi] from the perimeter of occupied sage-grouse leks, new lines should be designed to be raptor proof by installing anti-perching devices, or burying them when possible, and no surface occupancy((including but not limited to the drilling of wells, the construction of well pads, roads, pipelines, or other types of rights-of-way, and/or the installation of permanent or high profile structures) within a 1.0-km [0.6-mi] radius of occupied sage-grouse leks. The applicant's Environmental Report states that appropriate roost guard designs that follow BLM guidelines will be attached to primary power poles and cross arms, which will help minimize raptor roosting on power poles and to minimize predation on sage grouse (LCI, 2008 Section 4.6.3.2). In addition, the proposed plans to install the transmission line along the access road, which is an active two-track dirt road, will minimize the potential habitat impacts and will localize human disturbances.

The applicant prepared a Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010, Attachment OP-6) that was developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD. The monitoring plan describes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A). Because of the proposed mitigative and monitoring measures, NRC concludes the transmission line installation would have a SMALL impact on sage-grouse.

According to the applicant wildlife surveys conducted at the proposed project site (LCI, 2008, Section 3.6.3.3) there are no active black- or white-tailed prairie dog colonies in the proposed project area. The nearest active prairie dog colonies are 1.6 to 3.2 km [1 to 2 mi] south southwest of the proposed Lost Creek ISR Project area. SEIS Appendix A provides the USFWS input regarding prairie dog colonies. The USFWS stated that if a field check indicates that prairie dog towns may be affected, the applicant should contact the USFWS for guidance on ferret surveys. As stated above the applicant would construct power lines in accordance with the latest approved methods. Because no prairie dog colonies are located within the proposed project area, NRC concludes installation of the transmission line would have SMALL impact on prairie dogs. No changes were made to the SEIS because of this comment beyond the information provided in this response.

Comment: L010-011

One commenter suggested that stronger mitigation measures be considered to reduce the level of impact to sage-grouse.

Response: *As described in SEIS Section 1.7, in January 2009 NRC staff met with staff from the USFWS Rawlins office, staff from the BLM Rawlins Field Office and the Casper Field Office, and with representatives from the WGFD Lander Regional office. NRC staff also met with the Wyoming Governor's Planning Office in January 2009 and June 2009. Each agency emphasized the importance of limiting impacts to sage-grouse. Guidance on mitigation measures to reduce or avoid adverse impacts from the proposed action was also provided. As described in SEIS Section 4.6.1.1.4 and other comment responses in this appendix, the applicant prepared a Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010,*

Attachment OP-6) that was developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD. The monitoring plan describes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Addendum OP-A6-A). SEIS Section 6.4.2 describes planned wildlife monitoring that would be completed by the BLM or WGFD biologists, or a third-party contractor (approved by BLM prior to completing any work). The mitigation and monitoring measures described in the applicant monitoring plan may be adjusted to comply with required agency guidelines. SEIS Sections 3.6.3 and 4.6.1.1.4 were revised in response to this comment.

Comments: L010-012; L017-025

Two commenters expressed concern that truck traffic and increased traffic in general along Lost Creek Road may have negative effects on sage-grouse throughout the life of the proposed project.

Response: *NRC staff recognizes that sage-grouse are sensitive to noise and human disturbance that would be caused by increased traffic for the proposed project activities. The applicant plans to upgrade an existing two-track dirt road to serve as a primary access road that would be called Lost Creek Road, which would the proposed Lost Creek ISR Project area that would connect Wamsutter-Crooks Gap Road to the west and Sooner Road (BLM 3215) to the east (SEIS Figure 2-3). The applicant proposes to use the western access road for large, heavy-duty trucks carrying materials and supplies, while they expect the majority of the workers (in light-duty trucks) would gain access to the proposed site from the east (SEIS Section 2.1.1.1.7). Two active sage-grouse leks are located less than 0.4 km [0.25 mi] south of the proposed Lost Creek Road west of the proposed project boundary and east of Wamsutter-Crooks Gap Road. Three leks are located within or east of the proposed project area 0.4 to 0.8 km [0.25 to 0.5 mi] north of the proposed Lost Creek Road. No traffic count data are available for the proposed Lost Creek Road (LCI, 2008).*

SEIS Chapter 4 Transportation, Noise, and Ecology sections describe potential impacts from dust, dust impacts to forage palatability, noise, vegetation removal, habitat fragmentation, human proximity, and incidental wildlife kills, which could all be attributed to increased traffic. As described in SEIS Section 4.3.1.1, most of the heavier transports of materials and equipment into and from the proposed site would use the proposed Lost creek Road and Wamsutter-Crooks Gap Road west of the proposed project area that connects Wamsutter and Jeffrey City. During construction, an estimated 30 to 35 light-duty trucks and 2 to 5 heavy-duty trucks would travel to and from the proposed site each day. Light-duty traffic would likely approach the site on the proposed Lost Creek Road from either the west or east, whereas heavy-duty traffic would be required to use Wamsutter–Crooks Gap Road from the west. The proposed operations would mostly involve commuting traffic of approximately 20 vehicles per day and trucking activity ranging from 2 to 5 trucks per day (Section 2.1.1.1.7) that would likely use the proposed Lost Creek Road. The proposed transportation activities would decrease during operations relative to the proposed transportation described in SEIS Section 4.3.1.1 for the construction phase. Transportation impacts during the aquifer restoration phase would be similar to those of the operation phase and will gradually decrease through the course of aquifer restoration (SEIS Section 4.3.1.3). The estimated level of trucking activity for decommissioning

waste shipments is lower than for trucking during the other phases of the proposed facility lifecycle (SEIS Section 2.1.1.1.7).

SEIS Section 3.8 describes the ambient (background) sound levels at the proposed project site to be less than 40 dBA. E.O. 2010-4 stipulations recommend that noise is limited to 10 dBA above the ambient noise measured at the perimeter of a lek from 6 PM to 8 AM during breeding season between March 1 and May 15. A summary of noise effects on wildlife populations (Federal Highway Administration, 2004) includes reference to measured average traffic noise levels at 15 m [50 ft] of 54–62 dBA for passenger cars and 58–70 dBA for heavy trucks. As described in GEIS Section 4.2.7.1, noise from a line source like a highway is reduced by about 3 dB per doubling of distance (NRC, 2009). Using the highest noise level of 70 bBA at 15 m [50 ft] along the access road closest to the two active sage-grouse leks located west of the proposed project boundary and east of Wamsutter-Crooks Gap Road, the noise level at the perimeter of the nearest lek would be approximately 52-55 dBA. Traffic noise along the road is expected to be localized and mostly limited to daylight hours. It is also expected that traffic would decline after the initial peak drilling, construction, and startup activities, which would also decrease wildlife impacts. However, noise from roads with low average traffic counts could have a relatively higher noise impact on wildlfie, particularly when facilities are experiencing peak (construction) employment. Therefore, noise impacts to the leks within 3.2 km [2 mi] of the proposed Lost Creek Road would be MODERATE.

E.O. 2010-4 recommends a no surface occupancy stipulation including no placement of roads within 1 km [0.6 mi] of an active sage-grouse lek in core areas; however, the applicant developed a Wildlife Protection Plan and Wildlife Monitoring Plan with mitigation and monitoring strategies to meet the conservation objective for core areas (LCI, 2010, Attachment OP-6) that was developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD. The monitoring plan describes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A).

During the phases of the proposed ISR facility, the proximity of the proposed Lost Creek Road could cause noise, dust, incidental kills, and other human disturbances that could affect the typical behavior of sage-grouse near the proposed road including mating, nesting, and brood-rearing that would result in a MODERATE impact. After additional consideration, NRC staff changed the expected level of impact to protected species and species of concern from SMALL to MODERATE during the construction and decommissioning phases of the proposed project. As a result, changes were made SEIS Sections 4.6.1.1.4, 4.6.1.1.5, and 4.6.1.4 based on review of these comments.

Comment: L010-013

The commenter points out that the proposed project may not comply with requirements outlined in the *Federal Land Policy Management Act* (FLPMA) with regard to State plans and policies.

Response: The goals and objective of the FLPMA of 1976 as amended (Public Law 94-579) is to manage the use of public lands administered by BLM in coordination with local, state, and federal agency plans. The applicant ER Section 4.1.1.1 (LCI, 2008) states that the proposed

project will conform to the BLM Rawlins Resource Management Plan (2008), which demonstrates that the proposed project is also consistent with the FLPMA. The applicant has worked with WDEQ, WGFD, and BLM Rawlins Field Office to develop a Wildlife Protection Plan and Wildlife Monitoring Plan to develop mitigation and monitoring strategies that will meet the conservation objective for sage-grouse core areas (LCI, 2010, Attachment OP-6). Data collection and analysis would be completed annually through the life of the proposed action, and consultation with BLM, WGFD, FWS, and WDEQ-LQD would occur as necessary prior to completing survey work. SEIS Section 1.7.3.7 describes that NRC staff has been in continuous communication with the SGIT, organized by the Governor's Planning Office. The SGIT is composed of representatives from Federal, State, and local agencies, as well as industry and the general public. The NRC staff received regular notes of meetings from the Chairman of the SGIT, as well as the proposed changes to the stipulations implementing the Governor's original Executive Order in 2008 for sage-grouse protection (E.O. 2008-2). Changes to the stipulations adopted in E.O. 2010-4 include a detailed analysis of the area affected to determine an allowable habitat disturbance (E.O. 2010-4). SEIS Sections 3.6.3 and 4.6.1.1.4 have been updated with the most recent Executive Order recommended stipulations. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A). SEIS Section 4.6.1.1.4 describes that the NRC is not bound by either E.O. 2010-4 or the BLM sage-grouse recommendations for development.

Because of the continued coordination effort with state and federal agencies, NRC staff concludes that the applicant is following the most current State guidance available and has received sufficient guidance from state and federal planners responsible for upholding the FLPMA provisions, including State policies with regard to sage-grouse protection. Consequently, no further modifications have been made to the SEIS beyond this comment response.

Comments: L017-022; L019-013; L019-019

Two commenters suggested that the SEIS inadequately analyzes impacts to wildlife in the proposed project area and does not provide adequate mitigation measures. One of the commenters stated that it is the responsibility of NRC to explore alternatives and mitigation measures that minimize impacts to wildlife.

Response: *The SEIS 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. NRC reviewed the applicant environmental and technical reports, responses to requests for additional information, various permit applications and exemption requests, and independent resources during the development of this SEIS. As described in SEIS Section 2.1, NRC considered reasonable alternatives including the proposed action, the No-Action alternative (i.e., not approving the license application), and dry yellowcake (uranium recovery and the production of dry yellowcake as the final product). SEIS Section 2.2 describes the alternatives considered, but eliminated from detailed analysis. Pursuant to NEPA, the NRC staff considered reasonable alternatives, that is alternatives that would meet the purpose and need of the proposed action. Although the NRC may analyze reasonable alternatives, its ability to impose them is limited to the NRC's authority under the AEA. BMPs, mitigation measures, and management actions that avoid or reduce environmental impacts can be imposed through license conditions in the NRC license; however, NRC can only establish license conditions within the limits of the authority granted by Congress. NRC also requires licensees to obtain all*

necessary permits and licenses from the appropriate regulatory authorities prior to operating their facility, and mitigation may be imposed as a requirement established by other agencies through required permits the proposed Lost Creek ISR Project applicant must obtain.

SEIS Section 4.6 analyzes the potential impacts to vegetation and wildlife and describes mitigation measures that either the applicant commits to implement or that could further reduce potential impacts to wildlife. The applicant worked with WDEQ, WGFD, and BLM Rawlins Field Office to develop a Wildlife Protection Plan and Wildlife Monitoring Plan to establish mitigation monitoring strategies that meet state and federal wildlife management objectives or adequate mitigation (LCI, 2010, Attachment OP-6). WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A). As stated in SEIS Section 4.6.1.1.4, NRC staff recognizes that recommendations BLM and the Wyoming Governor's E.O. have outlined may not all be met under the proposed action. NRC staff modified the level of impact for species of concern and sensitive species has changed from SMALL to MODERATE since the publication of the Draft SEIS. SEIS Sections 4.6.1.1.4, 4.6.1.1.5, and 4.6.1.4 were changed in response to previous comments. This modification is due to the changes in FWS status of the sage-grouse and Wyoming guidance (E.O. 2010-4) regarding the protection sage-grouse. NRC has evaluated the alternatives to the regulatory extent possible and considered mitigation and monitoring measures, therefore, no changes to the SEIS text were made in response to this comment.

Comments: L017-023; L020-105

Two commenters pointed out that the WGFD Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats will not be met under the proposed action, and the proposed action cannot demonstrate that there will be no declines in sage-grouse populations as a result of the proposed action.

Response: *SEIS Section 4.6.1.1.4 states that the proposed project may not comply with all the development recommendations established by the Wyoming Governor and the BLM. NRC, the applicant, and the WGFD worked together to develop a mitigation plan that can be implemented over life of the proposed Lost Creek ISR Project that demonstrates that the proposed project would not cause harm to, or declines in sage-grouse population. The Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010) described in SEIS Section 6.4.2.5 discusses how the applicant would protect this species. SEIS revisions were made to the aforementioned sections in response to this comment.*

Comments: L008-083; L017-024; L020-094

Commenters point out that the sage-grouse leks, including the Crooked Well lek, where no sage-grouse were recorded during the baseline surveys conducted for the proposed action, are located in the core population area and project activities should comply with the WGFD Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats for all leks.

Response: *The NRC received comments from WGFD which clarified the status of the Crooked Well lek as unknown (WDEQ, 2010), which was added to Section 3.6.1.2.3. Section 3.6.1.2.3 was further revised to clarify recommendations for leks with an unknown status.*

SEIS Section 4.6.1.1.4 states that the proposed project may not comply with all the development recommendations established by the Wyoming Governor's E.O. 2010-4 or BLM. The applicant prepared a Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010, Attachment OP-6) that was developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD. The monitoring plan describes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A).

Comment: L017-028

The commenter suggested that NRC should provide additional analyses of sage-grouse impacts for each alternative.

Response: *NRC staff revised the discussion of ecology for the proposed action (Alternative 1) because of new information that became available regarding sage-grouse previously described in this appendix. As stated in SEIS Section 4.6.3, the implementation of Alternative 3 would have impacts similar to Alternative 1 (the proposed action) because there would be no increase in the area of land disturbed, equipment used, and human presence. Alternative 3 would require additional equipment that would be placed in the processing plant that is already included in the Alternative 1 analysis. The Alternative 3 MODERATE level of impact for sensitive species and species of concern therefore are the same as for Alternative 1. SEIS Table 2-3 was changed to reflect the modified level of impact.*

Comments: L017-034; L020-101

Two commenters suggested that NRC should commit to implement mitigation measures for fencing that would protect sage-grouse and big game.

Response: *Appendix F describes WGFD and BLM-provided fencing and screening mitigation measures. The applicant has stated that they would implement these measures and other BMPs to minimize and mitigate impacts to wildlife (LCI, 2008 Section 4.6.3.2 SEIS Section 4.6.1.2.2 states that the applicant will use BLM fencing recommendations for big game (LCI, 2008 Section 4.6.3.2).*

The applicant developed a Wildlife Protection Plan and Wildlife Monitoring Plan that includes fencing activities associated with wellfields, mud pits, and storage ponds and other mitigation (LCI, 2010, Attachment OP-6). Fencing mitigation measures planned for sage-grouse could also benefit big game species.

Comment: L019-017

The commenter suggests WFGD data identifies sage-grouse leks at different locations than the figure published in the draft SEIS and that the proposed site is within a sage-grouse core area.

Response: *The SEIS acknowledges that the proposed Lost Creek ISR Project is located within a sage-grouse core area. The NRC received WGFD comments on the draft SEIS which provided new information on the status of the Crooked Well lek. SEIS Section 3.6.1.2.3 was*

revised to describe the unknown status of the Crooked Well lek according to WGFD and applicable recommendations for leks with an unknown status (BLM, 2011). SEIS Figure 3-12 was revised to depict a total of 11 lek locations in the permit area and within a 6.4-km [4-mi] perimeter of the proposed Lost Creek ISR Project site, including the Crooked Well and Discover 2 leks.

The applicant prepared a Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010, Attachment OP-6) that was developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD. The monitoring plan describes extensive monitoring to assess sage-grouse populations that may be affected by the proposed project. Monitoring and agency reporting will be conducted throughout the life of the proposed project. WGFD reviewed the applicant's Wildlife Protection Plan and Wildlife Monitoring Plan and concurred that the monitoring protocol described in the plan is well designed to detect changes in populations and habitats used by sage-grouse and other wildlife (LCI, 2010, Attachment OP-6, Addendum OP-A6-A).

Comment: L020-093

The commenter points out that the sage-grouse core population area includes essential habitat in addition to breeding areas.

Response: *NRC agrees with the commenter, and revised SEIS Section 4.6.1.1.4 to further explain the core area habitat.*

Comments: L020-102; L020-104; L020-106

The commenter suggests that sage-grouse may avoid areas with power poles or tall structures and that the NRC analysis should consider that habitat loss could result from the presence of such structures.

Response: *The NRC staff recognizes that sage-grouse have exhibited avoidance behavior in areas where power poles are present. SEIS Section 4.6.1.1.4 was revised to describe the potential impacts to sage-grouse because tall structures (e.g., power poles) would be present including a discussion of the efficacy of raptor inhibitors.*

Comment: L020-103

The commenter noted that the BLM protective dates for active sage-grouse leks are between March 1 and July 15, and Table 4-2 of the SEIS should be modified.

Response: *Based on the BLM Rawlins Regional Management Plan, Appendix 15, avoidance of surface disturbance should be observed between March 1 and July 15. The information in Appendix F reflects these dates.*

Comment: L020-108

The commenter pointed out that according to the WGFD and BLM sage-grouse development recommendations, there can be no disturbance within core population areas between March 15 and June 30 regardless of distance from a lek.

Response: *In core areas, BLM guidance states that surface disturbances or disruptive activity is prohibited or restricted between March 1 and June 30th (BLM, 2008). The most recent Wyoming guidance (E.O. 2010-4) states that human and vehicular activity should not be allowed within 1 km [0.6 mi] of the perimeter of leks in a core area between March 15 and June 30. The NRC staff recognizes that the proposed project would not meet the BLM and Wyoming development recommendations. The applicant has worked with WDEQ, WGFD, and BLM Rawlins Field Office to develop a Wildlife Protection Plan and Wildlife Monitoring Plan to develop mitigation strategies that meet state and federal wildlife management objectives or adequate mitigation (LCI, 2010, Attachment OP-6). In development of this plan, BLM specifically directed the applicant to use the exsiting two-track dirt road as the proposed Lost Creek Road, which would cause less disturbance to sage-grouse than moving the road outside of the 1 km [0.6 mi] perimeter of leks. BLM/WGFD recommends that the applicant follow the development stipulations during initial construction of the facility; however, once the facility is operational, the applicant will not be expected to cease operations within the distances and timeframes outlined in the stipulations. SEIS Section 4.6.1.1 was revised to explain in greater detail the collaborative approach of the revised applicant development plan acceptable to WGFD and BLM.*

B.5.23.4 General Comments on Threatened and Endangered Species

Comment: L006-005

The commenter noted that the FWS plans to reopen the comment period in April 2010, on the proposed rule to list the mountain plover as a threatened species (67 FR 72396, December 5, 2002). The commenter further stated that following the comment period and USFWS' completion of the new finding, the mountain plover may be proposed for listing. Section 7(a)(4) of the *Endangered Species Act* requires Federal agencies to confer with the USFWS on any action that is likely to jeopardize the continued existence of any species proposed for listing.

Response: *The mountain plover (Charadrius montanus), is a small ground bird which is currently listed as a Wyoming species of greatest conservation need, as designated by the WGFD. The mountain plover occur throughout the State of Wyoming. As described in SEIS Section 3.6.1.2.7, mountain plover was not observed within the project area during the applicant's baseline wildlife surveys; however, plover have been noted in adjacent areas (LCI, 2007). As stated in SEIS Section 6.4.2, annual wildlife inventories at the Lost Creek site would be conducted either by BLM or WGFD biologists, or by a BLM-approved third party after consultation with and approval of a work plan by BLM and WGFD. Recommendations would be made to include newly listed species. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L006-007

The commenter suggested that the final EIS should identify the blowout penstemon (*Penstemon haydenii)* as a federally endangered species that could occur in the project area.

Response: *The NRC staff agrees that the blowout penstemon should be included as a federally endangered species that could occur in the project area. SEIS Section 3.6.3 has been revised in response to this comment.*

Comment: **L010-004**

The commenter stated that the BLM has new guidance regarding development with sage-grouse Core Population Areas.

Response: *NRC staff is aware that, in response to the FWS announcement of the sage-grouse as a candidate species, the Wyoming BLM issued an instructional Memorandum on March 5, 2010, which supplements the BLM's previous National Sage-Grouse Habitat Conservation Strategy published in 2004. SEIS Sections 3.6.3, 4.6.1, and Appendix F were revised to reflect this information.*

Comment: L017-044

The commenter suggested that annual raptor surveys for known and new nests be conducted so that the applicant does not violate the *Migratory Bird Treaty Act.*

Response: *SEIS Section 6.4.2.3 states that monitoring of known raptor nests would be completed each year between April and July. Furthermore, surveys for new nests would also be conducted on the project site and extending out to a 1.6 km [1.0 mi] radius at least once every 5 years. The applicant would also complete raptor nest surveys prior to any new disturbances on the project site. The commenter should note that the Migratory Bird Treaty Act does not require completion of annual raptor surveys. No changes were made in the SEIS beyond the information contained in this response.*

Comment: L020-098

The commenter recommended that raptor surveys be conducted and that the access road be realigned to avoid sage-grouse leks by at least 1 km [0.6 mi] which the existing two-track road currently does not do.

Response: *SEIS Section 3.6.1.2.4 provides raptor survey results the applicant conducted. NRC staff revised the SEIS in response to this comment to include additional applicant-provided information from the license application that describes the raptor nest surveys that were conducted for the proposed Lost Creek ISR Project (LCI, 2008). NRC staff used this information to inform the environmental review. Additional raptor surveys could be requested by other permitting agencies.*

SEIS Section 4.6.1.1.4 explains NRC is not bound by either the Wyoming Governor's 2010-4 Executive Order or the WGFD recommendations. NRC is also is not required to meet BLM guidelines used for BLM evaluations. The applicant has worked with WDEQ, WGFD, and BLM Rawlins Field Office to develop a Wildlife Protection Plan and Wildlife Monitoring Plan to develop mitigation strategies that will meet the conservation objective for core areas (LCI, 2010). This plan would consider road construction activities.

Comments: L020-111; L020-112; L020-113

The commenter suggests that the applicant should collect incidental amphibian data and conduct surveys for the Great Basin spadefoot (*Spea intermontana*).

Response: *In response to public comment, discussion of the Great Basin spadefoot, among other reptiles, was identified in SEIS Section 3.6.1.2.8 as one that could potentially occur within*

the proposed Lost Creek ISR Project area. The Great Basin spadefoot is ranked as a Native Species Status (NSS) 4 due to a lack of quantifiable data on its abundance and distribution (WGFD, 2005). The applicant's TR Section 2.8.3.3 (LCI, 2008b) explains that the BLM Rawlins Field Office wildlife biologists did not require reptile and amphibian surveys for the project for BLM wildlife study requirements prior to the applicant submittal of the BLM Plan of Operation; however, the applicant did record incidental observations for three reptile species (LCI, 2008). Although the upland and lowland sagebrush shrubland found on the proposed project site provides habitat for reptiles, no amphibians were observed during the wildlife surveys (SEIS Table 3-4). The BLM is developing an EIS for the proposed project and, based on the findings, could include additional wildlife survey requirements. Other permitting agencies with statutory authority could also make such requests.

SEIS Section 4.6.1.1.1 provides a discussion of the potential impacts to terrestrial ecology from proposed construction activities. In SEIS Section 4.6.1.1.2, the NRC staff concludes the impact from construction on small mammals, reptiles, and amphibians would be SMALL. No changes were made to the SEIS beyond the information provided in this response.

B.5.23.5 Concerns about Mitigation and Timing

Comment: L006-006

The commenter encouraged project planners to develop and implement protective measures should mountain plovers occur within the project area. The commenter provided a list of potential protective measures which included: (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. The commenter strongly encouraged that protective measures be developed with an assurance of implementation should mountain plovers be found within the project areas.

Response: *As described in Comment L006-005, the mountain plover is known to occur throughout the State of Wyoming but has not been observed within the proposed Lost Creek ISR Project area. As stated in SEIS Section 6.4.2, the applicant would conduct annual wildlife inventories at the Lost Creek site after consultation with and approval of a work plan by BLM and WGFD. The applicant would also develop and implement protective measures as directed by the appropriate agencies based on survey results. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L010-031

The commenter expressed that because sage-grouse habitat will be affected, NRC should choose the Alternative 2 (No Action) for this project.

Response: *The Lost Creek SEIS was prepared in accordance with NRC guidance in NUREG–1748 (NRC, 2003a), which requires the consideration of a No-Action alternative. The NRC staff recognizes that some commenters are not supportive of the proposed action. Chapter 7 of the SEIS provides a cost-benefit analysis of the proposed action. Because this*

comment is general and does not provide additional information, no changes were made to the SEIS.

Comment: L020-100

The commenter suggested the wildlife mitigation measures described in Section 4.6.1.1.1.2 apply to other wildlife in addition to big game.

Response: *The mitigation measures that were in Section 4.6.1.1.1.2 have been relocated to Appendix F and the NRC staff agrees that the measures apply to wildlife in general and the text was revised accordingly*

B.5.23.6 Habitat Loss and Fragmentation

Comment: L010-014; L010-015

The commenter expressed concern about the habitat fragmentation that may affect pygmy rabbits. The commenter suggested that the proposed surface disturbances should be shifted to avoid all pygmy rabbit habitats. The commenter also suggested that complete avoidance of pygmy rabbit habitats for the purposes of road and well construction activities should be included as a license condition.

Response: *As described in SEIS Section 4.6.1.1.5, the proposed Lost Creek ISR Project construction and operation would result in the short-term and long-term loss of 16 ha [39 ac] of pygmy rabbit habitat (Lowland Big Sagebrush Shrub land) within the project area. Pygmy rabbit habitat, approximately 15 percent of the proposed project area, is depicted in SEIS Figure 3-11 as narrow, mostly vertically aligned veins that follow low drainage areas. SEIS Figure 3-3 shows the existing roads that are located within the proposed project area and Figure 2-6 shows the proposed Lost Creek Road that traverses through the proposed wellfield area. SEIS Figure 2-6, Project Wellfields, depicts the proposed wellfield layout in a single, connected, mostly clustered pattern. Wellfields are connected by a system of pipes that connect the well equipment to header houses and the processing facility. This system cannot operate sectioned into disconnected units to avoid the narrow corridors of the pygmy rabbit habitat.*

NRC staff acknowledges in Table 8-1 that unavoidable impacts due to vegetation removal would occur, and that habitat loss constitutes an irretrievable resource that would be difficult to fully recover; however, planned reclamation activities would reduce unavoidable impacts due to vegetation removal. As described in the applicant Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010, Attachment OP-6), the applicant plans to implement the seasonal use, noise, vehicular traffic, and human proximity measures to mitigate potential impacts to affected species. The applicant also plans to conduct wildlife monitoring on an annual basis over the life of the proposed project. This monitoring would be coordinated with the BLM Rawlins Field Office and the WGFD. Based on this information, the SEIS concludes that impacts to pygmy rabbits would be SMALL because only a few individuals would be affected, thus not constituting an important attribute of the total population, nor destabilizing the population. No changes were made to the SEIS beyond the information provided in this response.

Comment: L010-016

The commenter suggested that the expected ISR impacts to habitat should include the entire footprint of the wellfield and a quarter-mile buffer area, similar to impacts resulting from oil and gas development.

Response: *NRC staff determined in SEIS Section 4.6.1.1.1.1 that the land area that would be disturbed by the proposed action would be about 115 ha [285 ac] of the total project area (1,705 ha [4,220 ac]), inclusive of the main access roads to the site. This disturbed area encompasses the entire footprint of the six extraction units plus the main processing plant, roads, pipelines, and header houses. Of these, 115 ha [285 ac], 23.5 ha [58 ac] would be stripped of topsoil and vegetation. SEIS Table 4-1 shows the areas that would be disturbed and stripped of vegetation. NRC staff also acknowledges in Section 4.6.1.1.1.1 that a temporary increase in dust from travel over bare soil and unpaved roads, could be deposited on vegetation both on- and off-site. NRC staff also agrees that vegetation disturbance has the potential to cause habitat degradation. Therefore, the NRC assessed the total area of potential vegetation disturbance. The applicant plans to reclaim all disturbed areas to their preoperation contours and revegetate to support postoperation land uses according to its Plan of Operations that the applicant prepared for and that is currently under review by the BLM Rawlins Field Office. No changes were made to the SEIS beyond the information provided in this response.*

Comments: L010-017; L010-018; L017-039

The commenter stated that fragmentation of shrubsteppe habitats has a particularly negative impact on birds.

Response: *NRC staff recognizes in Section 4.6 that the proposed project construction and operation may result in the short-term loss of 115 ha [285 ac] of nesting habitat for passerine birds, potentially resulting in localized lower reproduction rates and increased predation, or resulting in increased mortality from motor vehicle collisions. NRC staff evaluation of habitat fragmentation considered that birds are mobile and would disperse into adjacent habitat areas where similar habitat is abundant. NRC staff also recognizes that in arid environments natural revegetation would take a considerably longer time. However, active revegetation in a phased (sequential) schedule would be conducted incrementally to minimize the length of time that habitat is unsuitable for obligate wildlife species. Because disturbed areas would be revegetated according to the reclamation plan in the applicant Plan of Operations, impacts to passerine birds would not occur outside the natural range of variability and no long-term impacts on the general population would be expected to occur. Wildlife would be temporarily displaced but would return after decommissioning and reclamation were complete and vegetation and habitat had become reestablished.*

SEIS Section 4.6.1.1.1.2 was revised to describe potential impacts to vegetation and birds during the construction phase based on bird displacement, destruction of habitat, and the slow reestablishment of the sagebrush shrubland. The applicant's commitment to implement mitigative measures as described in Appendix F, especially near sage-grouse leks (e.g., minimizing noise, vehicular traffic, and human proximity discussed in detail in SEIS Section 4.6.1.1.4), would benefit other bird species and nests within the vicinity of the leks. Therefore, the potential impact on upland game birds, except for MODERATE impacts to sage-grouse, during the ISR construction phase would be SMALL.

Comment: L020-092

The commenter stated that in addition to disturbing raptors, powerlines could affect distribution and habitat use by prairie/sage-grouse, and cause habitat fragmentation.

Response: *The commenter specifically points to Executive Summary page xix of the draft SEIS, which mentions mitigation measures for raptors from powerlines. The draft SEIS Executive Summary provides the potential significance level of impact for each resource area during each lifecycle phase but is not intended to be a complete or exhaustive list of every potential impact. The analysis of potential impacts to raptors and sage-grouse is provided in SEIS Section 4.6.1.1.1.2, which does describe the potential impacts that powerlines would have on avian species including avoidance and habitat fragmentation. No changes were made to the SEIS in response to this comment because the potential impact powerlines could have on sage-grouse, avian distribution, and habitat fragmentation is described in SEIS Sections 4.6.1.1.1.2 and 4.6.1.1.4.*

B.5.23.7 Comments on Migratory Birds

Comment: L017-037; L017-038

The commenter suggested that NRC does not adequately address potential impacts or provide suitable mitigation measures for migratory birds. The commenter suggested that NRC is dismissive about potential impacts to migratory birds.

Response: *SEIS Section 4.6.1.1.1.2 describes potential impacts to migratory birds including mortality from vehicle collision, exposure to constituents in the storage ponds, displacement of birds, and disruption of habitat. SEIS Section 4.6.1.1.1.2 describes applicant mitigation commitments that will reduce the potential impacts to migratory birds including the following: (i) fence storage ponds according to WDEQ-LQD guidance, (ii) check water quality in the storage ponds monthly, (iii) use deterrents around storage ponds, and (iv) conduct annual migratory bird surveys that will follow techniques recommended by the WDEQ (LCI, 2010, Attachment OP-6). NRC staff believes that the migratory bird analyses for operations, aquifer restoration, and decommissioning are supported by sufficient technical bases, whether tiered from the GEIS or based on supplemental staff analyses, and expects the level of impact to migratory birds to be SMALL. Appendix F documents the applicant mitigation measures provided in their Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010).*

Comment: L017-040

The commenter expressed that due to conflicting information presented in the SEIS, an evaluation of impacts to raptors was complicated.

Response: *SEIS Section 3.6.1.2.4 (Raptors) was revised to clarify the information regarding raptors. In addition, the response to Comment L017-042 provides information regarding raptor surveys that the applicant conducted during baseline biological studies for the site.*

Comment: L019-009

The commenter expressed a concern of potential impacts to wildlife from selenium contamination.

Response: *NRC acknowledges that wildlife may be temporarily exposed to contamination from spills and leaks in SEIS Section 4.6.1.2. Proposed operations that could involve spills of process solutions containing dissolved selenium would be conducted at the central processing plant, wellfields, the satellite ion exchange facility, and header houses and along pipelines that connect wellfields, header houses, and the central plant. As described in the study cited by the commenter (Ramirez and Rogers, 2000), prior studies have associated selenium with food chain bioaccumulation and adverse impacts to migratory and aquatic birds involving impaired reproduction and mortality. The process solution the applicant proposes to pump from the ore zone aquifer would contain selenium. Selenium occurs naturally in the host rock of the ore zone, and it would be mobilized (i.e., dissolved into the groundwater), along with the uranium and other constituents, by the proposed lixiviant injection into the ore zone aquifer. This solution would then be circulated through the processing circuit, and a portion would be diverted as wastewater (thereby causing selenium and other constituents mobilized by the lixiviant injection to be present in wastewater).*

SEIS Section 2.1.1.1.2.2 describes the applicant plan to prevent liquid releases to the environment at the central processing plant and outdoor storage locations and to implement a Spill Prevention, Control, and Countermeasure (SPCC) plan at the proposed Lost Creek ISR Project. The applicant engineering design would contain any spills within a curbed area that drains to a sump where the liquid effluent would collect for appropriate treatment and disposal (LCI, 2008). For spills that may occur in pipelines, the applicant proposes to utilize an alarmed operational system to detect leaks or other off-normal operating conditions (LCI, 2008). The applicant proposes to design and build storage ponds to NRC standards using impermeable synthetic liners, use a leak detection system, and regularly inspect the storage ponds (LCI, 2008). While some leaks and spills would inevitably occur, the staff expects these would be localized and temporary events based on the proposed detection measures. After a leak or spill has been identified, the applicant proposes to conduct the necessary corrective actions, document the location of the event, sample affected areas, and remediate areas that exceed regulatory limits. The applicant's proposed design and control measures would not eliminate wildlife exposures to process solutions containing selenium, and direct ingestion of spilled solutions by waterfowl (and perhaps other species) may have incidental impacts to individuals within those waterfowl populations. However, the staff considers the applicant's measures would limit the magnitude, spatial extent, and duration of spills, leaks, and other potential wildlife exposures to process solutions containing selenium to a degree that would mitigate potential impacts to wildlife populations.

The report referenced by the commenter is field study of the Highland ISR facility located in Converse County, Wyoming. This study reports elevated environmental concentrations of selenium where land was irrigated with wastewater for a period of approximately 9 years (Ramirez and Rogers, 2000). Land application is a regulated waste disposal method that irrigates land with treated wastewater (stored in surface impoundments) using agricultural irrigation equipment to facilitate the evaporation of water either directly or by plant transpiration. As water evaporates from the soil, it leaves behind constituents that were dissolved in the water, including selenium, as solid deposits thereby creating the potential for buildup of these constituents in soil over time. The proposed Lost Creek Project does not involve the use of land application or surface impoundments in its proposed wastewater disposal method, therefore, the NRC staff considers the levels of selenium deposition and buildup evaluated in the study cited by the commenter and the magnitude of the resulting wildlife exposures to soils and wastewater are not applicable to the proposed operations of the Lost Creek ISR Project.

The applicant's proposed use of underground injection using deep disposal wells is designed to isolate wastewater deep below the land surface and therefore reduce the potential for wildlife impacts relative to other available wastewater treatment and disposal options, such as evaporation ponds or land application. Because the potential impacts to wildlife from leaks and spills are discussed in the SEIS and the commenter does not provide new information to consider, no changes were made to the SEIS.

B.5.23.8 General Vegetation Comments

Comment: L006-008

The commenter suggested that prior to NRC licensing, the project area be surveyed for the presence of blowout penstemon. The commenter further stated that surveys should be conducted from mid-June to early-July when flowering occurs by knowledgeable botanists trained in conducting rare plant surveys.

Response: *In response to public comment, discussion of the blowout penstemon (Penstemon haydenii), was identified in SEIS Section 3.6.3 as a federally-listed endangered species that could potentially occur within the proposed Lost Creek ISR project. This species was not observed, however, during the applicant's preliminary field studies, nor is it known to occur within the proposed project area. Because the blowout penstemon is a federally-listed species, the applicant would be required under the Endangered Species Act to report occurrences to the NRC and FWS within the proposed Lost Creek ISR Project area. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L020-034

The commenter suggested the drainage features in the project area should be better described, for example if vegetation is present or not.

Response: *SEIS Section 3.6.1.1.2 describes lowland big sagebrush shrubland in and immediately surrounding the ephemeral channels within the proposed project area. Section 3.6.1.1.2 also describes the lowland big sagebrush shrubland type vegetation, species makeup, and its occurrence in and along ephemeral dry washes and drainages. Figure 3-11, Site Vegetation Map, shows where the vegetation types are located within the proposed project area. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L020-046

The commenter indicated that revegetation could take years and would not be a short-term impact.

Response: *SEIS Section 4.6.1.1.1 describes impacts to vegetation from construction. Table 4-1 identifies the area of vegetation to be disturbed and whether the disturbance would be classified as long-term over the project life and beyond the period of uranium milling, mid-term disturbances would span the life of the unit or about 3 years, and short-term disturbances would last 2 weeks to 6 months. NRC staff recognizes that the sagebrush shrubland vegetation type may require several years to achieve full site recovery (WGFD, 2007). Section 4.6.1.1.1 was revised to support the conclusion that construction impacts would be long-term.*

B.5.23.9 Impacts to Terrestrial Ecology and Wildlife

Comments: L017-046; L017-047; L017-048

The commenter suggested that NRC underestimated the potential threat to small mammal species of concern and also that cumulative impacts to small mammals should be considered.

Response: *NRC staff explains in SEIS Section 3.6.3 that the State-listed olive-backed pocket mouse (Perognathus fasciatus) and prairie vole (Microtus ochrogaster) were not observed in the proposed project area; however, suitable habitat exists in the proposed project area and these species are known to occur in the region. The applicant did not perform small mammal trapping surveys for these species during the initial biological studies for the site. In November 2008, FWS responded to an NRC staff request for information regarding threatened, endangered, and sensitive species at the proposed Lost Creek site (FWS, 2008). Neither, the olive-backed pocket mouse nor the prairie vole were identified by FWS. However, NRC staff revised the impact determination in Section 4.6.1.1.5 for the pygmy rabbit from SMALL to MODERATE because imperative habitat for the pygmy rabbits could be fragmented or destroyed and it would take many years to reestablish usable habitat. However, the impacts to the pocket mouse and prairie vole in particular would remain SMALL because these species are common in Wyoming and have the ability to occupy a variety of habitats (WGFD, 2011).*

The analysis of cumulative impacts in Section 5.6 concludes the cumulative impacts on terrestrial ecological resources and protected species, which includes small mammals, from past, present, and reasonably foreseeable future actions would be MODERATE, and that species of nongame/migratory birds, raptors, and sage-grouse would experience impacts due to loss, alteration, or incremental fragmentation of habitat; various stresses associated with human disturbance; and direct or indirect mortalities. Furthermore, the proposed Lost Creek ISR Project would have a SMALL incremental effect on terrestrial ecology when considering the fact that the proposed action would disturb approximately 115 ha [285 ac] of habitat out of approximately 18,685 ha [46,172 ac] of land projected to be disturbed by 2020 within the ecological resources study area evaluated.

Comment: L020-129

The commenter suggests that a livestock grazing enhancement project could be considered.

Response: *NRC staff agrees with the commenter that livestock grazing enhancements, such as rangeland improvement projects, could be considered. However, the NRC does not have the statutory authority to require the applicant to perform such enhancements. SEIS Section 4.6.1.1.2 was revised to include livestock grazing enhancement as a consideration.*

Comment: L020-130

The commenter suggests that sagebrush and other plant species found in the sagebrush shrubland type should be considered as forgeable for livestock.

Response: *NRC staff agrees with the commenter that sagebrush shrubland type vegetation should be considered as forgeable for livestock. SEIS Section 6.2.3 was revised in response to this comment.*

B.5.23.10 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

BLM. "Wildlife Survey Protocols." Newcastle, Wyoming: U.S. Department of Interior, Bureau of Land Management, Wyoming High Plains District, Newcastle Field Office. January 2011. <http://www.blm.gov/pgdata/etc/medialib/blm/wy/field-offices/newcastle/wildlife/docs.Par.53483.File.dat/SurveyProtocols.pdf> (7 February 2011).

BLM. "Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management." Rawlins, Wyoming: BLM, Rawlins Field Office. January 2008.

BLM. "Statewide Programmatic Biological Assessment: Black-Footed Ferret (*Mustela nigripes).*" Cheyenne, Wyoming: U.S. Department of Interior, Bureau of Land Management, Wyoming Office. August 25, 2005.

E.O. 2010-4. "State of Wyoming: Greater Sage-Grouse Core Area Protection." Cheyenne, Wyoming: Office of the Governor, Dave Freudenthal, Governor. August 18, 2010.

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B.5.24 Meteorology, Climate, and Air Quality

B.5.24.1 Air Impact Assessment

Comments: L015-015; L015-016; L018-006

One commenter expressed concern about the greenhouse gas emissions from the proposed Lost Creek ISR Project and the impact on climate change from these emissions. Another commenter suggested the draft SEIS ignores climate change impacts based on what was stated as the imprecise nature of the science. The commenter noted that the exact extent and timing

of climate change is not certain, but that many adverse impacts have already been documented and such impacts will continue into the future. Citing draft guidance from CEQ (2010) (to help Federal agencies improve their consideration of greenhouse gas emissions and climate change in evaluations of proposals for federal actions), the commenter stated that despite the evolving nature of climate change science, Federal agencies have an obligation to consider both greenhouse gas emissions emitted from proposed projects and the impacts the action has on natural resources that could also be affected by climate change.

Response: *As one commenter noted, the state of the science of climate change is evolving. The NRC staff acknowledges the changing state of the science on climate change and the evolving federal role in evaluating the potential environmental impacts of federal actions. The NRC approach to evaluating potential climate change impacts from NRC licensing actions is also evolving as more information becomes available that NRC staff can use to evaluate potential impacts.*

To address these and other comments regarding the need for the NRC staff to consider and evaluate the potential impact of greenhouse gas emissions on the global climate, the staff have calculated annual and cumulative CO2 emissions from applicant use of diesel construction equipment during construction and decommissioning of the production wellfields and facilities. Because operating ISR facilities are not major sources of CO2 or other greenhouse gas emissions, the NRC staff expect construction equipment emissions (including well drilling rigs) produced during both construction and decommissioning phases to represent the majority of greenhouse gas emissions from the proposal. The emissions estimates are documented in a Appendix D to the final SEIS and are summarized in Section 2.1.1.1.6. The NRC staff also added an evaluation of potential impacts to climate from the calculated construction equipment emissions from the proposed facility and the potential impacts of climate change on the proposed facility and its potential environmental impacts in Section 4.7. The response to comment L015-017 (below) provides additional information on projected climate changes and the NRC staff's evaluation of these changes on the proposed facility and its potential environmental impacts. The cumulative air impact analysis was also updated to evaluate the impact of the emissions in the context of other past, present, and reasonably foreseeable future actions.

Comments: L015-017; L015-018; L015-019; L015-023

One commenter provided a number of comments related to climate change and the potential impacts of climate change on the potential environmental impacts from the proposed Lost Creek ISR facility. The commenter provided a report from the U.S. Global Change Research Program entitled "Global Climate Change Impacts in the United States" (Karl et al., 2009) as the technical basis for predictions of climate change in the region where the facility is proposed. The commenter suggested the report shows that climate changes in the region have the potential to impact the proposed facility and, therefore, such impacts should be evaluated by NRC in the SEIS. Specifically, they asked that if the region where the proposed project is located is expected to have reduced snowpack and spring runoff and disruption of precipitation over the next decades NRC should also evaluate whether potable water sources outside the ore zone should be sacrificed in exchange for extracting uranium. The commenter clarified by footnote that the term "sacrificed" referred to an assumption that groundwater would be restored to a poor quality baseline standard. They also requested that if climate change was expected to increase the precipitation in the region, NRC should disclose and evaluate how increased soil saturation, flooding, and aquifer recharge would interact with project impacts.

Response: *With regard to future changes in climate altering the potential impacts of the proposed action, the NRC staff evaluated the report cited by the commenter, and found that the projected changes in climate over the 10-year time period of the licensing action for the proposed facility were limited in degree and unlikely to significantly change the intensity of the potential impacts evaluated in the final SEIS. For example, the projected changes in precipitation for a high-emissions scenario were described for the latter part of this century (years 2080 through 2090) as 10 to 15 percent above current values for the Great Divide Basin of Wyoming where the proposed site would be located. Changes during the next 10 years would be expected to be much less than the values reported for the end of the century. The NRC staff could not identify information in that report to suggest that over the next 10 years there would be the types of changes the commenter indicated (e.g., soil saturation, flooding, recharge effects). Projected temperature changes are also cited in the report as long-term consequences. The cited report includes projected changes in average temperature for year 2020 as ranging from a slight decrease in the present temperature to a maximum of approximately 2 degrees higher than present temperatures. The resource area that would be expected to be the most sensitive to small changes in ambient temperature would be the local ecology. Potential changes to the regional ecology from a rise in average temperature (including invasive species, fire, erosion, desertification) would occur whether the site were licensed or not, but localized effects could be exacerbated to some degree by proposed site activities that would contribute additional surface disturbance and noise and an increased potential for the introduction of invasive species and fire. In response to these comments, NRC staff added description of the potential impacts from projected changes to climate in Section 5.7 (Cumulative Air Quality Impacts) of the final SEIS.*

In SEIS Section 5.7.1.4, the NRC staff concluded that the overall effect of projected climate change on the proposed Lost Creek facility would be SMALL. The small, predicted increases in temperature and precipitation over the next decade would have no effect on the proposed Lost Creek facility during any of the ISR phases.

Regarding the portion of a comment that suggested potable water sources outside the ore zone would be sacrificed based on an assumption about restoration water quality, that portion of the comment was marked as two separate groundwater restoration comments (L015-020, L015-021 and L015-022)(see Section 5.9.8, Groundwater Restoration Criteria and Methods).

Comment: L015-025

Referring to the draft SEIS Chapter 5 description of climate change, a commenter suggested the draft SEIS failed to consider the impacts of climate change by not disclosing all greenhouse gas emissions. The commenter noted the emissions for the proposed site discussed in the draft SEIS are incomplete because they do not include the emissions from other nuclear fuel cycle facilities such as facilities involved in uranium conversion, uranium enrichment, and nuclear fuel fabrication.

Response: *NRC focused on evaluating CO_2 emissions for the life of the proposed facility and compares this with other forms of mineral extraction in the area. The primary source of CO_2 emissions from ISR facilities are combustion engine emissions from construction equipment (including drill rigs). NRC staff estimated annual and total CO_2 emissions over the life of the facility from the proposed Lost Creek Project for construction and decommissioning activities and documented these in Appendix D of the final SEIS.*

Section 5.7 of the final SEIS describes projects occurring within an 80-km [50-mi] radius of the proposed Lost Creek Project, which include up to seven other operating or planned ISR facilities (see Table 5-1) that would generate emissions comparable to emissions projected for the proposed project. ISR facilities commonly use a phased approach to well drilling and wellfield construction; therefore, all eight facilities would not undergo construction concurrently. To estimate the potential annual contribution of the eight facilities to local air emissions, the NRC staff considered the emissions results in Appendix D of this SEIS.

Evaluation of environmental impacts from other nuclear fuel cycle facilities that are outside the region of influence for potential environmental impacts of the proposed Lost Creek Project is beyond the scope of the current licensing action regarding whether or not to grant a license to the proposed Lost Creek Project. NRC evaluates the potential safety and environmental impacts of other nuclear fuel cycle facilities when those facilities are proposed or their licenses are amended. Because the requested information is beyond the scope of the current licensing action, no changes were made to the SEIS in response to the comment.

Comments: L018-004; L018-014; L018-017; L018-019; L018-024; L018-025; L022-029; L022-034; L022-029

One commenter stated that the draft SEIS lacked information on air pollutant emissions and the impact analysis is inadequate to assess the impacts of those emissions. The commenter also stated that ISR projects would likely result in a deterioration of air quality due to emissions from drill rig engines, fugitive road dust, and uranium processing activities. The commenter suggested that projects similar in scope require hundreds of wells and multiple deep injection wells, and without a complete air quality analysis, such activity is likely to have significant adverse local air quality impacts. The commenter was particularly concerned about the air emissions from the truck-mounted diesel drilling rigs and the drilling of hundreds of wells for the Lost Creek ISR project. They noted the SEIS mentions several drilling rigs operating simultaneously but did not indicate how many, did not provide the number of rigs proposed and did not provide an air impact analysis from rigs and associated land disturbance. The commenter suggested this level of development may have cumulative emission rates in excess of several hundred tons per year of nitrogen oxides, particulates, and other priority air pollutants. They requested a screening analysis be conducted for air emissions to identify far field impacts including visibility parameters for Class I and sensitive Class II air sheds. They also requested that a near-field air analysis be conducted to evaluate direct air impacts and that any modeling protocols be distributed for review by stakeholders.

Response: *In response to this and other comments, NRC staff reviewed the applicable sections of the draft SEIS and added more detailed information on emissions from drilling rigs, construction equipment, and unpaved roads (i.e., fugitive road dust) to Section 2.1.1.1.6.1 and Appendix D. The NRC staff also added information to Section 3.7.2 on nearby Class I and Class II areas that could potentially be impacted by emissions generated by the proposed action; and added text to Section 4.7 to incorporate the new emissions and environment information into impact analyses, clarify the NRC staff approach to evaluating impacts and improve the transparency of the NRC bases for impact conclusions.*

The NRC staff estimates of annual nitrogen oxide and particulate emissions from drilling rigs and construction equipment are approximately 17.2 t/yr [19 T/yr] and 0.76 t/yr [0.84 T/yr] as discussed in Appendix D. The NRC staff estimated the nitrogen oxide emissions could be as high as 35 t/yr [39 T/yr] if the applicant drilled all five deep disposal wells in one year; however, this would be a 1 year maximum, as no additional deep wells would need to be drilled in later

years. The magnitude of the annual diesel emissions calculated by the NRC staff are well below the several hundreds of tons suggested by the commenter. NRC staff concludes the combustion engine emissions from the proposed Lost Creek ISR project are sufficiently low that they would not change the current National Ambient Air Quality Standards (NAAQS) attainment status of the region surrounding the site nor would the emissions be likely to destabilize the local air quality and, therefore, additional detailed quantitative air analyses are not warranted to support the evaluation of nonradiological air impacts.

The applicant estimates of fugitive road dust emissions at 154 t/yr [169.9 T/yr] (LCI, 2008b) are below the Clean Air Act threshold for defining a major emitting facility for the prevention of significant deterioration from unspecified sources of any pollutant (227 t/yr [250 T/yr]). The NRC staff reviewed the applicant calculations and then conducted additional calculations using the same EPA methods and data (EPA, 2006) used by the applicant but applying different assumptions. The staff also considered that the applicable state air permitting authority, the WDEQ, has conducted a best available control technology analysis for road dust treatment as part of their air construction permit review (WDEQ, 2010). The WDEQ permit requires the applicant to apply dust control measures to a portion of the unpaved roads that the applicant would use to access the site. The staff's calculations assumed the required road treatment would be effective but concluded, in particular, that if no carpooling of employee commuting is assumed, and the miles traveled by both incoming and outgoing traffic is considered, the resulting road dust emissions estimates for the untreated portions of the roads could be higher by about a factor of four from the applicant's estimate. Although the applicant has not proposed any carpooling programs, if carpooling is assumed to occur at the applicant's assumed 2.6 persons per vehicle then the NRC road dust estimates would be below the aforementioned 227 t/yr [250 T/yr] threshold.

Based on the range of road dust estimates, the staff concluded that, there is a potential for significant dust emissions. Therefore, short-term and intermittent visible air emissions are possible to the local area surrounding the site when vehicles travel on unpaved roads. Such impacts would be reduced but not eliminated by road treatments the applicant proposed and as required by WDEQ (2010). As a result, while the unpaved transportation network is sparsely populated, the air quality impact analysis in Section 4.7 has been revised to describe the potential for intermittent but moderate dust impacts to the town of Bairoil that lies along one of the potential worker transportation routes. Regarding potential regional air quality impacts, the NRC staff compared the range of calculated emissions with a particulate matter (PM_{10}) emission estimate for the Atlantic Rim Natural Gas Project. That project had estimated PM_{10} emissions within the range estimated by the NRC staff for the proposed Lost Creek Project and did not exceed the NAAQS when the emission was modeled to evaluate potential air impacts (TRC Environmental Corporation, 2006). That study excluded road dust from far field impact analyses, including PSD and visibility based on reports of near field settling of road dust. The NRC staff also consider the recent WDEQ review of proposed fugitive dust emissions and the subsequent granting of an air quality construction permit indicate the potential for regional air quality impacts from the proposed emissions have been evaluated by the applicable permitting authority and any measures deemed necessary by the WDEQ to protect the air quality in accordance with the authority granted to them by the Clean Air Act have been taken. Based on this review, the NRC staff concluded the regional air quality would not be significantly affected by the proposed road dust emissions. With regard to resuspension of dust from disturbed soil areas, the applicant proposes to limit the impacts of surface disturbances by establishing vegetation at disturbed areas as soon as conditions allow (LCI, 2008b).

The proposed emissions from uranium processing activities are addressed separately as a public and occupational radiological health and safety topic in Section 4.13 of the SEIS and in Section B5.28 of this Appendix. The scope of the air impact analysis in Section 4.7 of the SEIS and this section of this Appendix are intentionally limited to consideration of nonradiological air quality impacts. This is because, as noted in the draft SEIS, radiological air emissions are regulated by NRC whereas nonradiological emissions are regulated by the State and the EPA and are best evaluated separately in SEIS Section 4.7.

Comments: L018-018; L022-016

One commenter indicated the proposed project may adversely impact nearby federal Class I areas, which require special protection of air quality and air-quality-related values such as visibility in accordance with requirements of the CAA. They indicated the project is near Bridger Wilderness and Mt. Zirkel Class I areas and the Popo Agie Wilderness sensitive Class II area.

Response: *The mobile nonroad diesel emissions from construction and mobile fugitive road dust emissions from all phases are the emissions from the proposed action that could impact nearby Prevention of Significant Deterioration (PSD) areas based on the types and magnitudes of emissions associated with ISR facilities and the information provided by the applicant on this specific proposal. As described in Section 2.1.1.1.6.1, the applicant estimated fugitive road dust emissions to be approximately 154 t/yr [169.9 T/yr] (LCI, 2008b) if not controlled; however, the applicant is required by a condition of their construction air permit to control these emissions on specific sections of road by water application or other means of road treatment (WDEQ, 2010). The NRC staff conducted similar calculations (described in detail in the response to comment L018-004) that assumed the required road treatment would be effective but concluded, in particular, that if no carpooling of employee commuting is assumed, and the miles traveled by both incoming and outgoing traffic is considered, the resulting road dust emissions estimates for the untreated portions of the roads could be higher by about a factor of four from the applicant's estimate.*

Regarding potential regional air quality impacts, the NRC staff compared the range of calculated road dust emissions with a particulate matter (PM_{10}) emission estimate and air modeling analysis for the Atlantic Rim Natural Gas Project. That project had estimated PM10 emissions within the range estimated by the NRC staff for the proposed Lost Creek Project and did not exceed the NAAQS when the emission was modeled to evaluate potential air impacts (TRC Environmental Corporation, 2006). That study excluded road dust from far field impact analyses, including PSD and visibility based on reports of near field settling of road dust. The NRC staff also consider the recent WDEQ review of proposed fugitive dust emissions and the subsequent granting of an air quality construction permit indicate the potential for regional air quality impacts from the proposed emissions have been evaluated by the applicable permitting authority and any measures deemed necessary by the WDEQ to protect the air quality in accordance with the authority granted to them by the Clean Air Act have been taken. Based on this review, the NRC staff concluded the regional air quality would not be significantly affected by the proposed road dust emissions.

All other emissions information reviewed by the NRC staff support the conclusion that the proposed action would neither be comparable to nor considered a major source of emissions (e.g., a stationary source that emits or has the potential to emit 90.7 t/yr [100 T/yr] of an air pollutant to 9.1 t/yr [10 T/yr] of any individual hazardous air pollutant, or 22.7 t/yr [25 T/yr] of any combination of hazardous air pollutants as defined in Sections 501 and 112 of the Clean Air

Act). While NRC staff recognize the stationary source requirements, by definition, do not apply to mobile sources of emissions, these requirements apply to the same types of air pollutants that are emitted by the mobile sources proposed by the applicant and the threshold values are emission levels that trigger a substantial increase in the requirements that must be met to ensure the protection of air quality. NRC staff conclude that such emissions (i.e., well below the major source thresholds) in an area with meteorology favorable for dispersion would be unlikely to impact air quality at the nearest Class I areas to the proposed action. These Class I areas, Bridger Wilderness, Fitzpatrick Wilderness, and Mt Zirkel areas are located approximately 96.6 km [60 mi], 161km [100 mi], and 145 km [90 mi], respectively, to the northwest and south of the Lost Creek site (USDOI, 2008). Popo Agie Wilderness Area, the closest Class II area to the proposed action located about 93.4 km [58 mi] to the northwest of the Lost Creek site would also unlikely be impacted by the magnitude of proposed emissions-generating activities. In addition to the magnitude of emissions and distance, the predominant wind directions measured at the proposed site and in the vicinity of the site are from the west and west northwest and, therefore, would carry emissions to the east and east southeast, away from these Class I and II areas.

While the NRC staff analysis of emissions within the context of Clean Air Act regulations supports the assessment of potential environmental impacts that is required by the NEPA, as amended, WDEQ has the authority to enforce Clean Air Act Regulations in Wyoming, and they are responsible for making applicability and compliance decisions regarding the regulations that implement the Clean Air Act. In that role, the WDEQ has evaluated and approved the applicant's application for an air quality construction permit (WDEQ, 2010). This permit clarifies what additional air quality permits would be required for the proposed action and specifies additional controls to limit emissions (e.g., radon, fugitive road dust controls). Should the air quality in the nearby Class I areas become degraded in the future, the WDEQ has the authority and would take appropriate corrective actions to reestablish attainment air quality in these protected areas.

In response to this and other comments about the potential impact from air emissions, NRC staff updated the description of proposed air emissions in SEIS Section 2.1.1.1.6.1. and developed a new Appendix D with supporting calculations of mobile nonroad diesel emissions from well drilling activities and construction equipment. The description of the affected environment (SEIS Section 3.7.2) and air quality impact analysis (SEIS Sections 4.7) were also updated to identify the nearest Class I and II areas and evaluate the potential impact to these areas from the proposed emissions.

Comment: L018-037

A commenter suggested NRC expand the discussion of greenhouse gas emissions and climate change in the draft SEIS. Specifically, the commenter suggested that the SEIS consider the projected regional climate changes and the project contribution to these changes. The commenter also requested NRC staff quantify the annual and cumulative greenhouse gas emissions and discuss the link between greenhouse gas emissions and climate change. A discussion of mitigation measures for greenhouse gas emissions was also requested.

Response: *To address these and other comments regarding the need for NRC staff to consider and evaluate the potential impact of greenhouse gas emissions on the global climate, NRC staff calculated annual and cumulative CO_2 emissions from applicant use of diesel construction equipment during construction and decommissioning of the production wellfields and facilities. Because operating ISR facilities are not major sources of CO_2 or other*

greenhouse gas emissions, NRC expects the construction equipment emissions (including well drilling rigs) produced during both construction and decommissioning phases will represent the majority of greenhouse gas emissions from the proposed action. The emissions estimates are documented in a new Appendix D and summarized in Section 2.1.1.1.6. The staff also evaluated potential impacts to climate from the calculated construction equipment emissions from the proposed facility in Section 4.7. The analysis of the cumulative impact on air quality was revised to evaluate the impact of the projected emissions in the context of other past, present, and reasonably foreseeable future actions. The revised impact analyses included an explanation of the current understanding of the link between greenhouse gas emissions and global climate change. Based on the nature of the emissions (e.g., construction equipment) and the lack of available carbon dioxide emissions control technology for such equipment, Section 5.7.1.5 was added to discuss general mitigation measures that could be implemented to reduce fuel consumption and therefore the overall GHG emissions from the proposed Lost Creek ISR Project.

Comment: L022-028

Referring to of the draft SEIS p. 4-55, a commenter noted that no project-specific emissions estimates were provided in the draft SEIS. The commenter noted that the draft SEIS references GEIS Section 2.7.1, which includes emissions estimates for a similar facility from a 1997 NRC Final Environmental Impact Statement (NRC, 1997). The commenter stated the draft SEIS did not discuss how that facility, and therefore its emissions estimates, relate to the proposed facility. The commenter also suggested that the referenced emissions estimates from 1997 were not current and should be updated.

Response: *In response to this and other comments about the potential impacts of air emissions, NRC staff revised the description of proposed air emissions in SEIS Section 2.1.1.1.6.1 and provided Appendix D (supporting calculations of mobile nonroad diesel emissions from well drilling activities and construction equipment). NRC staff also revised the analysis of air quality impact impacts in SEIS Section 4.7 to reflect the updated emissions information. Text was also added to Section 4.7 comparing the Crownpoint facility to the proposed action to establish a more transparent basis for adopting the GEIS air impact analyses in the SEIS.*

Comments: L022-031; L022-042

One commenter, referring to Sections 4.7 and 5.7 expressed that the draft SEIS describes potential local impacts to NAAQS without providing bases for the impact conclusions.

Response: *In response to this and other comments, the NRC staff revised SEIS Section 4.7 to clarify the NRC staff approach to evaluating impacts and to clarify the NRC staff bases for impact conclusions. The revisions in Section 4.7 considered the detailed information on emissions from drilling rigs, construction equipment, and unpaved roads (i.e., fugitive road dust), which was added to Section 2.1.1.1.6.1 and Appendix D in response to other comments. Section 5.7 of the cumulative impact analysis was similarly revised to clarify the NRC staff bases for impact conclusions. The specific statement about compliance with NAAQS the commenter emphasized paraphrased impact conclusions from the GEIS, and the text was clarified to more explicitly associate the statement with the GEIS.*

Comment: L022-044

One commenter indicated statements in, the draft SEIS Section 5.7, p, 5-15 refer to a 2008 emission inventory for some, but not all, NAAQS pollutants. The commenter questioned why some pollutants were missing from the discussion.

Response: *The discussion to which the commenter referred describes the conclusions from a BLM air quality impact assessment (BLM, 2008) that is referenced in the draft SEIS. In response to this comment, the NRC staff verified the pollutants discussed in the draft SEIS statement to which the commenter referred are consistent with the information in the conclusion in the cited reference. The BLM report concluded that while the pollutant emissions would increase in the future in the study area, the ambient concentrations were not expected to exceed standards. In response to this and other comments, the statement in Section 5.7 was clarified and the impact analysis was updated with additional information and bases for impact conclusions.*

B.5.24.2 Air Permitting and Regulations

Comments: L022-001; L022-043

One commenter referred to the Executive Summary at page xx of the draft SEIS and noted the Executive Summary states the proposed project would not be subject to Title V of the CAA without providing a basis for the statement. The commenter also requested a detailed air emission inventory be developed and used to evaluate CAA programs that may apply, including PSD New Source Review, Maximum Achievable Control Technology, National Emission Standards for Hazardous Air Pollutants, and Title V (Permits).

Response: *The NRC staff analysis of emissions within the context of CAA regulations supports the assessment of potential environmental impacts as required by NEPA. WDEQ has the authority to enforce regulations implementing the CAA programs in Wyoming. In that role, WDEQ evaluated the applicant's air quality construction permit application and issued a permit (WDEQ, 2010) to the applicant. This permit includes a condition that the applicant must obtain a permit to operate in accordance with Wyoming Air Quality Standards and Regulations, Chapter 6, Section 2(a) (iii). According to the language of that cited requirement, such a permit applies to facilities that are not subject to the provisions of Wyoming Air Quality Standards and Regulations, Chapter 6, Section 3. Wyoming Air Quality Standards and Regulations Section 1 refers to Section 3 as the state operating permit program required under Title V of the CAA. Section 1 also refers to the required Section 2 operational permit as a minor source permit to operate. This information indicates WDEQ has concluded that the proposed Lost Creek ISR facility is not considered a major source of emissions nor is it subject to Title V operating permit requirements. The Executive Summary and applicable portions of the air impact analyses in Sections 4.7 and 5.7 have been revised to clarify the air impacts information.*

Further, as stated in Section 4.7, the NRC staff concludes the estimated emissions from the proposed project would not affect attainment with ambient air quality standards in the region surrounding the proposed site areas or PSD increments in Class I or Class II areas closest to the proposed Lost Creek ISR Project areas.

In response to these and other comments, the staff revised the description of proposed air emissions in SEIS Section 2.1.1.1.6.1 and provided supporting calculations of mobile nonroad diesel emissions from the proposed well drilling activities and construction equipment, in a new

Appendix D. The air impact analysis (Section 4.7) and the Executive Summary were revised to reflect this additional information and to provide additional bases to support air impact conclusions. The complete bases for impact conclusions are documented in the impact analysis in Section 4.7, but are not repeated in the Executive Summary.

B.5.24.3 Baseline Air Quality

Comments: L020-006; L020-007

A commenter referenced State Air Quality Permit #CT-7896, issued on January 4, 2010, and general comments regarding ambient air quality standards (NAAQS and WAAQS).

Response: *Wyoming revised its ambient air quality standards in January 2010. The SEIS reflects the changes in Section 3.7.2. No other changes were made to the SEIS beyond the information provided in this response.*

B.5.24.4 References

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B.5.25 Noise

Comment: L020-109

The commenter stated that continuous loud noises can cause sage-grouse to abandon leks and eliminate breeding success.

Response: *The NRC staff recognizes that sage-grouse are sensitive to noise, particularly during breeding. SEIS Section 4.6.1.1.4 was revised to consider human-caused noise impacts to sage-grouse.*

Comment: L020-110

The commenter noted that compressors would be contained in structures that would muffle noise and recommended that these structures remain closed and sealed during use and that mufflers be used to reduce noise to ambient levels within 100 m [328 ft] of the source.

Response: *SEIS Section 4.8.1 describes potential noise impacts during the project. NRC staff expects that the applicant will adhere to OSHA regulatory limits and mitigation. No changes were made to the SEIS in response to the comment.*

B.5.25.1 Reference

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. "Oil and Gas Development in Western North America: Effects on Sagebrush Steppe Avifauna With Particular Emphasis on Sage Grouse." Transactions of the North American Wildlife and Natural Resources Conference. Vol. 67. pp. 337–349. 2002

B.5.26 Historical and Cultural Resources

B.5.26.1 Potential Impacts to Cultural, Historical, and Sacred Places

Comment: L005A-002

The commenter noted an error in the text, which stated the Wyoming SHPO had declared all sites ineligible for listing on the National Register of Historic Places (NRHP). The commenter further stated the Wyoming SHPO does not necessarily determine the eligibility of sites. The determination of site eligibility is made by the lead agency, which in the case of the proposed Lost Creek ISR Project is NRC.

Response: *NRC agrees that the Wyoming SHPO does not determine the NRHP eligibility of cultural resources. The responsibility of the SHPO is to indicate agreement or disagreement with the status of resource eligibility determined by the Federal agency assessing the resources*

[36 CFR 800.4(c)(2)]. As such, Sections 1.7.2, 3.9, and 4.9 were revised in response to this comment.

Comment: L005A-005

The commenter requested a text change to indicate that the applicant would likely be required, under conditions in its license, to stop work upon discovery of previously undocumented historic or cultural resources.

Response: *NRC staff acknowledges this comment and has revised SEIS Section 4.9.1.1.1 to address inadvertent discovery.*

Comment: L010-028

The commenter is concerned that improperly sited wellfields will impose development that will impact the settings of NRHP-eligible sites. Facilities should be configured such that they do not occur within the viewsheds of NRHP-eligible sites.

Response: *As described in Section 3.10, the scenic quality inventory of the proposed Lost Creek ISR Project was evaluated in accordance with BLM methodology, which includes cultural modifications, and was given a score of 7 out of a possible 32, precluding further evaluation. While there are three NRHP-eligible sites within the proposed license area, only site will be adversely affected. Because of this, an MOA among the Wyoming SHPO, the applicant, BLM, the Wyoming State Attorney General's Office, the Eastern Shoshone and Northern Arapaho Tribes, and the NRC was developed and executed. The MOA stipulates that all impacts to all NRHP-eligible sites must be mitigated in accordance to applicable regulations. A copy of the MOA is appended to the SEIS. No changes were made to the SEIS in response to this comment.*

Comment: L022-033

The commenter suggested that a detailed description of resolution of the identified adverse effects on historic/cultural properties in accordance with 36 CFR 800.6 is needed.

Response: *NRC, in coordination with the Wyoming SHPO, the applicant, BLM, and the State of Wyoming Attorney General's Office, developed an MOA for NRHP-eligible site 48SW16604 that could be impacted in the proposed project area. NRC staff included information in Section 4.9.1.1.1 from the MOA on how adverse effects to the cultural resources in the project area would be resolved and mitigated. A copy of the MOA is appended to the SEIS. No additional changes to the SEIS were made in response to this comment.*

B.5.26.2 License Conditions to Address Potential Impacts to Historical and Cultural Resources

Comment: L016-017

The commenter stated that NRC should be more specific in each final SEIS as to when license conditions are imposed on its licensees with respect to control (e.g., elimination or mitigation of a potential impact) so that members of the public and interested stakeholders are aware that NRC is regulating that activity.

Response: *NRC can only impose license conditions for a proposed ISR facility within the limits of the authority granted by Congress. State and other Federal agencies can also establish permit conditions based on their statutory and regulatory authorities. NRC can rely on mitigation measures the applicant includes in its license application or includes as a license condition or those imposed by other State and Federal agencies in evaluating the potential environmental impact of the proposed project.*

The NRC license for the proposed Lost Creek ISR Project, if approved, would contain license conditions to reduce or eliminate adverse impacts to cultural and historic resources at the Lost Creek ISR Project site. In October 2010, NRC, Wyoming SHPO, BLM, Northern Arapaho Tribe, Eastern Shoshone Tribe, and the applicant executed an MOA regarding archaeological data recovery at NRHP-eligible site 48SW16604. If issued, the license will reference the MOA (see Appendix E).

B.5.26.3 Historic and Cultural—General

Comment: L005A-001

The commenter noted that while the 50-year cutoff date for possible inclusion on the NRHP is a good rule of thumb, it is not a hard and fast rule that fully excludes sites younger than that for inclusion.

Response: *The commenter is correct in that the 50-year threshold is not a hard and fast rule. SEIS Section 3.9 was revised to recognize that possible inclusion of younger sites into the NRHP.*

Comment: L005A-003

The commenter stated the Lost Creek SEIS incorrectly titled Section 3.9.3 Historic Properties Listed in the National and State Registers. The commenter noted that the State of Wyoming does not maintain a Register of Historic Places.

Response: *The title and text in Section 3.9.3 were revised in response to this comment.*

Comment: L005A-004

The commenter requested text clarification in SEIS Section 4.9.1.1.1. The text, in part, describes eligibility for the NRHP under criteria in 36 CFR 60.4(a)–(d) and/or a Traditional Cultural Properties (TCP) (NPS, 1990). Per National Register Bulletin 38, “Guidelines for Evaluating and Documenting Traditional Cultural Properties,” in order for a property to be eligible as a TCP, it must be eligible under one of the four criteria of eligibility set forth in 36 CFR 60.4. This should be clearly stated in the document.

Response: *NRC staff acknowledges this comment. The text was revised in Sections 4.9.1.1.1 and 1.7.2 in response to this comment.*

Comment: L005A-006

The commenter expressed that any impact to cultural resources is permanent and irretrievable and is not short term as described in the SEIS.

Response: *NRC staff acknowledges that physical impacts (e.g., construction) to cultural resources are not only permanent and irretrievable, but irreversible. One NRHP-eligible site (48SW16604) would be adversely affected by the proposed project. The treatment plan for this site was formalized with the development and execution of a Memorandum of Agreement (MOA) among the NRC, Wyoming SHPO, the applicant, BLM, the Wyoming State Attorney General's Office, the Eastern Shoshone and Northern Arapaho Tribes, and the NRC. SEIS Section 4.9.1.1.1 has been revised.*

Comment: L008-120

The commenter stated that the entire proposed project area was surveyed by a professional archaeologist and that there should be no need for additional studies.

Response: *NRC staff acknowledges that the proposed license area was surveyed by a professional archaeologist and has revised SEIS Section 4.9.1.1.1, accordingly. Should any undiscovered resources be encountered during the construction phase, the applicant has committed in its license application and in an MOA to have an inadvertent discovery procedure.*

Comment: L008-134

The commenter stated that mitigation will likely occur for only one of the three eligible cultural resource sites because two of the sites are outside the area of any planned impact.

Response: *Only one of the three NRHP-eligible sites (48SW16604) would be adversely affected by the proposed project. NRC staff revised Sections 4.9.1.1.1 and 5.9 to reflect this information.*

Comments: L022-004; L022-006

The commenter noted the NHPA description does not identify which parties are determined to be consulting parties under 36 CFR 800.2(c) and that completion of the NHPA consultation process should be documented in the final SEIS.

Response: *SEIS Section 1.7.2 was revised to indentify the consulting parties (WY SHPO, the applicant, NRC, BLM, the Eastern Shoshone and Northern Arapaho Tribes). A copy of the finalized MOA is appended to the final Lost Creek ISR SEIS.*

Comment: L022-017

The commenter suggested that the description of tribal consultations should provide more detail regarding communication with the Northern Arapaho and Eastern Shoshone.

Response: *As addressed in comments L022-005 and L022-007 in Section B5.12 of this appendix, SEIS Sections 1.7.2 and 1.7.3.3 were revised to provide further detail regarding consultation efforts with all consulting parties. Copies of correspondence are included in Appendix A, and a copy of the MOA is included in Appendix E.*

Comment: L022-032

The commenter stated that the transition between the GEIS summary and SEIS site-specific information in SEIS Section 4.9.1.1 was abrupt and confusing.

Response: *NRC staff acknowledges the comment. SEIS Section 4.9.1.1 was revised in response to this comment.*

B.5.26.4 References

36 CFR Part 60. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 60, "National Register of Historic Places." Washington, DC: U.S. Government Printing Office.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Places." Washington, DC: U.S. Government Printing Office.

National Park Service. "Guidelines for Evaluating and Documenting Traditional Cultureal Properties." *National Register Bulletin No. 38*. U.S. Department of the Interior, National Park Service. 1990.

B.5.27 Socioeconomics

Comment: L007-006

The commenter expressed wanting an open relationship with UR Energy throughout the project and that any undue socioeconomic burden to the City of Rawlins is adequately addressed.

Response: *NRC staff acknowledges the comment, but due to the general nature of the comment, no changes were made in the SEIS.*

Comments: L008-014; L008-122

The commenter stated the SEIS should describe positive impacts and weigh them against negative impacts when assigning a final impact rating.

Response: *NUREG–1748* (NRC, 2003) *categorizes the significance of potential environmental impacts as SMALL, MODERATE, and LARGE, and does not differentiate between the positive and negative impacts. These descriptions are given as a way of categorizing impacts qualitatively. Although positive and negative descriptions can be used in describing socioeconomic impacts, impacts discussed in the SEIS should be assumed to be negative unless otherwise indicated. No changes were made to the SEIS beyond the information provided in this response.*

Comments: L009-001; L014-002

The commenter expressed support for the proposed project and stated the economic development will help to diversify the economy for the long run. Another commenter stated that his/her small community would benefit greatly from the influx of workers and the overall impact would be positive for the community economics.

Response: *NRC staff acknowledges these comments. However, due to the general nature of the comments, no changes were made in the SEIS.*

Comments: L020-008; L020-009

The commenter expressed concern over the use of the split Wyoming East and Wyoming West Uranium Milling Regions and that political subdivisions would cause data to be collected incongruently.

Response: *The two uranium milling regions were developed, specifically, for analysis in the GEIS. The SEIS, which is tiered from the GEIS, used a site-specific analysis of socioeconomic factors for the proposed Lost Creek ISR Project site. The SEIS uses a Region of Influence approach limited to the proposed project site area and its surroundings (Sweetwater County). Socioeconomic information pertaining to this county was derived from U.S. Census Bureau information in addition to different State agency data. The socioeconomic information in the SEIS is limited to the project vicinity and is taken from resources that typically standardize their collection methods. The SEIS Section 3.11 and 4.11 was restructured to clarify the information presented.*

Comment: L020-010

The commenter expressed concerns about using 10-year-old U.S. Census Bureau data in the socioeconomic analysis.

Response: *While the GEIS used 2000 U.S. Census Bureau data (USCB, 2000), the SEIS used 2009 U.S. Census Bureau State and County QuickFacts (USCB, 2010). The SEIS also used current state and county agency data. Changes were made in the SEIS in accordance with the information in this response.*

B.5.27.1 Socioeconomic Housing

Comment: L007-002

The commenter agreed with SEIS Section 4.11.1.2.3 that the closest town to the UR Energy proposed Lost Creek ISR Project is Rawlins where the majority of workers would likely come from. The commenter also stated that the proposed project would bring stability to the area by using local workforce.

Response: *NRC staff acknowledges the comment. However, due to the general nature of the comment, no charges were made in the SEIS.*

Comment: L008-124

The commenter stated that SEIS Section 7.2.2 mentions that a total of 63 new families would move into the area and require housing (rental or new). The commenter further stated that only 8 percent of the available housing in the area would be occupied from the projected workforce and that 20 to 25 percent of the workforce was hired from 2005 to 2009. The commenter stated that the SEIS calculates the influx of workers all at once during the startup and not spread over previous years and that the actual impact would be 20 percent less than what was calculated. The commenter requested that NRC take note that communities such as Wamsutter are investing money to attract people to their community and that the overall impacts to housing should be SMALL instead of MODERATE.

Response: *NRC staff acknowledges the comment. Construction impacts to housing analyzed in the SEIS were determined to cause a short-term increase in the demand for (rental) housing units in the county but were considered to be keeping pace with the increase in county population, and impacts were determined to be SMALL. However, operation impacts to long-term housing were determined to have MODERATE impacts based on site-specific conditions of a currently overstressed housing market. No changes were made in the SEIS beyond the information in this response.*

Comment: L008-125

The commenter stated that the SEIS determines a negative impact on employment diversity and believes that the methodology used to make this determination is flawed. The commenter further stated that uranium mining would tend to smooth the economic boom and bust cycles experienced in the region caused by fluctuations in oil and gas prices. The commenter requested that when assessing economic diversity, uranium recovery should be analyzed as an independent industry instead of an extractive industry, which is subject to economic fluctuations in oil and gas and other types of mining activities.

Response: *NRC staff acknowledges the comment. As mentioned in SEIS Section 3.11, the State of Wyoming has been experiencing a boom over the last several years, which has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. Additionally, with the global recession affecting the demand for energy and the associated decline in price for natural gas, oil and coal, exploration/extractive activities have decreased. Therefore, the ISR project would contribute negatively to the area's economic diversity. In general, the more diversified the economy, the healthier it is. Diversified economies can weather fluctuations in one industry without going through a "bust" cycle. Based on these conditions, impacts to employment structure were determined to be MODERATE. No changes were made in the SEIS beyond the information in this response.*

Comments: L008-126; L013-004

The commenter disagreed with the findings of MODERATE impacts to education and stated that the impacts should be SMALL based on their analysis.

Response: *The discussion of socioeconomic conditions in the proposed project area was reviewed and revised in response to public comments to reflect updated information. The superintendent of schools for Carbon County District No. 1 confirmed there is sufficient capacity in the school system to accommodate the children of workers supporting the proposed action (CCHEC, 2010). SEIS Section 4.11 was revised in response to this comment.*

Comment: L013-003

The commenter disagreed with SEIS Section 4.11.1.2.3 that impacts to housing will further stress a housing market that is currently overstressed. The commenter stated there are currently more houses and rental properties available than during the oil and gas boom.

Response: *NRC staff acknowledges the comment. Construction impacts to housing analyzed in the SEIS were determined to cause a short-term increase in the demand for temporary (rental) housing units in the county but were considered to be keeping pace with the increase in county population, and impacts were determined to be SMALL. However, operation impacts on long-term housing could range from SMALL in the region to MODERATE for nearby small*

communities. As described in SEIS Section 3.3, the demand for housing in the area has increased, but the housing vacancy rate was 8.7 percent for the period from 2007–2009. No changes were made to the SEIS beyond the information provided in this response.

Comment: L007-003

The commenter expressed community support for the workers of the 140 ancillary jobs created by the proposed Lost Creek ISR Project.

Response: *NRC acknowledges the comment. The GEIS estimated total peak employment (NRC, 2009) at an ISR facility could be as much as 200 people and that an additional 140 ancillary jobs could be created supporting the proposed facility. For the proposed Lost Creek facility, construction employment cold be as much as 90 personnel and operational employment as much as 100 personnel (LCI, 2011). This could create an additional 70 support jobs in the region. This comment is general in nature; however, changes were made to SEIS Section 4.11.1.1.4.*

Comment: L011-002

The commenter supports UR Energy plans to hire and train employees from the local workforce, but requested that permanent employees be brought in from outside the community. The commenter further stated the proposed Lost Creek ISR Project would have positive effects on the county and will provide beneficial socioeconomic impacts on the local community.

Response: *NRC staff acknowledges the comment. The process of hiring and training workers is not typically described in NRC environmental reviews. This would need to be negotiated between UR Energy and any stakeholders involved. This comment is beyond the scope of the SEIS; therefore, no changes were made in the SEIS.*

Comment: L013-002

The commenter expressed support that the City of Rawlins would benefit from the workforce during the construction and operations phase. The commenter further supported the workforce added to Carbon County and the MODERATE impacts described in the SEIS associated with the increase in population and jobs.

Response: *NRC staff acknowledges the comment, but due to the general nature of the comment, no changes were made in the SEIS.*

B.5.27.2 Socioeconomics Local Finance

Comments: L007-005; L013-005

Commenters expressed concern about the proposed project being located in Sweetwater County. A commenter stated that the City of Rawlins would receive the majority of socioeconomic impacts, but would not benefit from the tax revenues because it is located in Carbon County. The commenters requested that UR Energy take delivery of project materials and supplies in Rawlins in order to improve the tax benefits in the City of Rawlins and Carbon County.

Response: *NRC staff acknowledges that potential socioeconomic impacts may be incurred by the City of Rawlins; however, the process of delivering project materials and supplies is not typically described in NRC environmental reviews. This comment is beyond the scope of the SEIS therefore, no changes were made in the SEIS.*

B.5.27.3 Emergency Services

Comment: L007-004

The commenter stated there could be a demand on police services in the area as a result of the creation of ancillary jobs and that mitigation should take place to reduce impacts. The commenter also suggested that UR Energy should practice local hiring and training of ancillary workers.

Response: *SEIS Sections 4.11.1.1.7 and 4.11.1.2.7 describes potential impacts to public services during the construction phase, including health and emergency services. Potential impacts to public services were determined to be SMALL. The process of hiring and training workers is not typically described in NRC environmental reviews and is beyond the scope of the SEIS. No changes were made in the SEIS beyond the information made in this response.*

B.5.27.4 References

Carbon County Higher Education Center. "Comment Letter on Draft Supplemental Environmental Impact Statement for the Lost Creek ISR Uranium Milling Facility." Carbon County Higher Education Center. January 2010.

LCI. "Worker Estimate." E-mail (February) communication from Applicant to NRC staff. ADAMS Accession No. ML110540488. Casper, Wyoming: Lost Creek International, LLC. 2011.

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

U.S. Census Bureau. "American FactFinder 2000 Census Data." <http://factfinder.census.gov> (February 2008)

U.S. Census Bureau. "State and County QuickFacts for Sweetwater, Carbon and Fremont Counties, Wyoming." <http://quickfacts.census.gov> (Accessed August 2010).

NRC. NUREG–1910. "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

B.5.28 Public and Occupational Health

B.5.28.1 Public and Occupational Health–General

Comment: L016-020

The commenter suggested that the SEIS should be more specific as to the technologies and processes that are employed at ISL facilities that provide additional protection of public and occupational health and safety. The specific examples cited by the commenter included

downflow ion-exchange (IX) columns and vacuum dryers that provide additional protections by limiting or eliminating potential public and worker exposure to radon gas and yellowcake dust.

Response: *The downflow ion-exchange equipment is identified in the description of the proposed action in the Lost Creek SEIS. The proposed Lost Creek action does not involve vacuum dryers. This information was considered in the analysis of radiological impacts to the public and workers and determined to be SMALL. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L016-022

The commenter suggested the NRC staff's description of radiation protection issues should reference comparisons of potential radiation dose to natural background and should not be limited to comparison to NRC dose limits.

Response: *The SEIS contains the information to permit a reader to make the requested comparison. Section 3.12 of the SEIS states that the background dose level in the Wyoming West Uranium Milling Region, where the Lost Creek site is located, is 316 mrem/yr and the annual average dose to the public from all sources is 620 mrem/yr. Section 3.12.2 of the SEIS states that the NRC annual dose limit for members of the public (100 mrem/yr) is a fraction of the background dose. Furthermore, Table 4.2-2 of the GEIS (NRC, 2009) reported the dose to the nearest resident at ISR facilities in the Wyoming West Uranium Milling Region, which averaged approximately 7 mrem. From these data, the NRC staff concluded that a dose to a member of the public from an ISR facility is a fraction of the NRC dose limit and would be an even smaller fraction of the dose from natural background.*

Since the primary purpose of the SEIS is to estimate the environmental impacts on the various resource areas from implementation of the proposed action and alternatives and comparison of impacts to regulatory standards or ongoing impacts (e.g., background) is not the main purpose of the document no change was made to the final SEIS beyond the information provided in this response.

Comment: L008-019

The commenter stated that that the gamma readings and soil sampling don't support the assertion that there are high concentrations of radionuclides in the surface soils at the Lost Creek site.

Response: *The discussion of background radiological conditions in Section 3.12.1 of the SEIS characterizes the radioactivity in soil as being consistent with typical background ranges for this region of Wyoming. NRC considers this position to be consistent with the point raised by the commenter. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L018-027

One commenter who requested the SEIS include an analysis of the potential use of evaporation ponds, further requested that this analysis include radon emission estimates and comparison to applicable CAA requirements.

***Response**: The draft SEIS did not evaluate the use of evaporation ponds because evaporation ponds were not included in the applicant's proposal which was the focus of the NRC environmental review. However, additional information was provided in final SEIS Section 2.1.1.2.1 to describe and discuss the environmental impacts from other wastewater disposal options for liquid effluent not considered by the applicant. That evaluation of wastewater management options considers the use of evaporation ponds and how the potential environmental impacts compare with the applicant's proposal and other liquid effluent management options. The waste management options are discussed at a general level of detail with regard to radon emissions because there are various implementation options that an applicant could propose that would affect the amount of radon emitted from a specific proposal.*

B.5.28.2 Impacts to Members of the General Public

Comment: L022-020

The commenter suggested that it was unclear in the SEIS which emergency response and accident procedures or protocols are referred to and how they will be applied to this ISL facility.

***Response:** The SEIS describes information presented in the GEIS due to the use of similar emergency and accident procedures across the ISR industry. The GEIS goes into detail on accidents and emergency response; in particular for this case in Section 4.2.11.2.2 on Radiological Impacts to the Public and Occupational Health and Safety from Accidents. These procedures are considered in the analysis of environmental impacts in the SEIS. They are also reviewed in depth in the safety review for such a facility. No change to the SEIS was made beyond the clarifying information provided in this response.*

B.5.28.3 Reference

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Uranium Milling Facilities." Washington, DC: NRC. 2009

B.5.29 Waste Management

B.5.29.1 General Waste Management Comments

Comments: L020-052; L020-055

The commenter was concerned about the management of contaminated media, such as soils. In particular, the commenter asked whether soils and other media contaminated by spills and other releases would be transported to solid waste disposal or treatment facilities in Wyoming.

***Response:** SEIS Sections 2.1.1.1.6.3 and 4.14 indicates that ISR facilities generate radiologically contaminated wastes, including contaminated soils, structures, and liquids, that are classified as byproduct material if they cannot be decontaminated. NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept byproduct material before ISR operations begin. The existing facilities that are NRC licensed to accept 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, NRC agreement states license two sites in Utah and one in Texas to accept byproduct material for disposal. Because the information provided in the SEIS about the disposal of contaminated materials the proposed Lost Creek ISR Project would*

generate is sufficient to support the evaluation of environmental impacts, no changes were made to the SEIS beyond what is contained in response to this comment.

Comment: L020-060

The commenter noted that the Wyoming Solid Waste Program encourages applicants to consider development of onsite recycling plans for use during the construction, operation, restoration, and decommissioning phases of facility operations.

Response: *SEIS Section 1.6.2, as well as relevant sections in Chapters 2, 3, and, 4 explain that, in addition to the NRC license, ISR facilities must obtain permits or authorizations from Federal, Tribal, and State agencies for any activities subject to regulation by these authorities. However, NRC's regulations do not require an applicant to conduct such operations or to prepare a plan for non-radiological waste. No changes were made to the SEIS beyond the information provided in this response.*

Comments: L020-064; L020-065; L020-066; L020-068; L020-069; L020-074; L020-075; L020-077; L020-078; L020-079; L020-084; L020-085; L020-086; L020-088; L020-089

The commenter indicated that the volume of solid byproduct material generated and the capacity of the solid byproduct material disposal sites being considered were needed to determine waste management impacts.

Response: *NRC has expanded the discussions in Chapters 2, 3, 4, and 5 to include more information about the volume of solid byproduct material generated during all phases of the proposed Lost Creek ISR Project. As described in the final SEIS, NRC requires applicants to have a (radioactive) byproduct material disposal agreement in place prior to operations. This agreement would account for byproduct material generated throughout the life of the project, including decommissioning. The applicant has not yet developed an agreement with a licensed disposal site, but the NRC requirement to have an agreement in place will be reflected in a license condition for the proposed Lost Creek ISR Project. The highest estimated annual volume of solid byproduct material to be generated during the decommissioning phase comprises 1,605 m^3 [2,098 yd^3]. For the entire duration of the decommissioning phase, which the applicant projects would occur over a period of 6 years, the applicant estimated a total volume of 3,034 m^3 [3,966 yd^3] of solid byproduct material. This updated information on decommissioning waste volumes was incorporated into SEIS Sections 2.1.1.1.6.3 (solid wastes), 2.1.1.1.7 (transportation), 3.13.1 (affected environment, waste management), 4.3.1.4 (transportation impacts, decommissioning), 4.14.1.1.4 (waste management impacts, decommissioning) and 5.14 (cumulative impacts, waste management) in the final SEIS.*

Comments: L020-053; L020-054; L020-057; L020-081

The commenter indicated that only estimates of solid wastes for the operations phase are provided, and that estimates for all phases are needed to determine whether adequate landfill capacity exists.

Response: *As the commenter indicates, the draft SEIS did not include estimates of solid waste volumes generated throughout the entire lifecycle of the proposed Lost Creek ISR Project. For the final EIS, the staff has provided additional information on solid waste volumes generated for all phases through decommissioning. The highest estimated annual amount of solid waste is generated during the decommissioning phase, and comprises 1,605 m^3 [2,098 yd^3] of byproduct*

material and 1,056 m^3 [1,380 yd^3] of nonhazardous solid waste. For the entire duration of the decommissioning phase, which the applicant plans to occur over a period of 6 years, the estimated amount of solid waste comprises 3,034 m^3 [3,966 yd^3] of byproduct material and 1,055 m^3 [1,380 yd^3] of nonhazardous solid waste. This updated information on decommissioning waste volumes was incorporated into Sections 2.1.1.1.6.3 (solid wastes), 2.1.1.1.7 (transportation), 3.13.1 (affected environment, waste management), 4.3.1.4 (transportation impacts, decommissioning), 4.14.1.1.4 (waste management impacts, decommissioning) and 5.14 (cumulative impacts, waste management) in the final SEIS. As stated in Section 5.14, the total volume of solid waste (including sewage sludge) generated for the entire lifecycle of the proposed Lost Creek ISR Project through the end of decommissioning would be about 4,132 to 5,367 m^3 [5,404 to 7,020 yd^3]. The descriptions in final SEIS Sections 3.13.1, 4.14, and 5.14 have also been modified to address the projected life of the Carbon County and Sweetwater County landfills, which are both near the proposed Lost Creek project. As stated in Chapter 3, the applicant has indicated that it would likely ship nonhazardous solid waste to the Carbon County landfill.

Comment: L020-058

The commenter was concerned that the amount of solid waste the proposed Lost Creek ISR Project would generate would cause the recipient solid waste landfill to reach capacity sooner than originally anticipated and the siting and permitting of a new landfill would impose an undue burden on the local community.

Response: *The NRC staff has revised SEIS Section 3.13.2 to indicate that the Rock Springs Landfill has a capacity of 13.8 million m^3 [18 million yd^3] and accepts on an average day approximately 364 m^3/day [400 yd^3/day], or approximately 133,000 m^3/year [146,000 yd^3/year]. Also as stated in Section 3.13.2, the Carbon County landfill currently accepts 123 t [135 T] of MSW per week (conservatively assuming 1500 lbs/yd^3 of trash, this is about 164 yd^3 per week) and 136 t [150 T] per week of C&D waste (about 181 yd^3 per week). Based on this rate of acceptance, the landfill has a useful life expectancy of 50 years. The contribution of 380 to 540 m^3/year [500 to 700 yd^3/year] by the proposed Lost Creek ISR Project will result in less than 1 percent increase in solid waste accepted by either landfill.*

Comment: L020-073

The commenter was concerned that the estimate for non-byproduct solid wastes of [500 to 700 lb/y] was unrealistic.

Response: *NRC staff has reviewed the estimates of non-byproduct solid wastes in the SEIS and the applicant technical report. It appears that the estimate should be about 380 to 540 m^3 [500 to 700 y^3] per year. Chapter 2 of the SEIS was modified to address this comment.*

Comment: L022-002

The commenter noted that some construction materials, such as organic solvents, paints, used oil, and paint thinners, may be classified as hazardous wastes subject to regulation under the *Resource Conservation and Recovery Act* (RCRA).

Response: *Sections 2.1.1.1.6 and 3.13 of the SEIS have been modified to more clearly describe the hazardous wastes that would be generated. Section 4.14.1.1.1 has been modified to account for hazardous wastes generated during the construction phase.*

Comment: L022-041

The commenter was concerned with the lack of detail in the SEIS regarding recycling or disposal of used oil.

Response: *The applicant has indicated that a commercial business would be used for used petroleum product recycling or energy recovery purposes. Additional description has been included in SEIS Section 13.13.1 to address used oil. No other changes were made in response to this comment.*

B.5.29.2 Scope of the Assessment of Waste Management Impacts

Comment: L018-011

The commenter questioned the SEIS accuracy on the volume of radiological and nonradiological liquid waste to be generated at the Lost Creek facility.

Response: *SEIS Section 2.1.1.1.3.2 provides estimates of liquid effluent generated during operations of the proposed project, and fig. 2-13 shows a water balance for the proposed project. As stated in that section, approximately 230 to 340 Lpm [60 to 90 gpm] would be diverted as production bleed. Furthermore, the applicant acknowledges additional miscellaneous plant wastewater which would include liquids from process drains, well development water, pumping test water, elution circuit bleed, and washdown water. As stated in Section 2.1.1.2, during the aquifer restoration phase of the facility, the majority of the liquid waste would comprise discharge from the groundwater sweep and reverse osmosis processes used to treat groundwater, with each process generating about 606 Lpm [160 gpm] for disposal.*

Comments: L018-003; L018-013

The commenter was concerned about the narrow range of waste disposal alternatives and limited discussion regarding waste management impacts in the *SEIS*. The commenter stated that the SEIS should discuss (i) treatment of the liquid effluent stream to applicable Wyoming Groundwater Class of Use standards prior to injection or discharge; (ii) evaluation of radioactive contaminant removal; (iii) arrangements for offsite commercial, licensed land disposal of the treatment residue; (iv) use of evaporation ponds with double liners and leak detection systems; and (v) costs to remove other potentially harmful nonradiological constituents before injection.

Response: *SEIS Sections 2.1.1.1.6, 3.13, and 4.14 have been modified to include more detailed information about the types and amounts of wastes generated and how they would need to be managed, descriptions of additional wastewater disposal alternatives, and a more detailed explanation of potential waste management impacts. In addition, Section 4.14.1.1.2 was revised to include conditionally exempt small-quantities-generator requirements (for hazardous waste) and the consequences if the site fails to meet the requirements.*

B.5.29.3 Characteristics of Wastes Generated by ISR

Comment: L016-014

The commenter suggested that the final SEIS be reformatted so that members of the public and interested stakeholders clearly understand the difference between wastes at ISL facilities that are classified as byproduct material and nonradiological wastes. The commenter

also noted that NRC should follow the format presented in the Generic Environmental Report issued by National Mining Association.

Response: *The NRC staff agrees that the discussion of waste management should clearly distinguish between byproduct materials and non-byproduct wastes. The discussion of liquid and solid wastes in SEIS Section 2.1.1.1.6 has been restructured to more clearly distinguish byproduct materials from other wastes, and similar clarifying revisions have been made to sections 3.13 and 4.14. In addition, a text box has been added to Section 2.1.1.1.6.3 to define the terminology used to classify materials for the purpose of discussing the proposed waste management actions. As indicated in the revised Sections 2.1.1.1.6, 3.13, 4.14, and 5.14, the proposed action would generate liquid and solid byproduct material, as well as other hazardous and nonhazardous liquid and solid wastes. As stated in these sections, the applicant has proposed that all liquid byproduct material, whether radiological or not, would be disposed via state-permitted deep disposal (Class I) well injection. Remaining liquid wastes consist of standard sanitary wastewater and uncontaminated well development and well test water. Also as stated in these sections, solid byproduct material would be disposed of at a site licensed to receive such waste; nonhazardous solid waste would be disposed at a municipal waste disposal site; and hazardous waste would be transported to the Sweetwater County solid waste facility, which is permitted to accept small quantities of such wastes.*

Comments: L020-059; L020-061; L020-062; L020-135; L022-010

Two commenters were concerned that the handling and disposal of hazardous wastes was not consistent with pertinent local, state, and federal regulations.

Response: *SEIS sections 3.13.1 and 4.14.1.1 have been revised to include more information about compliance with pertinent state and federal regulations governing hazardous waste handling and disposal.*

Comment: L020-071

The commenter was concerned that the SEIS did not acknowledge that a portion of the solid wastes generated at the site is classified as 11e.(2) byproduct material.

Response: *Draft SEIS Sections 2.1.1.6.3.2 (final SEIS Section 2.1.1.1.6.3) and 4.14.1.2 (final SEIS section 4.14.1.1.2) identify specific examples of process wastes and equipment. For the final SEIS, the discussion of liquid and solid wastes in SEIS Section 2.1.1.1.6 has been restructured to more clearly distinguish byproduct materials from other wastes. In addition, a text box has been added to Section 2.1.1.1.6.3 to define the terminology used to classify materials for the purpose of discussing the proposed waste management actions. More information has also been added to Section 3.13 concerning byproduct material.*

Comment: L022-039

The commenter was concerned that the definition in the SEIS of Conditionally Exempt Small Quantity Generator (CESQG) did not fully explain the requirement for this exemption or the consequences if the site fails to meet the requirements.

Response: *Section 4.14.1.1.2.2 was added to Waste Management Section of the SEIS; it includes all the requirements for a CESQG and the consequences if the site fails to meet the requirements.*

B.5.29.4 Waste Treatment and Disposal Methods

Comment: L008-131

The commenter indicated that solid waste (non-byproduct material) would most likely be sent to the Carbon County Landfill north of Rawlins as opposed to the Sweetwater County District #1 Landfill in Rock Springs as stated in the Lost Creek SEIS.

Response: *NRC staff has confirmed with the Sweetwater County District #1 Landfill that solid non-byproduct waste would not be sent to that facility initially, and that the Carbon County Landfill would receive all solid waste from the Lost Creek facility. The staff has revised relevant text in Chapters 3 and 4 to reflect that the applicant would likely send its solid waste to the Carbon County landfill. The Sweetwater County District #1 Landfill would be used as a standby disposal site.*

Comments: L018-007; L018-008; L018-009; L018-012; L010-024

The commenters expressed concern about the deep well disposal of liquid wastes because of the waste water composition (radioactive and nonradioactive components), the potential impacts to the receiving strata, and other USDW.

Response: *The applicant has identified deep well disposal as its preferred liquid waste disposal option. The Safe Drinking Water Act (SDWA) grants EPA the primary authority to regulate underground injection and protect current and future sources of drinking water. EPA implements this responsibility through its UIC program. EPA has authorized the State of Wyoming to administer the UIC programs in accordance with EPA regulations. The applicant has obtained its permit from the State of Wyoming for a Class I UIC permit, issued May 28, 2010 (WDEQ, 2010). The State's UIC review process verifies that the injected fluids are isolated from the accessible environment, including potential sources of drinking water. The terms of the permit dictate the constituent concentrations (radioactive and nonradioactive) and injection rates allowable for the five Class I UIC wells. Had the applicant not been issued a permit or been unable to obtain the proposed Class I UIC permit, an amendment to its NRC license application would have been required to accommodate another disposal method. According to the terms of the permit, LCI is required to submit quarterly reports and annual reports to WDEQ (WDEQ, 2010). The text in Chapters 2 and 4 has been modified to indicate the applicant's permitted status for the Class I deep disposal wells.*

Comment: L020-067

One commenter expressed concern that the proposed Lost Creek ISR Project facility and two other proposed ISR facilities could produce a cumulative amount of byproduct material from decommissioning that would result in a large impact to disposal options in Wyoming.

Response: *An important aspect of the NRC staff evaluation of potential waste management impacts is the availability of disposal capacity. As explained in the GEIS, NRC requires through a license condition that an ISR facility have an agreement in place with a licensed disposal facility to accept byproduct material from facility operations, aquifer restoration, and decommissioning. Such agreements ensure that sufficient disposal capacity for byproduct material would be available throughout the life of the facility.*

As discussed in draft SEIS Section 2.1.1.1.6.3 and 3.13.2, the applicant does not presently have an agreement in place with a licensed site to accept solid byproduct material for disposal. Sites that NRC currently licenses to accept byproduct material for disposal include the Pathfinder-Shirley Basin site in Mills, Wyoming, and the Rio Algom Ambrosia Lake uranium mill tailings impoundments near Grants, New Mexico. Additionally, NRC Agreement States license three sites to accept 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).

At the time of this writing, NRC has received no proposals to expand byproduct material disposal capacity in Wyoming. As explained in the GEIS (Section G5.32.2), proposals for onsite disposal of byproduct materials at locations without available disposal capacity are uncommon, but if NRC received such proposals, they would be evaluated on a case-by-case basis against criteria in 10 CFR Part 40, Appendix A. NRC staff would evaluate the potential environmental impacts of any such proposals if and when they are received. Based on the disposal options currently available and the disposal agreement that NRC requires prior to operations, the NRC staff continues to conclude that the potential waste management impacts associated with the generation of byproduct material would be SMALL.

In response to this and other similar comments, the NRC staff reviewed the draft SEIS and, as the commenter has also noted, found the reported facility waste volumes did not include estimates of decommissioning byproduct material. As a result, the NRC staff then calculated the amount of solid byproduct material that could be generated from decommissioning activities based primarily on information provided in the applicant surety estimate (LCI, 2010). The calculation results for the Lost Creek proposal were added to the SEIS Section 2.1.1.1.6.3 description of byproduct material expected to be generated by the proposed action. The estimates were also added to the revised waste management cumulative effects analysis and description in Section 5.14. As described in the draft SEIS Section 2.1.1.1.6.3, the applicant does not currently have an agreement in place with a licensed site to accept its solid byproduct material for disposal.

Comment: L020-076

The commenter noted that the information in Chapter 3 regarding the Rock Springs landfill was not accurate.

Response: *NRC staff reviewed the description of the Rock Springs landfill in Section 3.13 of the draft SEIS. For the final SEIS, the staff has updated this section with recent information from Sweetwater County, and this is consistent with the information in the WDEQ permit files.*

Comment: L022-038

The commenter was concerned about the disposal of hazardous waste from the site at the Sweetwater County District #1 Landfill in Rock Springs.

Response: *Based on the estimated waste volumes the licensee provided, and as stated in chapters 2, 3 and 4 of the SEIS, the proposed Lost Creek site will likely qualify as a CESQG and may transport its hazardous waste for collection at the Sweetwater County landfill. No further changes were made to the SEIS beyond the information provided in this response.*

B.5.29.5 Regulation of Wastes and Disposal Methods

Comment: L020-063

The commenter expressed concern that the SEIS contains no references to the role the State of Wyoming plays in authorizing 11e.(2) byproduct material disposal facilities and that the 11e.(2) byproduct waste is defined as solid waste by Wyoming statute and subject to the state's regulatory requirements.

Response: *Concerning the definition of byproduct material as "solid waste" and the State of Wyoming regulatory authority thereof, the NRC agrees that such waste would be subject to Wyoming solid waste regulations if it meets NRC criteria for unrestricted release. However, NRC regulates byproduct material (i.e., waste that does not meet NRC criteria for unrestricted release) under 10 CFR Part 40. This is not "solid waste" according to 40 CFR 261.4(a)4. Because Wyoming is a nonagreement state, NRC retains jurisdiction over byproduct material. However, a discussion of construction and authorization of additional byproduct material disposal facilities goes beyond the scope of this document. No further changes were made to the SEIS beyond the information provided in this response.*

Comment: L020-082

The commenter indicated that WDEQ prefers that CESQGs manage their hazardous waste at permitted hazardous waste disposal facilities.

Response: *As stated in Section 3.13.2, LCI has stated in its application that it would use a commercial contractor for used petroleum product recycling or energy recovery purposes, and would use a licensed disposal facility for chemical waste recycling or disposal. All liquid hazardous wastes would be handled and disposed of in accordance with federal and state regulations governing hazardous waste. Section 4.14.1.1.2 was modified to include the requirements for a CESQG.*

Comment: L020-083

The commenter indicated that used oil storage and spent battery generation and disposal are regulated by the State of Wyoming and may require a permit.

Response: *As stated in Sections 2.1.1.1.6, 3.13 and 4.14, the applicant would use a commercial contractor for used petroleum product recycling or energy recovery purposes, and solid hazardous wastes (such as batteries) would be periodically collected by a commercial hauler for disposal at a licensed disposal facility. All hazardous waste materials would be handled and disposed of in compliance with all pertinent state and federal regulations.*

B.5.29.6 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Washington, DC: U.S. Government Printing Office.

40 CFR Part 261. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 261, "Identification and Listing of Hazardous Waste." Washington, DC: U.S. Government Printing Office.

LCI. “Lost Creek Project, Clarifications to TR, Docket No. 40-9068, TAC No. LU0142.” Letter (May 14) from J. Cash to T. Palmateer Oxenberg, NRC. Casper, Wyoming: Lost Creek International, LLC. 2010.

WDEQ. “State of Wyoming Department of Environmental Quality Underground Injection Control Permit Issued Under Wyoming Water Quality Rules and Regulations, Chapter 13, Class I Injection Well, Lost Creek Disposal Wellfield, Permit Number 09-586.” Cheyenne, Wyoming:. May 28, 2010.

B.5.30 Cumulative Effects

B.5.30.1 The SEIS Does Not Adequately Address Cumulative Effects

Comments: L004-003; L003-003; L015-070; L015-076; L017-017; L017-018; L019-032

Multiple commenters expressed concern that the SEIS does not adequately address cumulative effects. For example, several commenters noted that the SEIS provided a listing of other EISs prepared by different agencies but with no associated meaningful analysis. Other commenters expressed concern that cumulative impacts were presented as conclusory statements with an inadequate basis. Another commenter expressed concern that the SEIS only considered federal actions in the cumulative effects analysis. Also, another commenter noted that the cumulative effects analysis in the SEIS was not transparent and was not developed with sufficient public input.

Response: *The NRC staff believes that the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative effects. Mitigation measures are described throughout SEIS Chapters 4 and 5, and additional monitoring measures are described in Chapter 6. The cumulative effects analysis presented in SEIS Chapter 5 was revised to improve the transparency and clarity of the analysis and provides a more detailed description of potential cumulative effects for critical resource areas such as groundwater and land use.*

Comments: L015-061; L015-063; L015-067; L015-068; L015-069; L017-020

The commenters expressed concern that the cumulative effects analysis presented in the GEIS (NRC, 2009) was inadequate and used to constrain the scope of the cumulative effects analysis in the SEIS. For example, one commenter noted that the SEIS does not consider the cumulative impacts of past uranium mining and milling combined with the current project. One commenter noted that the GEIS deferred conclusions on the potential cumulative impacts to the site-specific SEIS. Because the site-specific cumulative effects analysis presented in the SEIS is based heavily on information presented in the GEIS, the commenter concluded that the SEIS does not address the NEPA requirements with respect to cumulative impacts.

Response: *The relationship between the GEIS and the site-specific SEIS is described in Section 1.4.1 of this document. Revisions to the GEIS are beyond the intended scope of the public comment process associated with the SEIS. The NRC staff believes that the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative effects. The cumulative effects analysis presented in SEIS Chapter 5 was revised to improve the transparency and clarity of the analysis and provides a more detailed description of potential cumulative effects for critical resource areas such as groundwater and land use.*

Comment: L022-040

The commenter suggested the SEIS concludes that cumulative impacts from deep well disposal would be SMALL. The commenter believes NRC has made this conclusion based on incorrect assumptions illustrated in the SEIS that state "[b]y design, Class I UIC is protective of all underground sources of drinking water (no discernible pathway to drinking water) and permanently removed from the accessible environment." The commenter pointed out that issuance of a Class I UIC permit does not guarantee that there are no pathways to drinking water or guarantee that the waste is permanently removed from the accessible environment. The commenter requested that the SEIS needs to consider potential scenarios if there are well failures or other problems with well injection.

Response: *The SEIS does not conclude that the cumulative impacts only from deep well disposal would be SMALL. To clarify this point, the cumulative impact to groundwater is evaluated by using the approach described in Section 5.1.2, which is based on CEQ guidance (CEQ, 1997). The commenter should note that the SEIS states that impacts to groundwater from past, present, and reasonably foreseeable future activities in the Lost Creek area of the Great Divide Basin are anticipated to be MODERATE (Section 5.5.2). Because the SEIS already includes descriptions of cumulative impacts resulting from deep disposal, no changes were made to the SEIS beyond the information provided in this response*

B.5.30.2 Past, Present, and Reasonably Foreseeable Future Actions

Comments: L015-071; L015-072; L015-073; L015-074; L015-075; L019-031; L017-019

Commenters expressed concern over the possible cumulative effects that could result from past, present, and reasonably foreseeable future actions associated with other resource extraction operations in the Great Divide Basin, such as coal bed methane production, oil and gas production, and coal mining. For example, several commenters noted that the SEIS should include a disclosure of the types and amounts of contaminants released from coal bed methane operations into aquifers and surface waters and provide a detailed analysis of the incremental impacts from the Lost Creek ISR. Other commenters stated the SEIS should include an analysis of the potential for cross contamination from wells associated with coal bed methane, oil and gas, and coal mining operations. Other commenters suggested that NRC present information related to the location (i.e., distance and whether sites are upstream or downstream) of past, present, or future uranium extraction projects near Lost Creek.

Response: *Potential impacts to groundwater resources and the effects of waste management practices at the site are described in SEIS Sections 4.5.2 and 4.14. SEIS Chapter 5 summarizes other past, present, and reasonably foreseeable future actions associated with resource extraction in the Great Divide Basin. In addition, as described in SEIS Section 1.7.3.1, NRC entered into an MOU with BLM to keep current on issues that develop with respect to these operations on public lands. The analysis presented in SEIS Chapter 5 was revised to clarify the technical basis for potential cumulative impacts to groundwater resources in the vicinity of Lost Creek.*

Comments: L015-078; L015-081; L019-029

Several commenters expressed concern that the cumulative impacts analysis presented in SEIS Chapter 5 did not consider impacts from past uranium mining or milling.

Response: *The cumulative impacts analysis presented in SEIS Chapter 5 includes a summary of past, present, and reasonably foreseeable future uranium recovery operations, both for conventional mining and milling and ISR technologies. NRC has regulatory authority for the radiological aspects of these facilities, and the potential environmental impacts from these facilities are (or would be) evaluated in accordance with NRC NEPA requirements in 10 CFR Part 51. In addition, the cumulative effects analysis was revised to improve the clarity and transparency of how past, present, and reasonably foreseeable future actions relating to uranium recovery were considered.*

Comments: L018-020; L018-021; L018-022

The commenter noted specific cumulative impacts from multiple ISR facilities with respect to the ambient air quality, including effects on NAAQS pollutants such as nitrogen oxides, particulate matter, and ozone. In addition, the commenter noted that the development of multiple ISR facilities could result in air emission levels that could adversely affect the air quality related values such as visibility in Class I and sensitive Class II areas.

Response: *Ambient air quality is described in SEIS Section 3.7, and potential impacts to air quality are described in Section 4.7. Visual resources are described separately in Sections 3.10 and 4.10 of the SEIS. These sections were revised to address recent changes in the air quality requirements and the cumulative effects section incorporates these analyses by reference.*

B.5.30.3 Specific Document Changes or Action Requests

Comment: L015-082

The commenter stated that the GEIS is the more appropriate document for conducting a cumulative impacts analysis. The commenter also suggested that NRC reissue the GEIS for public review and comment on its cumulative impacts analysis.

Response: *As described in SEIS Section 1.4.1, the NRC staff believes the SEIS is the appropriate way to update and supplement the environmental review in the GEIS. Specific revisions to the GEIS are beyond the intended scope of this environmental review. Because the relationship between the SEIS and GEIS and the tiering approach used are described in Section 1.4.1, no changes were made to the SEIS in response to this comment.*

B.5.30.4 Significance

Comment: L019-030

The commenter requested greater detail about how NRC determined the magnitude of cumulative impacts. Specific issues raised include whether cumulative impacts were evaluated at both a geographic and temporal scale and whether groundwater impacts could be classified as LARGE because the groundwater in the mining areas will never be the same.

Response: *The NRC staff believes that the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative effects. Section 5.1.2 identifies the temporal scale as being from 2007 to 2020. This period represents the time that NRC initially received the license application from the applicant (2007) through expected license termination (2020). The geographic scale varies by resource category and is clearly identified for each resource throughout SEIS Chapter 5. The cumulative effects analysis presented in SEIS*

Chapter 5 has been revised to improve the transparency and clarity of the analysis, including a more detailed discussion of how impact significance was determined for potential cumulative effects for critical resource areas, such as Land Use (SEIS Section 5.2), Groundwater (SEIS Section 5.5.2), Ecological Resources (SEIS Section 5.6), Air Quality (SEIS Section 5.7), and Socioeconomics (SEIS Section 5.11).

Comment: L015-080

The commenter noted that the cumulative effects analysis presented in the GEIS (NRC, 2009) was inadequate, assuming that most site-specific cumulative impact analyses would require only a Level-1 or Level-2 analysis. The commenter expressed concern that this assumption was used to constrain the scope of the cumulative effects analysis in the SEIS.

Response: *GEIS Section 5.4 describes approaches to addressing cumulative impacts in a site-specific EIS. These approaches are based on cumulative impacts assessment guidance CEQ developed providing examples and assumptions that NRC staff might use to determine the appropriate level of detail in analyzing the potential cumulative effects for a given resource area. The purpose of the information in the GEIS is to outline one methodology that may be used in conducting cumulative effects analysis. It does not prescribe a particular approach, nor does it presume a particular outcome (e.g., an impact significance level) in the site-specific EIS. In the examples given in the GEIS, a relatively lower level of detail (Level 1) might be, but not necessarily would be, applied to analyzing cumulative impacts for a resource area. The relationship between the GEIS and the site-specific SEIS is described in SEIS Section 1.4.1. Revisions to the GEIS are beyond the intended scope of the public comment process associated with the SEIS. NRC believes that the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative effects. The cumulative effects analysis presented in SEIS Chapter 5 was revised to improve the transparency and clarity of the analysis and provide a more detailed description of potential cumulative effects for critical resource areas such as groundwater and land use.*

B.5.30.5 Cumulative Impacts: Other

Comment: L015-024

The commenter noted that the cumulative impacts analysis in the SEIS should include consideration of the ISR facility on climate change and also related effects that climate change might have on groundwater supply for the region.

Response: *EPA issued regulations for inventorying greenhouse gas emissions on October 20, 2009, and on February 18, 2010, after the draft SEIS was published for comment; CEQ issued draft guidance to agencies on the consideration of the effects of climate change and greenhouse gas emissions in the context of NEPA environmental reviews. NRC is currently evaluating the best approaches for how it will address these recent developments with respect to climate change and greenhouse gas emissions while meeting its responsibilities under NEPA. SEIS Section 5.7.1 was updated to reflect these recent developments.*

Comment: L015-079

The commenter expressed concern that the cumulative effects analysis presented in the GEIS (NRC, 2009) effectively predetermined to what extent cumulative impacts will be analyzed in the SEIS.

Response: *GEIS Section 5.4 describes approaches to addressing cumulative impacts in a site-specific EIS. These approaches are based on cumulative impacts assessment guidance CEQ developed, providing examples and assumptions that NRC staff might use to determine the appropriate level of detail in analyzing the potential cumulative effects for a given resource area. The purpose of the information in the GEIS is to outline one methodology that may be used in conducting cumulative effects analysis. It does not prescribe a particular approach, nor does it presume a particular outcome (e.g., an impact significance level) in the site-specific EIS. The relationship between the GEIS and the site-specific SEIS is described in SEIS Section 1.4.1. Revisions to the GEIS are beyond the intended scope of the public comment process associated with the SEIS. NRC believes the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative effects. The cumulative effects analysis presented in SEIS Chapter 5 was revised to improve the transparency and clarity of the analysis and provide a more detailed description of potential cumulative effects for critical resource areas such as groundwater and land use.*

B.5.30.6 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” Washington, DC: U.S. Government Printing Office.

CEQ. “Considering Cumulative Effects Under the National Environmental Policy Act.” Washington, DC: Council on Environmental Quality. January 1997.

74 FR 5620. EPA. “Mandatory Reporting of Greenhouse Gases Rule.” H.R. 2764, Public Law 110-161. *Federal Register*. Vol. 74. October 30, 2009.

NRC. NUREG–1910, “Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities.” Vols. 1 and 2. Washington, DC: NRC. June 2009.

B.5.31 Environmental Justice

Comment: L022-035

The commenter expressed concern that the SEIS gave an insufficient justification for varying from NRC policy in defining the impact area of the proposed project. The commenter stated that the impact area of the project is too broad for an environmental justice (EJ) analysis and that the data are misleading. The commenter further stated that low income and minority individuals may reside in a community very near a project site and that the analysis would skew this by analyzing a broad impact area.

Response: *The environmental justice analysis in the SEIS used 2000 Census data for census tracts and block groups in Sweetwater County consistent with CEQ guidance. NRC staff acknowledges the comment and revised SEIS Section 4.12.1 in response to this comment.*

Comment: L022-036

The commenter stated the SEIS did not compare minority and low-income proportions in the impact area to the county and state proportions. The commenter further stated that the figures in the table show that a comparison was made, but the text does not show a comparison was made.

Response: *NRC staff acknowledges the comment and has made revisions to the SEIS EJ Section 4.12.1 that shows a comparison to county and state proportions.*

Comment: L022-037

The commenter noted a lack of description of tribal impact, specifically stating the CEQ guidance recommends considerations in the EJ analysis of impacts on tribal cultural and subsistence resources. Specifically the commenter stated, Tribal Impacts: CEQ guidance recommends consideration in the EJ analys is of impacts on Tribal cultural and subsistence resources. The GEIS notes the importance of hunting, plant gathering,and cultural resources to Tribal populations in the region. Although the draft SEIS considers Tribal cultural resources outside the EJ context (and finds there are none in the area), it does not discuss them in the EJ analysis. A reference to the cultural resource analysis should be added to the EJ section. Furthermore, there is no indication that Tribal subsistence resources were considered at all. (The draft SEIS notes that the project area falls within Wyoming Game and Fishing Department hunting areas for antelope, deer, and elk. Draft SEIS at 3-62.) Regardless of whether the draft SEIS correctly identified the impact area, it is possible that Tribal members from outside the area use subsistence resources within the area. Therefore, that possibility should either be eliminated by a specific analysis of Tribal use, or impacts on subsistence resources should be addressed.

Response: *NRC staff acknowledges this comment. As the GEIS notes the importance of hunting, plant gathering, and cultural resources to tribal populations in the area, SEIS Section 4.12 was revised to provide justification for the conclusions that there would be no impacts on environmental justice issues regarding tribal subsistence within the specific proposed project area.*

B.5.32 Best Management Practices

B.5.32.1 Enforcement of Mitigation Measures and Best Management Practices

Comment: L015-043

The commenter stated that classifying groundwater impacts from leaks and spills as SMALL is unjustified because this relies on the assumption that mitigation measures will be effective.

Response: *As noted in SEIS Section 4.5.2, implementation of the required leak detection program and well mechanical integrity testing should mitigate the potential impacts from leaks and spills to shallow (near surface) aquifers and result in SMALL potential impacts. This impact conclusion is based on facility-specific process descriptions for the proposed Lost Creek ISR Project and site-specific characteristics at the proposed site. In determining impact conclusions, the NRC staff reviewed information the applicant provided in its license application (including the technical and environmental reports), information and data the staff independently collected, and information and data provided in the GEIS. GEIS Section 2.11 presents an historical description of ISL operations, and Section 2.14 provides reference to specific facilities in Wyoming, Nebraska, and New Mexico. The intent of the information in these sections of the GEIS was to inform the reader regarding which issues have historically resulted in potential impacts at ISR facilities and to provide a range of conditions that may be expected for each of the four ISR phases. No changes were made to the SEIS in response to this comment.*

Comment: L019-018

The commenter stated, “The GEIS and SEIS do not demonstrate a commitment to following strict measures to protect the sage-grouse.” The commenter believes, based upon the description in the SEIS, there is a question of whether the applicant will implement BMPs that are sufficiently protective of the sage-grouse and other wildlife.

Response: *GEIS Chapter 7 provides a general overview of the types of BMPs, mitigation measures, and management actions that were historically used at ISR facilities to avoid or reduce potential environmental impacts. This overview also provides a foundation for developing customized management and mitigation plans for proposed facilities, such as the one at Lost Creek. As explained in SEIS Section 7.3, these types of practices may be, but are not always, imposed through conditions in the NRC license, or as requirements established by other Federal, state, and local permitting agencies. NRC staff would establish site-specific license conditions for the proposed Lost Creek ISR Project facility, but only within limits of the authority granted by Congress. With particular regard to the sage-grouse, the applicant and WGFD have worked together to develop a mitigation plan to be implemented during the lifespan of the proposed Lost Creek ISR Project to demonstrate that the proposed project would not cause a decline in sage-grouse populations. The applicant has developed a Wildlife Protection Plan and Wildlife Monitoring Plan (LCI, 2010) that would document key wildlife species, population trends, and habitats. For a more detailed response and SEIS changes made regarding the sage-grouse, refer to Section B5.23.3 of this Appendix.*

Comments: L010-001; L022-026

Two commenters noted the SEIS used terms of possibility rather than of assurance when discussing BMP implementation, monitoring and detecting system operation, and spill response. This commenter questioned what BMPs would be implemented and whether there was a way to assure BMPs were followed, monitoring and detecting systems were functioning properly, and spill responses were quick.

Response: *These types of practices may be imposed through conditions within the NRC license (see SEIS Section 1.6). The applicant must also obtain permits or authorization from other Federal, State and local agencies. Monitoring and detection systems and spill response are under the purview of the NRC and other agencies. Inspection is a mechanism used to determine that systems operate properly and responses are timely. Violations may result in penalties. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L022-030

The commenter was concerned about air quality impacts from fugitive dust emissions during the proposed Lost Creek ISR Project and questioned who would develop and enforce a site-specific monitoring plan.

Response: Pursuant to NEPA, the NRC examines the impacts of the fugitive dust emissions along with mitigation, but does not require compliance with a site-specific monitoring plan regarding fugitive dust emissions. The WDEQ permitting process would be the mechanism used to address air quality. The applicant has proposed BMPs, such as the application of water to suppress fugitive dust emissions.

B.5.32.2 Reference

LCI. "Wildlife Protection Plan and Wildlife Monitoring Plan." Attachment OP-6. Casper, Wyoming: Lost Creek International, LLC. February 2010.

B.5.33 Monitoring

Comments: L018-033; L022-027

The commenter questioned whether the 6-month postrestoration stability period is sufficient. Another commenter stated there should be a description on postrestoration monitoring.

Response: *NRC staff agrees with the commenter that the 6-month stability monitoring program may not be sufficient. Consequently, NRC is requiring a 9-month stability period after completion of restoration activities. Postrestoration sampling would begin with a sampling of baseline water quality parameters and continue with three quarterly samples during the subsequent 9-month stability period. Furthermore, NRC is requiring that a statistical analysis of the monitoring results show no increasing trends in concentrations during the stability period. Section 6.3.1.2 of the final SEIS has been modified in response to this comment.*

Comments: L020-027; L020-047, L020-049

The commenter is concerned that ephemeral channels be monitored before erosion becomes a major problem.

Response: *NRC agrees with the commenter that early identification of erosion indicators and surface water runoff patterns provides the opportunity to mitigate and ultimately reduce the impacts of erosion. However, WDEQ and BLM have the authority to regulate stormwater impacts to the site including monitoring. Table 1-2 shows that the applicant obtained a stormwater permit from WDEQ in January 2010. No changes were made to the SEIS beyond the information provided in this response.*

Comment: L020-048

The commenter stated that there appears to be a conflict between the information in Sections 6.2.5 and 6.3.3. The commenter further stated the surface water monitoring plan must be thoroughly described in the SEIS and should include methodology, parameters to be monitored, and frequency of monitoring.

Response: *The two sections are different (one describes groundwater monitoring, the other surface water monitoring). WDEQ or the BLM specify monitoring requirements through their permitting and approval processes. No changes were made to the SEIS beyond the information provided in this response.*

B.5.34 Editorial

B.5.34.1 Editorial—Grammatical

Comments: L012-001; L012-002; L017-049; L008-009; L008-013; L008-025; L008-026; L008-027; L008-029; L008-030; L008-031; L008-032; L008-033; L008-034; L008-037; L008-038; L008-039; L008-042; L008-043; L008-044; L008-049; L008-050; L008-051; L008-054; L008-057; L008-058; L008-062; L008-063; L008-066; L008-069; L008-074; L008-075; L008-076; L008-078; L008-080; L008-084; L008-085; L008-088; L008-089; L008-091; L008-096; L008-097; L008-098; L008-113; L008-117; L008-121; L008-127; L008-128; L008-129; L008-130; L008-133; L020-097; L020-134

Commenters suggested corrections for typographical errors, misspellings, and grammatical mistakes 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 SEIS.*

B.5.34.2 Editorial—Technical

Comments: L008-001; L008-004; L008-008; L008-010; L008-011; L008-012; L008-015; L008-016; L008-017; L008-018; L008-022; L008-024; L008-028; L008-035; L008-036; L008-040; L008-045; L008-046; L008-047; L008-048; L008-052; L008-053; L008-055; L008-056; L008-059; L008-060; L008-061; L008-064; L008-065; L008-067; L008-068; L008-070; L008-071; L008-072; L008-073; L008-077; L008-079; L008-082; L008-090; L008-092; L008-094; L008-099; L008-100; L008-101; L008-103; L008-104; L008-105; L008-106; L008-109; L008-110; L008-111; L008-112; L008-115; L008-116; L008-118; L008-119; L008-123; L008-136; L008-138; L008-139; L020-035; L020-090; L020-099;

Commenters suggested changes to the text to correct inaccuracies, inconsistencies, or purposed text to clarify information in the SEIS.

Response: *Proposed changes were evaluated and made when appropriate. Where proposed changes were intended to correct inaccuracies or inconsistencies, they were checked for accuracy prior to incorporation in the SEIS.*

Comments: L004-004; L017-031; L019-015; L019-016

Several commenters addressed the quality of the figures in the SEIS. The commenter stated that the clarity of the visual figures and graphics in the draft SEIS was inadequate. Another commenter noted interactions with NRC to obtain revised figures prior to the end of the comment period and that only four revised figures were posted on the NRC website prior to the closure of the public comment period.

Response: *NRC staff reviewed all 38 figures in the SEIS and opted to revise all 38 figures. The final SEIS includes a total of 38 revised figures and an additional figure in Section 3.6 and Chapter 5. Prior to the publication of the final SEIS, revised figures were posted on the NRC website. Many of these revised figures were posted on the NRC website prior to the closure of the public comment period on March 3, 2010. Figure 2-1 was updated to match the most recent applicant information submittal in response to these comments.*

Comment: L008-041

The commenter stated the SEIS incorrectly identified the reporting timeframe requirements for site excursions.

Response: *According to NUREG–1569 (NRC, 2003, p. 5-44), verbal reporting is required within 48 hours and a written report within 30 days of a verified excursion. The SEIS was changed to correctly identify the reporting timeframe requirements. No additional changes were made to the SEIS in response to this comment.*

Comments: L010-019; L020-016

A commenter requested a copy of the Lost Creek ER. Another stated that the lack of public access to the documents hindered public input.

Response: *NRC staff has made the Lost Creek ERs available on the ADAMS database. The applicant submitted an initial ER in October 2007 with document numbers ML073190550, ML073190655, ML073190657, ML073190660, and ML073201242. Supplemental revisions were made and are also available through ADAMS. Additionally, the Lost Creek SEIS was made available at various public venues listed in B2.3 of this appendix. Because these documents are publicly available, no further actions are necessary in response to this comment.*

Comment: L016-004

The commenter stated the final SEIS should indicate that the terms "ISL" and "ISR" can be used interchangeably.

Response: *SEIS Section 1.1 states that for purposes of the SEIS, "in-situ recovery," or ISR, is synonymous with "in-situ leach," or ISL. Because the SEIS already addresses this issue, no changes were made in response to this comment.*

Comment: L016-007

The commenter stated the final SEIS should use the term "unrestricted use" when referring to completed surface reclamation activities.

Response: *NRC staff agrees with the commenter that the "unrestricted use" term is correct when referring to surface reclamation activities. NRC staff reviewed the SEIS and did not find any instances where the description of completed surface reclamation activities warranted a change. Because the language in the SEIS was considered appropriate, no changes were made in response to this comment.*

Comment: L022-045

One commenter stated that the statement "Because hazardous and radioactive wastes are closely monitored throughout the United States, the potential impact from these activities would be expected to be SMALL" should be deleted. Not all hazardous and radioactive wastes are closely monitored throughout the United States, and the presence of governmental regulation/monitoring does completely guard against the occurrence of spills, leaks, accidents, improper disposal/treatment etc. that can have significant consequences for the environment.

Response: *The comment is noted. The discussion of waste management impacts has been revised in the final SEIS to describe the projected waste volume of different liquid and solid wastestreams generated by the proposed action compared to the available disposal capacity.*

B.5.34.3 Editorial—Programmatic

Comments: L008-005; L008-007; L008-020; L008-095; L008-102; L008-107; L008-114; L016-002; L016-003; L020-031; L020-037

Commenters suggested global changes to the text to clarify policy and programmatic issues in the SEIS.

Response: *Proposed changes were evaluated and made when appropriate. Where proposed changes were intended to correct inaccuracies or inconsistencies, they were checked for accuracy prior to incorporation in the SEIS.*

Comment: L006-009

The commenter stated that Section 3.6.3 does not segregate the species descriptions according to their protected status and as such is difficult to follow. The commenter recommended to group species descriptions according to their protected status under the following subtitles: threatened and endangered species, species proposed for listing, species designated by the BLM as sensitive species, and migratory birds.

Response: *SEIS Section 3.6.3, addresses federally listed species first followed by state-listed species of concern. The status of each federally-listed species is clearly described in an introductory statement followed by a life history description. The status of each state-listed species of concern is identified in Tables 3-4 and 3-6. No changes were made to the SEIS in response to this comment.*

Comments: L016-003; L008-002

Commenters requested the license not be referred to as a “source material license” but rather a “uranium recovery license” or a “combined source and 11e.(2) byproduct material license.”

Response: *According to NRC regulations in 10 CFR Part 40, the applicant is issued a “source material license.” No changes were made to the SEIS in response to this comment.*

Comment: L016-001

The commenter stated that the existing SEIS language concerning the preliminary recommendation on issuing a license was inadequate and should be rephrased to provide a clear understanding that the environmental review has resulted in a finding that the license should be issued.

Response: *As described in SEIS Section 1.6.1, the NRC licensing process includes a detailed technical review of the proposed Lost Creek ISR Project license application, which comprises both a safety review and an environmental review. These two reviews are conducted in parallel. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51. The focus of the safety review is to assess compliance with the applicable regulatory requirements in 10 CFR Part 20 and 10 CFR Part 40, Appendix A. NRC staff reviewed the*

SEIS language concerning the preliminary recommendation and determined that the text was consistent with the NRC licensing process. Because the information provided in the SEIS is considered appropriate, no changes were made in response to this comment.

Comment: L016-005

The commenter recommended that references to the proposed action as “mining” should be replaced with the term “milling.”

Response: *NRC staff agrees that the proposed action at Lost Creek should be described as milling rather than mining. NRC staff reviewed the descriptions of the proposed action in the draft SEIS and changed the text, where appropriate, when text referred to the proposed action.*

Comment: L016-006

The commenter noted NRC should use the terms “proposed,” “potential,” and “could” when referring to the proposed action and the impacts analyzed.

Response: *The draft Lost Creek ISR SEIS was published with the term “proposed” in front of each reference to the Lost Creek ISR Project. The word “potential” was used in front of “impacts” when appropriate. Because the words “potential” and “proposed” are used throughout the SEIS, the word “would” is used instead of “could” to indicate what impacts are most likely to occur from the proposed action. The word “would” is still conditional and appropriate. NRC staff reviewed the SEIS and made changes where appropriate.*

Comment: L017-041

The commenter expressed confusion about information provided in the SEIS regarding raptors and raptor nests in the proposed project area.

Response: *Based on the information provided in the ER, NRC staff has made changes to the SEIS in Section 3.6.1.2.4 and Table 3-5 to clarify the information regarding raptor nests.*

Comment: L020-036

One commenter stated NRC should clarify the SEIS text to differentiate the subtle differences in wording regarding water classifications.

Response: *NRC acknowledges this comment. SEIS Section 3.5.1 has been reworded to clarify differences between water classifications.*

Comments: L020-080; L020-087

The commenter asked NRC to see his/her earlier comments regarding information necessary to accurately characterize waste impacts.

Response: *The responses to comments regarding solid byproduct material are provided in Section B5.29.1. Changes made to the SEIS are identified in the responses.*

B.5.34.4 References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

LCI. "Lost Creek Project—South Central Wyoming, Environmental Report." ADAMS Accession Nos. ML073190550, ML073190655, ML073190657, ML073190060, and ML073201242. Casper, Wyoming: Lost Creek International, LLC. October 30, 2007.

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

APPENDIX C

ALTERNATE CONCENTRATION LIMITS

C ALTERNATE CONCENTRATION LIMITS

In-situ recovery (ISR) facilities operate by first extracting uranium from specific areas called wellfields. After uranium recovery has ended, the groundwater in the wellfield contains constituents that were mobilized by the lixiviant. Licensees shall commence aquifer restoration in each wellfield soon after the uranium recovery operations end (NRC, 2009). Aquifer restoration criteria for the site-specific baseline constituents are determined either for each individual well or as a wellfield average.

U.S. Nuclear Regulatory Commission (NRC) licensees are required to return water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in the regulations: “5B(5)―At the point of compliance, the concentration of a hazardous constituent must not exceed―(a) The Commission approved background concentration of that constituent in the groundwater; (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or (c) An alternate concentration limit (ACL) is established by the Commission.”

For an ACL to be considered by the NRC, a licensee must submit a license amendment application to request an ACL. In this ACL license amendment request, the licensee must provide the basis for any proposed limits including consideration of practicable corrective actions that limits are as low as reasonably achievable (ALARA), and information on the factors the Commission must consider. The NRC will establish a site-specific ACL for a hazardous constituent as provided in paragraph 5B(5) if the NRC finds the proposed limit as ALARA, after considering practicable corrective actions, and determining that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

To determine if the ACL does not pose a potential hazard to human health or the environment, NRC performs three risk assessments (NRC, 2003a). The first is a hazard assessment which evaluates the radiological dose and toxicity of the constituents in question and the risk to human health and environment. The second is an exposure assessment to examine the existing distribution of hazardous constituents, as well as potential sources for future releases and the potential consequences associated with the human and environmental exposure to the hazardous constituents. The last assessment is a corrective action assessment which evaluates (1) all applicant proposed corrective actions; (2) the technical feasibility of each proposed corrective actions; (3) the costs and benefits associated with each proposed corrective action; and (4) the preferred corrective action to achieve the hazardous constituent concentration which is protective of human health and the environment.

To perform these assessments, the NRC staff uses a rigorous review process. Licensees must provide a comprehensive ACL amendment that addresses groundwater and surface water quality and expected impacts on human health and the environment. Such information required in an amendment request pursuant to 10 CFR Part 40, Appendix A, Criterion 5B(6) includes the following factors:

- Potential adverse effects on groundwater quality, considering the following:

  - The physical and chemical characteristics of the waste in the licensed site including its potential for migration

  - The hydrogeologic characteristics of the facility and surrounding land

- The quantity of groundwater and the direction of groundwater flow
- The proximity and withdrawal rates of groundwater users
- The current and future uses of groundwater in the area
- The existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality
- The potential for health risks caused by human exposure to waste constituents
- The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
- The persistence and permanence of the potential adverse effects.

• Potential adverse effects on hydraulically connected surface water quality, considering the following:

- The volume and physical and chemical characteristics of the waste in the licensed site
- The hydrogeologic characteristics of the facility and surrounding land
- The quantity and quality of groundwater, and the direction of groundwater flow
- The patterns of rainfall in the region
- The proximity of the licensed site to surface waters
- The current and future uses of surface waters in the area and any water quality standards established for those surface waters
- The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality
- The potential for health risks caused by human exposure to waste constituents
- The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
- The persistence and permanence of the potential adverse effects.

Although state “class of use” standards are not recognized in NRC’s regulations as restoration standards, these standards may be considered as one factor in evaluating ACL requests for ISR facilities located in Wyoming. Furthermore, in considering ACL requests, particular importance is placed on protecting underground sources of drinking water (USDWs). The use of modeling and additional groundwater monitoring may be necessary to show that ACLs in ISR wellfields would not adversely impact USDWs. It must be demonstrated that the licensee has attempted to restore hazardous constituents in groundwater to background or a maximum contaminant level—whichever level is higher.

Before an ISR licensee is allowed to extract uranium, the U.S. Environmental Protection Agency (EPA) under 40 CFR Part 146.4 and in accordance with the Safe Drinking Water Act must issue an aquifer exemption covering the portion of the aquifer in which the uranium-bearing rock is located. The EPA cannot exempt the portion of the aquifer unless it is found that “it does not currently serve as a source of drinking water” and “cannot now and will not in the future serve as a source of drinking water”. Due to these criteria, only impacts outside of the exempted aquifer are evaluated. In most cases, the water in aquifers adjacent to the uranium ore zones does not meet drinking water standards. The staff will not approve an ACL if it will impact any adjacent USDWs. Therefore, the impact of granting an ACL request is SMALL.

Further guidance for the review of ACLs for ISR facilities is being developed in a revision of NUREG–1569 (NRC, 2003b). Existing guidance for the review of ACLs for conventional mills is in NUREG–1620, “Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978.” (NRC, 2003a).

References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy.* Part 40, Appendix A, “Criteria Relating to the Operations of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily From their Source Material Content.”

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of Environment.* Part 146, “Underground Injection Control Program: Criteria and Standards.”

NRC. NUREG–1910, “Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities.” Washington, DC: May 2009.

NRC. NUREG–1620, “Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978.” Final Report. Washington, DC. NRC. June 2003a.

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

APPENDIX D

NONROAD COMBUSTION ENGINE EMISSIONS ESTIMATES

CONTENTS

TABLES

ABBREVIATIONS/ACRONYMS

CO_2	carbon dioxide
CO	carbon monoxide
EF_i	emission factors
EPA	U.S. Environmental Protection Agency
HP_r	horsepower
ISR	*in-situ* recovery
MMBtu	million British Thermal Units
OT_r	operating time
PM_{10}	particulate matter
SEIS	supplemental environmental impact statement
SO_x	sulfur oxides
NO_x	nitrogen oxides
NRC	U.S. Nuclear Regulatory Commission
VOCs	volatile organic compounds
WDEQ	Wyoming Department of Environmental Quality

D NONROAD COMBUSTION ENGINE EMISSIONS ESTIMATES

D.1 Introduction

The primary nonradiological emissions from *in-situ* recovery (ISR) facilities include diesel combustion engine emissions from construction equipment (including drilling rigs) and fugitive dust emissions from vehicular travel on unpaved roads (NRC, 2009, Section 2.7.1). This appendix provides estimates of the expected nonroad combustion engine emissions from the proposed action. Fugitive dust emissions are described in the supplemental environmental impact statement (SEIS) and, therefore, those emissions are not described further in this appendix.

The U.S. Nuclear Regulatory Commission (NRC) has previously evaluated combustion engine emissions associated with ISR facilities in prior licensing actions (NRC, 1997, 2004) and has characterized the potential impacts to air quality as minor. Drilling rigs used during construction of these facilities, in particular, are not presently subject to State of Wyoming new source emissions permitting, and applicants that propose facilities in attainment areas (i.e., areas in compliance with ambient air quality standards) are not presently required by the state to document their emissions from these sources. Similarly, the NRC has not routinely requested detailed nonradiological emissions information from applicants. As a result, existing information pertaining to ISR construction emission activities is limited. Nonetheless, to address recent concerns expressed in public comments on the draft SEIS about potential air quality impacts (EPA, 2010), representative emissions estimates are calculated in this appendix.

Based on the similarities in design and construction of ISR facilities and the nature of associated nonradiological emissions, the nonroad combustion engine exhaust calculations in this section are based on a combination of proposal-specific and other general information that the staff considers adequate to support a conservative emissions screening analysis. The current calculations incorporate the best available information the applicant provided for the proposed action; representative information other NRC applicants provided as applicable; and emissions factors U.S. Environmental Protection Agency (EPA) developed. Mobile road (vehicle) combustion emissions were not calculated here, because these engine emissions are controlled at the source by mandated emission control technology and the magnitude of proposed road vehicle activity is small relative to existing road traffic (Section 4.3).

The calculations in this appendix were conducted to support the NRC evaluation of potential environmental impacts to air quality from the proposed action. These calculations are provided to meet NRC obligations pursuant to the National Environmental Policy Act of 1969, as amended, to more completely disclose the potential environmental impacts from the proposed action. While NRC is responsible for assessing the potential environmental impacts from the proposed action, NRC does not have the authority to develop or enforce regulations to control nonradiological air emissions from equipment licensees used. This authority rests with the State of Wyoming Department of Environmental Quality (WDEQ). To ensure the air quality of Wyoming is adequately protected, in addition to addressing all NRC regulatory requirements regarding radiological emissions, NRC applicants and licensees must also comply with all applicable State and Federal air quality regulatory compliance and permitting requirements.

D.2 Nonroad Diesel Combustion Engine Exhaust Emissions Calculation Methods

D.2.1 Well Drilling Emissions Calculations

ISR facilities are constructed using commonly available construction equipment, including truck-mounted or mobile drilling rigs (NRC, 2009). Based on past estimates (NRC, 2004), NRC staff expects well-drilling activities would represent the majority of nonroad combustion engine emissions during the construction period for the proposed Lost Creek Project. Emissions from diesel combustion engines, including drilling rigs, that the staff evaluated for potential impacts to air quality include nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), particulate matter (PM_{10}), formaldehyde, volatile organic compounds (VOCs), and carbon dioxide (CO_2). Carbon dioxide (CO_2) emissions were calculated to support the NRC evaluation of greenhouse gas emissions in the SEIS.

Diesel emissions were estimated using emission factors the EPA developed. Emissions factors provide the ratio of the mass of a pollutant emitted to the atmosphere by a source engine to the level of activity of the emission source (Eastern Research Group, 1996). The level of activity of the emission source in an emission factor is represented by power output (in horsepower-hours) or fuel use represented by heat energy of combusted fuel in million British Thermal Units (MMBtu). EPA developed emission factors for different engine classes based on its review of a variety of engine test data (EPA, 1996, 2004). Currently available EPA documentation of emissions factors for diesel combustion engines includes AP–42 (EPA, 1996) and a more recent update of emissions factors for the EPA NONROAD model (EPA, 2004). WDEQ recognizes AP–42 as a source for emissions factors that may be used to estimate emissions from drilling rigs (WDEQ, 2010a), while the NONROAD model factors represent a more current data source. For the following calculations, the emissions factors from AP–42 (EPA, 1996) were used. The updated emissions factors for the NONROAD model are considered for context in the discussion of the calculated emissions results.

WDEQ (2010a) provides methods for calculating emissions from drilling rigs based on fuel use. The WDEQ calculation methods are from worksheets provided to minor oil and gas emitters in a proposed ozone nonattainment area in southwestern Wyoming (Finley, 2010). These methods were adapted to the current analysis and are summarized by the following equations

$$E_{tot,r,i} = F_{tot,r}\, HC_{fuel}\, EF_i\, U_{conv} \qquad \text{(D.2–1)}$$

where

$E_{tot,r,i}$ — annual total emissions for drilling rig type *r* and pollutant *i* [tons/yr]
$F_{tot,r}$ — annual fuel use for drilling rig type *r* [gal/yr]
HC_{fuel} — heat content of diesel fuel [Btu/gal]
$EF_{i,r}$ — emission factor for pollutant *i* from drilling rig type *r* [lb/MMBtu]
U_{conv} — unit conversion [MMBtu/1E + 6 Btu] [ton/2000lb]

and

$$F_{tot,r} = \sum_n DT_{n,r}\, FC_r \qquad \text{(D.2–2)}$$

where

DT_n	—	duration of drilling for individual well *n* [hr]
FC_r	—	hourly fuel consumption for drilling rig type *r* [gal/hr]

Input parameters for well drilling equipment diesel emission calculations are provided in Tables D.2–1, D.2–2, and D.2–3. Proposed drilling activities include (i) drilling water wells for wellfield operations and associated monitoring and (ii) drilling deep disposal wells for disposal of operational liquid wastes. Water well drilling would involve truck-mounted drilling equipment that requires, on average, 12 hours of drilling per well and consumes approximately 9.5 L [2.5 gal] of diesel fuel per hour (LCI, 2010b). These operational water wells would be drilled to the depth of the ore body {approximately 91 to 213 m [300 to 700 ft]} (LCI, 2010a). Deep disposal well drilling would go to greater depths relative to the water wells. According to the applicant underground injection control permit WDEQ issued (WDEQ, 2010b), all the injection zones are at depths greater than 1,829 m [6,000 ft]. Such drilling requires a more powerful drilling rig that consumes more fuel than a water well drilling rig. The applicant estimates it will take approximately 528 hours of drilling and consume about 212 L [56 gal] of diesel fuel per hour to complete (LCI, 2010b). The applicant proposes to construct six wellfields and drill as many as five deep wells, although the schedule for deep well drilling has not yet been provided. Because the proposed wellfield development is phased over a period of years (Figure 2-1), annual emissions calculations consider the construction activities that would occur in any single year during the construction phase. As shown in Figure 2-1 in the SEIS, the applicant's schedule for wellfield construction allocates about 2 years per wellfield and, for a number of years, plans overlapping construction activities for two wellfields. Therefore, the total annual construction time for years where wellfield construction overlaps is assumed to be 2 years, or the equivalent of constructing a single wellfield in a year. Considering this schedule information, the initial calculation of annual emissions from the proposed Lost Creek ISR facility in this appendix assumes the drilling of one complete wellfield and two deep wells in a single year. Results are then scaled to evaluate different deep well construction options. To account for the differences in the two types of drilling operations (i.e., water wells, deep disposal wells), emissions calculations were conducted for each type of drilling activity. Input parameters for each activity are provided in Table D.2–1.

D.2.2 Construction Equipment Emissions Calculations

In addition to the use of drilling rigs, proposed wellfield construction involves the use of common diesel-powered construction equipment that would also contribute to air emissions. Emissions from this equipment were calculated using emission factors based on power output and operating time using the following equation

$$E_{tot,r,i} = HP_r \, OT_r \, EF_i \, U_{conv} \qquad \text{(D.2–3)}$$

where

$E_{tot,r,i}$	—	annual total emissions for construction equipment type *r* and pollutant *i* [tons/yr]
HP_r	—	engine horsepower rating for construction equipment type *r* [hp]
OT_r	—	operating time for construction equipment type *r* [hr/yr]
$EF_{i,}$	—	emission factor for pollutant *i* for diesel industrial engines [lb/hp-hr]
U_{conv}	—	unit conversion [ton/2,000lb]

Table D.2–1. Well Drilling Input Parameters for Emissions Calculations

Parameter	Symbol	Value	Remarks
Duration of drilling activities for 400 water wells [hr]	$\sum_n DT_{n,r}$	4,753	Staff estimate for drilling one wellfield based on the drilling times the applicant* provided and the current proposed number of wells for wellfield #1
Hourly fuel consumption for truck-mounted drilling rig [gal/hr]	$FC_{r\ water}$	2.5	Applicant* provided
Annual fuel use for truck-mounted water well drilling rigs [gal/yr]	$F_{tot,r\ water}$	11,884	Staff calculated from drilling duration and hourly fuel consumption
Duration of drilling activities for 2 deep waste disposal wells [hr]	$\sum_n DT_{n.r}$	1,056	Double the value the applicant* provided for drilling 1 deep well
Hourly fuel consumption for deep well drilling rig [gal/hr]	$FC_{r\ deep}$	56.25	Applicant* provided.
Annual fuel use for 2 deep well drilling rigs [gal/yr]	$F_{tot,r\ deep}$	59,400	Staff calculated from drilling duration and hourly fuel consumption
Heat content of diesel fuel [Btu/gal]	HC_{fuel}	137,000	Value from EPA AP–42†

*LCI (2010b)
†EPA (1996)
To convert from gal to L multiply by 3.785

Table D.2–2. Emissions Factors ($EF_{i,}$) for Uncontrolled Diesel Industrial Engines (lb/MMBtu)

Pollutant	Value*
Nitrogen Oxides (NO_x)	4.41
Carbon Monoxide (CO)	0.95
Sulfur Oxides (SO_x)	0.29
Particulate Matter (PM_{10})	0.31
Carbon Dioxide (CO_2)	164
Formaldehyde	0.00118
Volatile Organic Compounds (VOCs)	0.35

Source: EPA (1996) (Chapter 3.3, Tables 3.3-1 and 3.3-2).
*To convert from lb/MMBtu to ng/J, multiply by 430.

Table D.2–3. Emissions Factors ($EF_{i,}$) for Large Stationary Diesel Engines (lb/MMBtu)

Pollutant	Value
Nitrogen Oxides (NO_x)	3.2
Carbon Monoxide (CO)	0.85
Sulfur Oxides (SO_x)	1.01
Particulate Matter (PM_{10})	0.10
Carbon Dioxide (CO_2)	0.85
Formaldehyde	7.89×10^{-5}
Volatile Organic Compounds (VOC)	0.09

Source: EPA (1996) (Chapter 3.4, Tables 3.4-1 and 3.4-3).

Input parameters used in the construction equipment emissions calculations, including the types of equipment the applicant could use during the construction period, operating times for this equipment, and applicable emission factors, are provided in Tables D.2–4 and D.2–5. The information in Table D.2–4 summarizes detailed equipment emissions information the applicant (LCI, 2010b) voluntarily submitted to WDEQ to support a survey of small emitters. Table D.2–5 lists the applicable power-output-based emissions factors for diesel industrial engines.

D.2.3 Reclamation Equipment Emissions Calculations

The emissions during the construction period are expected to bound annual emissions from the operations and aquifer restoration phases because the use of diesel-powered equipment during those phases is much less than during construction (NRC, 2004). Construction equipment used during decommissioning and reclamation (hereafter, reclamation) is expected to be similar to the construction phase (NRC, 2004) because many aspects of reclamation, in effect, are the reverse of the activities conducted during construction. During construction, well drilling and facility construction activities predominate, while during reclamation, diesel equipment is used for other activities such as well plugging and abandonment, equipment removal, and land reclamation. The applicant plans to take 1 year to reclaim each wellfield and 2 years to reclaim the plant facilities, as shown in SEIS Figure 2-1.

Emissions for diesel equipment used for reclamation activities were calculated using the same methods as in Section D.2.2 for construction equipment [Eq. (D.2–3)], although input parameters were revised for equipment horsepower and operating times to reflect available information on the proposed reclamation activities. NRC staff identified the most detailed and complete information on proposed activities in the surety estimate for the proposed facility (LCI, 2010c).

Limited information on equipment was provided in the applicant’s surety; however, because equipment needed for ISR reclamation work would be similar among sites, the equipment was assumed to be similar to that another applicant described (EMC, 2007). Based on the available equipment information, specific equipment models were selected by reviewing documentation of commonly used reclamation equipment developed by the WDEQ (2009).

Equipment horsepower information for specific models was obtained from manufacturer documentation. A few items of equipment were only generally described in the surety estimate as truck and/or tow vehicles for well abandonment activities and these were assumed to be rated at 250 horsepower. Operating times for each item of equipment were derived from detailed information and assumptions on specific reclamation activities discussed in the applicant surety estimate (LCI, 2010c), including building demolition floor removal; pipeline removal; well abandonment; and reclamation of disturbed surface areas such as wellfields, facilities areas, and access roads. Equipment usage was not explicitly called out in the applicant surety for specific activities (e.g., back hoe, track hoe, dozer, dump truck, scraper, motor grader), so operating times were estimated based, in part, on assumptions about which reclamation activities would utilize the equipment (e.g., back hoe and track hoe for excavation, the motor grader for road grading and grading cleared foundation areas, the dozer for ripping packed land surface areas, the dump truck for transporting excavated topsoil, the scraper was assigned the same hours as for the construction work discussed in Section D.2.2). Information on equipment productivity, such as grading or ripping rates and payload amounts, was obtained from the aforementioned WDEQ documentation (WDEQ, 2009). The resulting equipment and operation times are provided in Table D.2–6. The emissions factors used in the calculations are provided in Table D.2–5.

Table D.2–4. Horsepower and Operating Times (hr/yr) for Diesel Construction Equipment

Equipment	Horsepower (HP_r)	Operating Time (OT_r)
Lull 944E Telehandler	110	392
John Deere 710J Backhoe	126	313
John Deere 410 Backhoe	66	209
Truck	250	78
John Deere Loader	200	44
Scraper	600	44
Blade	300	33
Caterpillar D8 Dozer	321	10
Source: LCI (2010b)		

Table D.2–5. Emissions Factors (EF_i) for Uncontrolled Diesel Industrial Engines (lb/hp-hr)

Pollutant	Value*
Nitrogen Oxides (NO_x)	0.031
Carbon Monoxide (CO)	0.00668
Sulfur Oxides (SO_x)	0.00205
Particulate Matter (PM_{10})	0.00220
Carbon Dioxide (CO_2)	1.15
Formaldehyde	0.00000826
Volatile Organic Compounds (VOC)	0.00247
Source: EPA (1996) (Chapter 3.3, Tables 3.3-1 and 3.3-2). *To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608.	

Table D.2–6. Horsepower and Operating Times (hr) for Diesel Reclamation Equipment

Equipment	Horsepower (HP_r)	Operating Time (OT_r)
Dump Truck	250	2170
Caterpillar 320DL Track Hoe	148	920
Caterpillar 430E Backhoe	101	845
Heavy Truck	250	800
Lull 944E Telehandler	110	450
New Holland 545D Tractor	63	104
Caterpillar D9 Dozer	474	60
Caterpillar 657G Scraper	600	50
Caterpillar 16H Motor Grader	265	6
Sources: Derived by staff from information in the following references: Energy Metals Corporation US (EMC) (2007); LCI (2010b); WDEQ (2009)		

D.3 Results and Discussion

The initial estimated annual emissions from well drilling and construction equipment are provided in Tables D.3–1 and D.3–2. These results apply to completing the first proposed wellfield (Mine Unit #1) and two deep disposal wells in 1 year. The total estimated annual emissions from both calculations combined are provided in Table D.3–3. The combined results for drilling and construction equipment show CO_2 and NO_x annual emissions are the highest of the pollutants evaluated. For well drilling equipment, the rig used for the two deep disposal wells generated higher annual emissions estimates when compared to the emissions from drilling all of the water wells for a single wellfield (400 wells). This result is explained by the larger, more fuel-consuming engine used by a deep well rig in comparison to the smaller water well rig and the long drilling time per well required for deep drilling. For example, in this calculation, the deep well drilling is estimated to emit 78 percent of the annual NO_x drilling emissions, compared with water well drilling of 400 wells that represents 22 percent of the annual drilling NO_x emission total. Compared with the calculated drilling emissions, the magnitude of the calculated construction equipment emissions is small. The total construction equipment emissions of NO_x are 13 percent of the total annual NO_x from all activities included in the calculations, while drilling activities constitute the remaining 87 percent of the total emissions.

Considering the applicant could decide to drill more than two deep disposal wells during initial construction, the deep well emissions in Table D.3–1 are weighted to match the additional wells that would be drilled. To evaluate that scenario, the deep well emission results in Table D.3–1 (that are based on drilling two deep disposal wells) are first divided by two and then multiplied by the new total number of wells that would be drilled. For the Lost Creek ISR facility, the applicant proposes a maximum of five deep disposal wells (WDEQ, 2010b). Therefore, the maximum annual emissions would occur if the applicant drilled all five deep disposal wells during the second year of initial construction (Figure 2-1) during the time when two wellfields were also being constructed (which, as discussed previously in Section B.2.1, based on the timing of construction for each wellfield equates to constructing a single wellfield in one year). The emissions resulting from this scenario (the applicant constructing one wellfield and five deep disposal wells in 1 year) are provided in Table D.3–4.

The emissions estimates are expected to be conservative because they are based on emissions factors applicable to engines that have no pollution controls. Table D.3–5 provides a comparison of the EPA AP–42 factors (EPA, 1996) that were used for the calculations in this appendix with updated emission factor values (EPA, 2004) that are based on more recent data that apply to engines with pollution controls (Tier 1 representing the first phase of standards that the Federal Government mandated in four phases of increasing limits). Table D.3–5 shows that calculated emissions estimates for NO_x and CO would be reduced approximately by a factor of two and PM_{10}, and VOC emissions by a factor of five if the updated emission factors were used. Because the actual equipment that would be used is uncertain, the assumption of an applicant using older, uncontrolled engines bounds the emissions should older equipment be selected for this work. That assumption also provides margin in the estimates if the actual selected equipment meets emission standards.

Table D.3–1. Calculated Annual Emissions From Well Drilling Activities* (tons/yr)

Drilling Activity	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOC†
Operational wellfield (water well) drilling	3.6	0.77	0.24	0.25	134	0.0010	0.29
Deep well drilling	13	3.5	0.20	0.41	670	0.00032	0.37
Total	17	4.2	0.44	0.66	800	0.0013	0.66

Includes drilling and construction of the first proposed wellfield and two deep disposal wells.
*To convert tons to metric tons, multiply by 0.907.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO = carbon dioxide; VOC = volatile organic compounds.

Table D.3–2. Calculated Annual Emissions From Construction Equipment* (tons/yr)

Equipment	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOC†
Lull 944E Telehandler	0.67	0.14	0.044	0.047	25	0.00018	0.053
JD 710J Backhoe	0.61	0.13	0.040	0.043	23	0.00016	0.049
JD 410 Backhoe	0.21	0.046	0.014	0.015	7.9	0.000057	0.017
Truck	0.30	0.065	0.020	0.022	11	0.000081	0.024
JD Loader	0.13	0.029	0.0089	0.010	5.0	0.000036	0.011
Scraper	0.40	0.087	0.027	0.029	15	0.00011	0.032
Blade	0.15	0.033	0.010	0.011	5.7	0.000041	0.012
CAT D8 Dozer	0.052	0.011	0.0034	0.0037	1.9	0.000014	0.0041
Total	2.5	0.55	0.17	0.18	94	0.00068	0.20

*Includes equipment used to support drilling and wellfield development operations.
*To convert tons to metric tons, multiply by 0.907.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO = carbon dioxide; VOC = volatile organic compounds.

Table D.3–3. Total Calculated Annual Emissions From Drilling and Construction* (tons/yr)

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOC†
Well drilling and construction	19	4.8	0.61	0.84	900	0.0020	0.86

Includes drilling and construction of the first proposed wellfield and two deep disposal wells. Results are the sum of total emissions from Tables D.3–1 and D.3–2.
*To convert tons to metric tons, multiply by 0.907.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO = carbon dioxide; VOC = volatile organic compounds.

Table D.3–4. Adjusted* Annual Diesel Emissions from Drilling and Construction (tons/yr)

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde†	VOC†
Development of the first proposed wellfield and two deep wells in 1 year adjusted to add emissions from 3 additional deep wells	39	10	0.91	1.4	2100	0.0024	1.4

*Results from Table D.3–3 adjusted to account for additional emissions if the applicant drills all five deep disposal wells in 1 year
*To convert tons to metric tons, multiply by 0.907.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO = carbon dioxide; VOC = volatile organic compounds.

Table D.3–5. Effect of Using Updated Emissions Factors That Account for Pollution Controls

Pollutant	1996 Uncontrolled Emission Factor for Diesel Industrial Engines (lb/hp-hr)	2004 Updated Value (Tier 1 Controlled 300-600 HP Diesel Engines)(lb/hp-hr)	Reduction Ratio (Updated/ Uncontrolled)
Nitrogen Oxides (NO_x)	0.031	0.0132	0.42
Carbon Monoxide (CO)	0.00668	0.00288	0.43
Particulate Matter (PM_{10})	0.00220	0.00044	0.20
Volatile Organic Compounds (VOC)	0.00247	0.000446	0.18
Source: EPA, 2004; EPA, 1996. To convert lb/hp-hr to kg/kw-hr, multiply by 0.608			

The results of emissions calculations for the reclamation activities are provided in Table D.3–6. Because wellfield reclamation for each wellfield is planned to take 1 year and the applicant proposes to decommission one wellfield per year using a sequenced approach (Figure 2–1), the results in Table D.3–6 are considered representative of annual emissions during the decommissioning phase of the proposed ISR facility. Many of the total values in Table D.3–6 are less than the annual emissions calculated for wellfield construction (in Table D.3–3) by approximately a factor of about two or less for several of the pollutants evaluated (NO_x, CO, CO_2). Annual emissions results for reclamation that are notably higher (SO_2, formaldehyde) than construction emissions results were higher by less than a factor of two, relative to the comparable construction emissions. A similar comparison with the adjusted emissions results that account for drilling all deep disposal wells in a single year in Table D.3–4 shows all annual emissions for reclamation are similar to or less than the construction emissions with the exception of formaldehyde, which is higher for reclamation.

Cumulative emissions for the proposed action were also approximated using the calculated emissions results and the number of wellfields and deep disposal wells the applicant proposed. For the purpose of this analysis, cumulative emissions are the emissions from all phases of the proposed action for the duration of the ISR facility lifecycle. Because the principal diesel emissions from the proposed action are associated with equipment used for constructing and decommissioning the project, the analysis focuses on the emissions from those phases. The initial calculated (and tabulated) annual emissions in Tables D.3–1, D.3–2, and D.3–6 apply to constructing a single wellfield, two deep disposal wells, and reclaiming a single wellfield and facilities. Assuming these emissions are representative of the construction and reclamation of the other wellfields to be developed, these results scale with the total number of wellfields and deep wells that are proposed. Because the applicant proposal includes phased construction of six wellfields (Figure 2-1) and as many as five deep disposal wells and each of these wellfields would require reclamation when operations and aquifer restoration are completed, the cumulative emissions for the proposed action were conservatively approximated by multiplying the sum of the calculated pollutant-specific water well drilling and construction emissions from Tables D.3–1 and D.3–2 and the reclamation emissions from Table D.3–6 by a factor of six. The deep well emissions from Table D.3–1 (applicable to drilling two deep wells) were divided by a factor of two and multiplied by five to calculate the emissions applicable to drilling five deep disposal wells. The resulting cumulative emissions for the proposed action are provided in Table D.3–7. To summarize, the cumulative emissions totals include the calculated diesel

Table D.3–6. Calculated Diesel Equipment Emissions (tons/yr) From Reclamation of One Wellfield and the Plant Facilities*

Equipment	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOC†
Dump Truck	8.4	1.8	0.56	0.60	310	0.0022	0.67
Caterpillar 320DL Track Hoe	2.1	0.45	0.14	0.15	78	0.00056	0.17
Heavy Truck	3.1	0.67	0.21	0.22	120	0.00083	0.25
Caterpillar 430E Backhoe	1.3	0.29	0.087	0.094	49	0.00035	0.11
Lull 944E Telehandler	0.77	0.17	0.051	0.054	28	0.00020	0.061
New Holland 545D Tractor	0.10	0.022	0.0067	0.0072	3.8	0.000027	0.0081
Caterpillar 657G Scraper	0.47	0.10	0.031	0.033	17	0.00012	0.037
Caterpillar D9 Dozer	0.44	0.095	0.029	0.031	16	0.00012	0.035
Caterpillar 16H Motor Grader	0.025	0.0053	0.0016	0.0017	0.91	0.0000066	0.0020
Total	17	3.6	1.1	1.2	620	0.0045	1.3

The applicant plans reclamation of a single wellfield over a 1-year period, so the results approximate the annual emissions during the reclamation phase.
*To convert tons to metric tons, multiply by 0.907.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} = particulate matter; CO = carbon dioxide; VOC = volatile organic compounds

Table D.3–7 Estimated Cumulative Emissions of the Proposed Action* (tons)

Activities	NO_x†	CO†	SO_2†	PM_{10}†	CO_2†	Formaldehyde	VOC†
Well drilling and construction of 6 wellfields and 5 deep wells and reclamation of all wells and facilities	170	38	9.6	11	6800	0.037	12

The planned duration of the proposed action represents a phased construction, operation, aquifer restoration, and reclamation schedule for each wellfield and central plant over a period of 12 years.
*To convert tons to metric tons, multiply by 0.907.
†NO_x = nitrogen oxides; CO = carbon monoxide; SO_x = sulfur oxides; PM_{10} – particulate matter; CO = carbon dioxide; VOC = volatile organic compounds

emissions from constructing 6 proposed wellfields, 5 proposed deep disposal wells, and reclaiming all wells and facilities over a 12-year period. The cumulative results are conservative, in part, because the (factor of six) multiplier overcounts the contribution from the plant facilities decommissioning that is included in each wellfield reclamation emissions calculation.

D.4 References

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APPENDIX E

MEMORANDUM OF AGREEMENT
AMONG UNITED STATES NUCLEAR REGULATORY COMMISSION WYOMING STATE HISTORIC PRESERVATION OFFICER, BUREAU OF LAND MANAGEMENT RAWLINS FIELD OFFICE, NORTHERN ARAPAHO TRIBE, EASTERN SHOSHONE TRIBE, AND LOST CREEK ISR, LLC REGARDING ARCHEOLOGICAL DATA RECOVERY AT 48SW16604, SWEETWATER COUNTY, WYOMING.

MEMORANDUM OF AGREEMENT
AMONG UNITED STATES NUCLEAR REGULATORY COMMISSION, WYOMING STATE HISTORIC PRESERVATION OFFICER, BUREAU OF LAND MANAGEMENT RAWLINS FIELD OFFICE, NORTHERN ARAPAHO TRIBE, EASTERN SHOSHONE TRIBE, AND LOST CREEK ISR, LLC REGARDING ARCHEOLOGICAL DATA RECOVERY AT 48SW16604, SWEETWATER COUNTY, WYOMING.

WHEREAS, the U. S. Nuclear Regulatory Commission (NRC) acknowledges and accepts as guidance the Advisory Council on Historic Preservation's (ACHP) "Recommended Approach for Consultation on Recovery of Significant Information from Archeological Sites," published in the *Federal Register* on May 18, 1999 (vol. 64, no. 95, p. 27085), as part of its revised regulations (36 CFR Part 800) for implementing Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA, 16 U.S.C. 470); and

WHEREAS, the NRC, the Wyoming State Historic Preservation Office (SHPO), Lost Creek ISR, LLC (LCI), and Bureau of Land Management Rawlins Field Office (BLM) (collectively hereafter called "Signatories") agree that site 48SW16604 is a historic property eligible under 36 CFR Part 60.4, Criterion D, that will be adversely affected by uranium recovery activities as presently planned; and

WHEREAS, the NRC has contacted the Northern Arapaho Tribe (NAT) and the Eastern Shoshone Tribe (EST) and has invited them as Signatories, and they have agreed to participate; and

WHEREAS, the NRC is the lead federal agency for this undertaking (Lost Creek ISR Facility) for purposes of compliance with Section 106 of the NHPA; and

WHEREAS, site 48SW16604 is located on land managed by the BLM Rawlins Field Office, which will carry out certain responsibilities identified in this MOA; and

WHEREAS, the "Treatment Plan for Mitigative Excavation of Prehistoric Site 48SW16604 for the Proposed Lost Creek ISR Project in Sweetwater County, Wyoming" (Treatment Plan), is incorporated herein by reference; and

WHEREAS, in accordance with 36 CFR Part 800.6(a)(1), NRC has notified the ACHP of its adverse effect determination with documentation specified in 36 CFR 800.11(e) and the ACHP has chosen not to participate in the consultation; and

WHEREAS, in accordance with 36 CFR 800.6(b)(1)(iv), NRC shall submit this MOA, along with the documentation specified in 36 CFR 800.11(f), to the ACHP prior to approving the Undertaking in order to meet the requirements of Section 106 and 36 CFR 800.6(b)(1); and

WHEREAS, the NRC, the BLM, the Northern Arapaho Tribe, the Eastern Shoshone Tribe, and State of Wyoming and SHPO do not waive their sovereign immunity by entering into this MOA, and each fully retains all immunities and defenses provided by law with respect to any action based on, or occurring as a result of, this MOA; and

WHEREAS, signing of this MOA does not constitute a record of decision or approval of the Lost Creek ISR project, by any of the consulting Federal agencies; and

WHEREAS, this MOA, consisting of seven pages, represents the entire and integrated agreement between the Signatories and supersedes all prior negotiations, representations and agreements, whether written or oral, regarding Section 106 review of the effects of the Lost Creek ISR project on site 48SW16604.

NOW, THEREFORE, the Signatories agree that, if approved, the Lost Creek ISR project shall be implemented in accordance with the following stipulations to mitigate the adverse effects of uranium recovery activities at site 48SW16604.

STIPULATIONS

A. DATA RECOVERY

1. Prior to the construction of any facilities within 200 feet of site 48SW16604, the data recovery program shall be implemented by LCI in accordance with the Treatment Plan prepared by Centennial Archaeology, Inc., dated January 2008, and incorporated into this MOA by reference.

2. The BLM will issue a renewal of the existing Cultural Resource Use Permit for Excavation or Removal for the data recovery to proceed and will monitor data recovery activities as needed.

B. NAGPRA CONSIDERATIONS

1. To the best of the Signatories' knowledge and belief, no human remains, associated or unassociated funerary objects or sacred objects, or objects of cultural patrimony as defined in Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001), are expected to be encountered during data recovery work. However, should human remains be encountered, work will immediately stop in the vicinity of the discovery, the area will be secured, and the archaeological field director will immediately contact the BLM and NRC. The BLM will notify the Sweetwater County Sheriff's office and Sweetwater County Coroner's office and the SHPO. If the human remains are determined to be Native American, the BLM will be responsible for compliance with the provisions of NAGPRA.

C. REPORTING

1. Upon completion of field work, a letter report briefly describing the results of field work, and a statement of confidence that completed investigations have met data recovery plans and adequately mitigated adverse effects, will be submitted by LCI to the Consulting Signatories for their review and comment.

   Upon approval of the letter report by the BLM and the SHPO, BLM will issue a formal Notice to Proceed to LCI.

2. A final report detailing results of data recovery efforts and mitigation procedures will be submitted by LCI to the Signatories for review no later than 24 months following the completion of field work, unless the Signatories mutually agree to an extension of this deadline.

3. The consulting archaeologist will prepare a summary journal article to be submitted to the editor of the *Wyoming Archaeologist* on the results of the data recovery within six months of the acceptance of the final data recovery report. The article should consist of summary information and results of the data recovery; approximately three to five standard 8 1/2 x 11 pages of text, two or three photographs and one or two illustrations. This information should be derived directly from the data recovery report and no new research is required. The editor of the Wyoming Archaeologist is not required to publish the report in the journal. Submission of the article by the consulting archaeologist completes the responsibility under this MOA. If data recovery **does not** provide information appropriate for a journal publication, consulting archaeologist will notify LCI and all Signatories will consult on the appropriateness of this stipulation. The Signatories will document the discussion and decision made in writing. The publication of the summary of the results of the excavations will make the information available to the general public.

D. PERMITTING AND INSPECTIONS

1. NRC shall require as a condition of any license issued to LCI, that LCI complies with the cultural resource Treatment Plan described in **STIPULATION A.1.** and the provisions in this MOA.

2. Any NRC license conditions will be enforced subject to the extent of NRC's regulatory authority and as NRC determines to be appropriate.

E. AMENDMENTS

1. Any Signatory to this MOA may request that it be amended, whereupon the Signatories will consult to reach agreement. Such amendment shall be effective

upon the signature of all Signatories to this MOA, and the amendment shall be appended to the MOA as an Appendix.

2. Modifications to the Treatment Plan as described in **STIPULATION A.1** may be executed upon concurrence of all Signatories as long as no modifications to the body of the MOA are required. This modification will not require a formal amendment to this MOA as per **STIPULATION E.1.**

F. DISPUTE RESOLUTION

1. Should any Signatory to this MOA object within 30 days to any activity pursuant to this MOA, NRC shall consult with the objecting Signatory to resolve the objection.

   If NRC determines the objection cannot be resolved, NRC shall forward all documentation relevant to the dispute to the ACHP. Any comments or recommendations received from the ACHP will be forwarded to the Signatories for consideration.

   Resolution of the objection will be documented in a written resolution and distributed to all Signatories by the NRC. If a Signatory fails to respond within 30 days of receipt of the written resolution, concurrence with the resolution will be assumed by the other Signatories and the resolution will go into effect.

   If resolution of the objection requires an amendment to the MOA, it will be done per Section E of this agreement.

2. Nothing in this Section shall be construed or interpreted as a waiver of any judicial remedy that would be available to any party of this MOA.

3. Nothing in this Section shall be construed or interpreted to apply to BLM's or NRC's enforcement actions related to compliance with BLM's or NRC's regulations or license conditions.

G. TERMINATION

Signatories to this MOA may initiate termination by providing written notice to the other Signatories of their intent. After notification by the initiating Signatory, the remaining parties shall have 60 business days to consult to seek agreement on amendments or any other actions that would address the issues and avoid termination. If such consultation fails, the termination will go into effect at the end of this 60 day period, unless all the Signatories agree to a longer period.

In the event of termination, the NRC will comply with any applicable requirements of 36 CFR 800.4 through 800.6 with regard to this individual undertaking covered by this MOA.

H. DURATION OF AGREEMENT

1. This MOA shall remain in effect for three years from its date of execution by the Signatories (last date of signature), or until completion of the work stipulated, whichever comes first, unless extended by agreement among the Signatories pursuant to **STIPULATION C.2**.

GENERAL PROVISIONS OF THE AGREEMENT

A. **ENTIRETY OF AGREEMENT**. This MOA, consisting of seven (7) pages, represents the entire and integrated agreement between the Signatories and supersedes all prior negotiations, representations and agreements, whether written or oral.

B. **PRIOR APPROVAL.** This MOA shall not be binding upon any Signatory unless this MOA has been reduced to writing before performance begins as described under the terms of this MOA, and unless this MOA is approved as to form by the Attorney General of the State of Wyoming, or his representative.

C. **SEVERABILITY.** Should any portion of this MOA be judicially determined to be illegal or unenforceable, the remainder of the MOA shall continue in full force and effect according to its terms, and any Signatory may renegotiate the terms affected by the severance.

D. **THIRD PARTY BENEFICIARY RIGHTS.** The Signatories do not intend to create in any other individual or entity the status of third party beneficiary, and this MOA shall not be construed so as to create such status. The rights, duties and obligations contained in this MOA shall operate only between the parties to this MOA, and shall inure solely to the benefit of the Signatories to this MOA. The provisions of this MOA are intended only to assist the Signatories in determining and performing their obligations under this MOA. The parties to this MOA intend and expressly agree that only those Signatory to this MOA shall have any legal or equitable right to seek to enforce this MOA, to seek any remedy arising out of a party's performance or failure to perform any term or condition of this MOA, or to bring an action for the breach of this MOA.

Execution of this MOA by NRC, SHPO, BLM, Lost Creek ISR, LLC, NAT, and EST the submission of documentation and filing of this MOA with the ACHP pursuant to 36 CFR §800.6(b)(1)(iv) prior to the Signatories approval of the undertaking, and implementation of its terms, are evidence that the NRC and BLM have taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

Signatures: In witness thereof, the Signatories to this MOA through their duly authorized representatives have executed this MOA on the days and dates set out below, and certify that they have read, understood, and agreed to the terms and conditions of this MOA as set forth herein.

The effective date of this MOA is the date of the last signature affixed to this page.

Signatories:

United States Nuclear Regulatory Commission

By: Larry W Camper Date: 8/24/10
Title: Larry W. Camper, Director
Division of Waste Management and Environmental Protection

Wyoming State Historic Preservation Officer

By: Mary Hopkins Date: 9/28/10
Title: Mary Hopkins, State Historic Preservation Officer

Bureau of Land Management

By: Patrick Madigan Date: 9-14-10
Title: Patrick Madigan, Rawlins Field Office Manager

By: Acting Date: 9-15-10
Title: Bill Hill, Deputy State Director
Resources Policy and Management

Lost Creek ISR, LLC

By: __________ Date: __________
Title: Wayne Heili, President

Execution of this MOA by NRC, SHPO, BLM, Lost Creek ISR, LLC, NAT, and EST the submission of documentation and filing of this MOA with the ACHP pursuant to 36 CFR §800.6(b)(1)(iv) prior to the Signatories approval of the undertaking, and implementation of its terms, are evidence that the NRC and BLM have taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

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United States Nuclear Regulatory Commission

By: [signature] Date: 8/24/10
Title: Larry W. Camper, Director
Division of Waste Management and Environmental Protection

Wyoming State Historic Preservation Officer

By: ______________________ Date: ______________
Title: Mary Hopkins, State Historic Preservation Officer

Bureau of Land Management

By: ______________________ Date: ______________
Title: Patrick Madigan, Rawlins Field Office Manager

By: ______________________ Date: ______________
Title: Bill Hill, Deputy State Director
Resources Policy and Management

Lost Creek ISR, LLC

By: [signature] Date: 8/31/2010
Title: Wayne Heili, President

Invited Signatories:

Northern Arapaho Tribe

By: ________________ Date: 10/14/10
Title: Harvey Spoonhunter, Tribal Chairman

Eastern Shoshone Tribe

By: ________________ Date: ________
Title: Ivan Posey, Tribal Chairman

Wyoming Attorney General's Office Approval as to Form:

By: ________________ Date: ________
Title: Don Gerstein, Senior Assistant Attorney General

Invited Signatories:

Northern Arapaho Tribe

By: ______________________________ Date: ______________
Title: Harvey Spoonhunter, Tribal Chairman

Eastern Shoshone Tribe

By: ______________________________ Date: 9/9/10
Title: Ivan Posey, Tribal Chairman

Wyoming Attorney General's Office Approval as to Form:

By: ______________________________ Date: ______________
Title: Don Gerstein, Senior Assistant Attorney General

Invited Signatories:

Northern Arapaho Tribe

By: ______________________________ Date: ______________
Title: Harvey Spoonhunter, Tribal Chairman

Eastern Shoshone Tribe

By: ______________________________ Date: ______________
Title: Ivan Posey, Tribal Chairman

Wyoming Attorney General's Office Approval as to Form:

By: S. Jane Caton Date: 9-21-10 #62954
Title: ~~Don Gerstein~~, Senior Assistant Attorney General
S. Jane Caton

MOA among NRC, SHPO, BLM, LCI, NAT and EST Archaeological Data Recovery at 48SW16604, Sweetwater County, Wyoming.
Page 7 of 7

APPENDIX F
ECOLOGICAL RESOURCES AND MITIGATION

CONTENTS

TABLES

ABBREVIATIONS/ACRONYMS

APLIC	Avian Power Line Interaction Committee
BLM	Bureau of Land Management
ISR	*in-situ* uranium recovery
LCI	Lost Creek International, LLC
NRC	U.S. Nuclear Regulatory Commission
WGFD	Wyoming Game and Fish Department

F ECOLOGICAL RESOURCES AND MITIGATION

The applicant at the Lost Creek *In-Situ* Uranium Recovery (ISR) Project has committed to reduce the impact on wildlife from implementing the proposed action by following the mitigative measures described in this Appendix. Section F.1 describes applicant-identified mitigative measures, Section F.2 describes the Bureau of Land Management (BLM) and Wyoming Game and Fish Department (WGFD) timing stipulations discussed in Chapter 4 of the Supplemental Environmental Impact Statement (SEIS), and Section F.3 describes the vegetation types and area that would be disturbed by implementing the proposed action.

F.1 Applicant Wildlife Mitigation Measures

The applicant commitments in the U.S. Nuclear Regulatory Commission (NRC) license application to minimize and mitigate potential impacts on wildlife (LCI, 2008a,b), which are consistent with regional land and wildlife management agency recommendations (BLM, 2008; WGFD, 2010, 2008), are listed in this section.

<u>Road and Right of Way Measures</u>

- Use existing two-track roads to the extent possible to minimize new disturbance of sagebrush habitat. Upgrade or construct roads following BLM and WGFD guidelines to minimize the road width, to limit the impact to vegetation on road shoulders, and to limit vehicular speeds.

- Locate utilities in the same road and right of way (ROW). Place pipelines and transmission lines either in, or adjacent to, the access road ROWs to minimize habitat disturbance.

- Gate and/or sign existing two-track roads located adjacent to the main access road and project facilities to minimize traffic disturbance of nesting raptors and sage-grouse leks.

<u>Fencing and Screening Measures</u>

- Fence wellfields to keep out cattle and wild horses with a design to minimize animal mortality rates. Fence placement would be temporary and fences would be removed after ISR wellfield operations are complete. Fences would be constructed to BLM specifications and would be equipped with sage-grouse diverters.

- Mud pits located outside fenced areas would be fenced during the drilling phase, while the pits are open and contain drilling liquid.

- If the storage pond fluid is determined to be harmful to birds, place netting or other appropriate deterrents over ponds to eliminate the hazard to migratory birds, sage grouse, or other wildlife. At a minimum, the storage ponds would be fenced to prevent wildlife from entering the area (LCI, 2008a, Attachment OP-6).

- Cover vent pipes with either netting or other methods to prevent bats, birds, or small mammals from being trapped.

Transmission Lines

- Build the primary transmission line and power poles to the latest approved methods [cross-arm design, transformer design, and perch guards (APLIC, 2006)] to prevent the electrocution of raptors in the proposed project area. Attach the appropriate roost guards to power poles and cross-arms to minimize raptor roosting and predation of sage-grouse. Follow either BLM guidelines (Oles, 2007) or other appropriate design guidelines.

- Bury transmission lines after (step-down) transforming to minimize risks to raptors and other large birds.

- Minimize raptor mortality from power lines by the use of raptor deterrent products and by the burial of transmission lines connecting the transformer with the header houses, and the header houses with the wells.

Restoration/Reclamation

- Phase reclamation throughout ISR construction and operations. Restore and reseed temporarily disturbed areas after disturbance at the next available seeding opportunity. Restore and reseed temporary access roads when no longer needed. Seed nonmaintained road shoulders and leave undisturbed.

- Obtain BLM approval of all seed mixes used for restoration. Use only native species in seed mixes. All seed mixes designed for permanent restoration would include sagebrush.

- Restore and protect existing habitats for sage-grouse and other species, as well as plant communities. Follow BLM guidelines and recommendations for weed prevention (BLM, 2008; 1996).

Reduce Human Disturbance and Incidental Loss of Wildlife

- Inform employees of applicable wildlife laws and penalties associated with unlawful taking and harassment of wildlife.

- Train employees on (i) the types of wildlife in the area susceptible to collisions with motor vehicles, (ii) the circumstances when collisions are most likely to occur, and (iii) measures that should be taken to avoid wildlife–vehicle collisions.

- Require signs, a gate, or both on all new and improved roads related to the proposed project to minimize public traffic.

- Sign and gate, as needed, two-track roads that connect to proposed project access road(s) to minimize disturbance of nesting ferruginous hawks or sage-grouse leks. Coordinate this activity with appropriate BLM and WGFD staff.

- Complete a survey following BLM guidelines prior to ground-disturbance activities in potential sage-grouse nesting habitat noting the sage-grouse population, sage-grouse nests, and sage-grouse leks.

Mud Pits and Storage and Waste Ponds

- Design or treat mud pits and ponds in accordance with BLM and WGFD recommendations to prevent the development of favorable mosquito habitat (to reduce possible transmission of West Nile virus) (BLM, 2009; WGFD, 2010).

F.2 Bureau of Land Management and Wyoming Game and Fish Department Wildlife Timing Stipulation

BLM and WGFD have determined that wildlife timing stipulations for certain species protect their populations and habitats (BLM, 2008; WGFD, 2005). The applicant plans to initiate construction activities outside the stipulated time restriction periods; however, activities would continue year round within the area of approved disturbance (e.g., wellfield patterns, roads, plant area). Exploration activities outside the preapproved disturbance area would not be performed during the stipulated time periods (LCI, 2008a, Attachment OP-6 Section 1.2). Details of BLM and WGFD wildlife timing stipulations are provided in Table F–1.

F.3 References

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WGFD. “Final Comprehensive Wildlife Conservation Strategy.” 2005. <http://gf.state.wy.us/wildlife/CompConvStrategy/index.asp> (7 April 2010).

Table F–1. Seasonal Wildlife Stipulations

Affected Areas/Species	Timing Restriction	Restricted Area
Big game crucial winter ranges	November 15–April 30	Antelope, elk, moose, bighorn sheep, and mule deer crucial winter ranges
Big game parturition areas	May 1–June 30	Identified parturition areas for elk and bighorn sheep
Sage-grouse noncore area (BLM, 2009)	(1) Prohibit surface disturbance/occupancy year round; March 15–May 15 from 6:00 pm to 8:00 am (2) Avoid surface-disturbing activities March 1–July 15	(1) Within a 0.4-km [0.25-mi] radius of occupied or undetermined sage-grouse leks (2) Within a 3.2-km [2-mi] radius of an occupied lek in nesting/early brood-rearing habitat
Sage-grouse core area (BLM, 2009)	(1) Prohibit surface disturbance/occupancy year round Prohibit human activity March 1–May 20 from 6:00 p.m. to 9:00 a.m. Prohibit surface disturbance/disruptive activity March 1–July 15 For additional restrictions, see Wyoming Governor Executive Order 2010-4, Attachment B, Final Stipulation Recommendations (E.O. 2010-4)	(1) Within a 0.4-km [0.25-mi] radius of occupied or undetermined sage-grouse leks (2) Within a 1-km [0.6-mi] radius of occupied or undetermined sage-grouse leks Within a 3.2-km [2-mi] radius of an active lek in nesting/early brood rearing habitat
Sage-grouse winter concentration areas in core areas	November 15–March 14	Within identified winter habitat that supports core area populations
Sage-grouse winter concentration areas in noncore areas	November 15–March 14	Within identified winter habitat
Bald eagle*	February 15–August 15	Within 0.4-km [0.25-mi] radius
Mountain plover	April 10–July 10	Potential and occupied habitat
Burrowing owl	April 15–September 15	Within 1.2-km [0.75-mi] radius

Table F–1. Seasonal Wildlife Stipulations (continued)

Affected Areas/Species	Timing Restriction	Restricted Area
Ferruginous hawk*	March 1–July 31	Within 1.6-km [1-mi] radius
Golden eagle*	January 15–July 15	Within 0.8-km [0.5-mi] radius
Goshawk*	April 1–August 15	Within 0.8-km [0.5-mi] radius
Great horned owl nest	February 1–July 15	Within 1.2-km [0.75-mi] radius
Kestrel nest	April 1–July 31	Within 1.2-km [0.75-mi] radius
Merlin*	April 1–August 15	Within 0.8-km [0.5-mi] radius
Northern harrier nest	April 1–July 31	Within 1.2-km [0.75-mi] radius
Peregrine falcon*	March 1–August 15	Within 0.8-km [0.5-mi] radius
Prairie falcon*	March 1-August 15	Within 0.8-km [0.5-mi] radius
Red-tailed hawk nest	February 1–July 15	Within 1.2-km [0.75-mi] radius
Short-eared owl nest	March 1–July 31	Within 1.2-km [0.75-mi] radius
Swainson's hawk nest	April 1–July 31	Within 1.2-km [0.75-mi] radius
Other raptor nests	February 1–July 15	Within 1.2-km [0.75-mi]radius
Active raptor nests	Year round	Within 251.5 m [825 ft] {ferruginous hawks, 0.4 km [1,200 ft]}

Sources: BLM (2008b); WGFD (2010); EO 2010-4.
*Restriction dates include territory establishment through fledging.

Table F–2. Stripped and Disturbed Land by Vegetation Type

Disturbance Location	Term of Disturbance*	Disturbed Vegetation-hectares [acres]				Total Stripped Area Hectares [acres]	Total Disturbed Area Hectares [acres]
		Upland Big Sagebrush Shrubland		Lowland Big Sagebrush Shrubland			
		Stripped	Disturbed	Stripped	Disturbed		
Roads (Outside of Pattern Areas)							
Permanent Main Access Road	LT	6.3 [15.6]	6.3 [15.6]	0.2 [0.6]	0.2 [0.6]	6.5 [16.2]	6.5 [16.2]
Permanent Main Roads within Permit Area	LT	6.3 [15.72]	6.3 [15.72]	0.9 [2.18]	0.9 [2.18]	7.2 [17.9]	7.2 [17.9]
Secondary Roads	LT	1.2 [3.1]	1.25 [3.1]	0.8 [2.01]	0.2 [0.6]	2 [5.11]	1.5 [3.7]
Two-track Roads	LT	2.9 [7.11]	2.9 [7.11]	0.4 [1.09]	0.4 [1.09]	3.3 [8.2]	3.3 [8.2]
Pipelines and Header Houses							
Header Houses	LT	1.5 [3.85]	1.5 [3.85]	0.5 [1.15]	0.5 [1.15]	2.0 [5.0]	2.0 [5.0]
Pipelines	LT	4.4 [10.81]	4.4 [10.81]	0.6 [1.59]	0.6 [1.59]	5.0 [12.4]	5.0 [12.4]
Mud Pits							
Drill Pad/Mud Pits (Deep Wells)	LT	4.6 [11.54]	1.4 [3.46]	4.6 [11.54]	1.4 [3.46]	6.0 [15]	6.0 [15]
Drill Pads/Mud Pits (Monitoring Wells)	LT	3.5 [8.74]	3.5 [8.74]	1.0 [2.56]	1.0 [2.56]	4.5 [11.3]	4.5 [11.3]
Drill Pads/Mud Pits (Delineation Holes)	LT	2.2 [5.49]	2.2 [5.49]	0.8 [2.03]	0.8 [2.03]	3.0 [7.5]	3.0 [7.5]
FIELD CONSTRUCTION LAYDOWN AREAS (STAGING AREAS)	LT	1.7 [4.2]	1.7 [4.2]	0 0	0 0	1.7 [4.2]	1.7 [4.2]
PATTERN AREAS (SIX WELLFIELDS)	LT	10 [24.61]	76.5 [189.15]	1.6 [4.01]	12.5 [30.85]	11.6 [4.7]	89 [220]
PLANT COMPOUND	LT	1.7 [4.2]	1.7 [4.2]	2.3 [5.8]	2.3 [5.8]	4.0 [10.00]	4.0 [10.00]
Totals		18.8 [46.5]	99.6 [246.1]	4.7 [11.5]	15.9 [39.3]	23.5 [58.0]	115.5 [285.4]

Source: LCI (2008a)
*LT = long term (greater than or equal to the project life)

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10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

By letter dated October 30, 2007, Lost Creek ISR, LLC (LCI, the applicant) submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Lost Creek in-situ recovery (ISR) Project. LCI is proposing to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the Lost Creek ISR Project site, located in Sweetwater County, Wyoming. The NRC staff evaluated site-specific data and information to assess whether the applicant-proposed activities were consistent with activities considered in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS) and determined which GEIS data and analyses could be incorporated by reference and what resource areas required site-specific review. The SEIS describes the environment potentially affected by the proposed site activities, describes the potential environmental impacts, and describes LCI's environmental monitoring program and proposed mitigation measures. The NRC staff responds to public comments received on the draft SEIS in the final SEIS.

The final SEIS was prepared in compliance with the National Environmental Policy Act of 1969 and in accordance with NRC's implementing regulations at Title 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 (10 CFR Part 51).

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ENVIRONMENTAL IMPACT STATEMENT FOR THE LOST CREEK ISR PROJECT IN SWEETWATER COUNTY, WYOMING

June 2011