2.1.8 Prevention, Reporting, and Correction of Accidental Releases

LCI would be required to conduct activities in a manner that minimizes the risk of accidents and provides for prompt reporting and remediation of releases, as required per the licenses and permits from agencies, including the NRC, the WDEQ-LQD, and the WDEQ-WQD. The requirements from the various licenses and permits are summarized in this section.

2.1.8.1 Prevention

As discussed in the Operations Plan of the WDEQ-LQD Permit to Mine (LCI, 2011b) and the NRC Technical Report (LCI, 2010), LCI would conduct the following actions to reduce the potential for accidental releases:

- Appropriate engineering design, construction, and maintenance of facilities;
- On-going employee training;
- Development and implementation of Standard Operating Procedures (SOPs) and plans, such as the SWPPP, covering topics including:
    - pipeline installation and testing;
    - automated system monitoring and alarming;
    - site inspections; and
    - corrective actions.

Table 2.1-3 lists the measures that would be taken to prevent the risk of spill and leaks for the various facilities at the Permit Area. A comprehensive training program would be developed and implemented prior to the initiation of operations to ensure that on-site personnel are familiar with the physical and chemical hazards present in the work place and how to successfully mitigate those hazards. The training program would include, at a minimum, the following items:

- The distribution of physical and chemical hazards in the work area and throughout the Plant and mine units;
- Methods and observations that are in place or may be used to detect the presence or release of a hazardous chemical in the work area;
- The measures employees can take to protect themselves from the hazards, such as in-place work practices and PPE to be used;
- Emergency procedures (including evacuation and notification of public emergency response personnel);
- Details of the hazard communication program, including the labeling system;
- Material safety data sheets and how employees can obtain and use the appropriate hazard information;

- Physical hazards presented by process tankage, piping, and equipment and how individuals may mitigate these hazards (lockout/tagout, confined space, moving parts, cryogenic fluids, and so forth); and
- The potential for upset conditions and how to safely mitigate these conditions.

LCI would designate an Environmental Health and Safety (EHS) Supervisor who would ensure that all individuals that may be exposed to processing hazards receive initial training. The EHS Supervisor would also ensure that employees and contractors receive the appropriate initial and refresher training. When an employee or contractor is given a new task, the supervisor would assess if additional training would be needed and provide all necessary training before the individual would be exposed to the hazard. On-the-job training would only be acceptable if an experienced operator is on-hand to immediately oversee all activities. All training would be documented by the trainer, with records maintained until the associated licenses and permits are terminated.

Table 2.1-3 Spill Prevention Measures (Page 1 of 2)

Potential Source of Spills or Leaks	Prevention Measures
Pipelines, Fittings, Valves	• All Plant equipment designed for the life of the Project • Pipelines constructed of corrosion-free high-density polyethylene (HDPE) material • Pipelines buried 5 to 6 feet below the ground surface • Pipeline junctions made of either corrosion-free HDPE material, stainless steel, epoxy-coated steel or a combination of the three • Pipeline systems equipped with high and low pressure shutdown systems and flow meters • Pipeline systems equipped with alarms to alert the operator immediately of malfunctions • Daily visual inspections of pipelines, valve stations, power lines, header houses, well heads, fences roads, and culverts by mine site staff • Routine inspections by the mine unit operators
Buildings (Tanks, Plant, header houses, and pump houses)	• Tanks and vessels would be inside the Plant, where possible; fuel tanks and other materials which could not be stored inside the Plant would have approved containment • The Plant would have a concrete containment curbing around the perimeter and several internal berms and sumps to contain spills

Table 2.1-3 Spill Prevention Measures (Page 2 of 2)

Potential Source of Spills or Leaks	Prevention Measures
Buildings (Tanks, Plant, header houses, and pump houses) Continued	• Header houses and pump houses equipped with sumps to contain spills Sumps equipped with fluid-detection sensors wired to automatic alarms and shutoffs • Alarms and automatic controls to keep fluid levels within the prescribed limits • Daily visual inspections of pipelines, valve stations, power lines, header houses, well heads, fences roads, and culverts by mine site staff • Routine inspections by the mine unit operators
Storage Ponds	• Two duplicate ponds constructed to allow for the complete removal of fluid from one pond to the other in the event of a liner leak • Storage Ponds equipped with leak detection systems between an impermeable base liner and the top liner • Each impermeable liner would be 40 mils thick • Maximum fluid depth of four feet with three feet of free board • Storage Ponds would be kept full of water to maintain their integrity by reducing liner exposure to the elements • Storage Pond embankments, fences, liners and free board inspected routinely
Wells	• Monitoring of well construction, pressures in the ISR system, mine unit balancing, and MITs of wells • Monitoring water levels and water quality in adjacent aquifers conducted routinely
Exploration Drill Holes	• Boreholes plugged and abandoned with bentonite mud or grouted • Monitoring water levels and water quality in adjacent aquifers conducted routinely • Pumping tests conducted prior to mine unit start-up to ensure no communication between aquifers • If there appears to be communication through historic drill holes, those drill holes would be re-entered and plugged
Transportation	• Regular road maintenance • Driver safety training • Use of proper containers • Chain of command for emergency response

2.1.8.2 Reporting

Accident situations would require reporting and sometimes emergency notification of various agencies. LCI would write and implement an Emergency Response SOP that clearly defines under which circumstances reporting is required and to which agency(ies). Each spill report would be documented in a spill file that would be maintained until the facility is decommissioned and the associated licenses and permit are terminated. Each annual report submitted to the agencies would contain a map showing the location and date of each reportable spill along with a table characterizing the date, volume, area, depth, contamination level, sampling locations and remediation efforts for each reportable spill.

2.1.8.3 Corrective Action

Corrective action would address immediate repairs to stop any releases, clean up and remediation of any releases, and assessment and implementation of any changes needed in work processes or equipment to prevent a recurrence. If an upset condition resulted in the release of mining solutions or chemicals to the environment, the affected system(s) would be shut down and thoroughly inspected/tested by an individual familiar with that system before being restarted. Clean up and remediation actions, including determining the extent of a release, the resource(s) impacted, and appropriate actions to remove or remediate any contamination would be implemented in accordance with agency requirements.

2.2 Agency-Required Measures

Agency-required measures and LCI's commitments and initiatives to comply with the applicable environmental statutory and regulatory programs have developed through several federal, state, and local permitting and licensing processes. As summarized in **Sections 1.4** and **1.5**, the Project has completed the permitting and licensing processes for the NRC, the WDEQ Land Quality, Water Quality, and Air Quality Divisions, and Sweetwater County, among others. The majority of these processes has included public notices and comment periods for scoping and review of agency approvals and opportunities for hearing in accordance with the specific agency requirements. In some instances, no public comments were received, and in others, extensive comments were received and addressed. As part of the WDEQ-LQD permitting process, an objection to issuance of the Permit to Mine was received and a hearing held before the Wyoming EQC. The WDEQ-LQD decision was upheld (EQC, 2011).

The BLM reviewed the permitting and licensing actions, in particular the WDEQ-LQD Permit to Mine (2011b) and the NRC SEIS and License (2011a and 2011b), and the required environmental protection measures associated with them. **Table 2.2-1** is a cross-reference, by resource and activity, to the sections of the WDEQ-LQD Permit to Mine, NRC SEIS, and License in which the required

environmental protection measures are discussed. The resources and activities are:

- Land Use;
- Transportation;
- Geology, Ore Mineralogy and Seismology;
- Soils;
- Surface Water, Wetlands and Aquatic Ecology;
- Groundwater;
- Vegetation;
- Wildlife;
- Wild Horses;
- Meteorology, Climatology and Air Quality;
- Noise;
- Historic and Cultural Resources;
- Visual and Scenic Resources;
- Socioeconomic Conditions;
- Background Radiology;
- Public and Occupational Health;
- Waste Management; and
- Financial Surety.

Table 2.2-1 Cross-References to Environmental Protection Measures and Impacts in WDEQ-LQD and NRC Documents (Page 1 of 5)

Agency & Document	WDEQ-LQD Permit No. 766 (1)	NRC		
		SEIS (2)		License No. SUA-1598 (3)
		Proposed Action & Alternatives	Impacts	
Land Use				
Baseline	Appendices D1 & D2	§ 3.2	--	--
Construction	§ OP 2.3	--	§ 4.2.1.1	
Operation			§ 4.2.1.2	
Reclamation	§ RP 4.5.1	§ 2.1.1.1.5	§§ 4.2.1.3 & 4.2.1.4	
Transportation				
Baseline	--	§ 3.3	--	--
Construction	§ OP 2.6	§§ 2.1.1.1.2.3 & 2.1.1.1.7	§§ 4.3.1.1 & 4.3.2.1	
Operation			§§ 4.3.1.2 & 4.3.2.2	
Reclamation	§§ RP 3.2 & RP 4.4	§§ 2.1.1.1.5.4 & 2.1.1.1.7	§§ 4.3.1.3, 4.3.1.4, 4.3.2.3, & 4.3.2.4	
Geology, Ore Mineralogy, & Seismology				
Baseline	Appendix D5	§ 3.4.1 & 3.4.3	--	--
Construction	§ OP 3.3	§§ 2.1.1.1.2.4.1 through 2.1.1.1.2.4.3	§§ 4.4.1.1, 4.4.2, & 4.4.3	Condition 10.5
Operation		§§ 2.1.1.1.2.4.3	§ 4.4.1.2, 4.4.2, & 4.4.3	
Reclamation	§ RP 3.1		§ 4.4.1.3, 4.4.1.4, 4.4.2, & 4.4.3	--
Soils				
Baseline	Appendix D5, Attachments OP-5a & b	§ 3.4.2	--	--
Construction	§ OP 2.5	§ 2.1.1.1.2.1	§§ 4.4.1.1, 4.4.2, & 4.4.3	Condition 11.6
Operation	§§ OP 2.5 & OP 3.5	§§ 2.1.1.1.4.4 & 2.1.1.1.4.5	§ 4.4.1.2, 4.4.2, & 4.4.3	
Reclamation	§§ RP 3.3 & RP 4.5	§ 2.1.1.1.5	§ 4.4.1.3, 4.4.1.4, 4.4.2, & 4.4.3	Conditions 11.6 & 12.13

Table 2.2-1 Cross-References to Environmental Protection Measures and Impacts in WDEQ-LQD and NRC Documents (Page 2 of 5)

Agency & Document	WDEQ-LQD Permit No. 766 [1]	NRC		
		SEIS [2]		License No. SUA-1598 [3]
		Proposed Action & Alternatives	Impacts	
Surface Waters, Wetlands, & Aquatic Ecology				
Baseline	Appendices D6 & D11	§§ 3.5.1 & 3.6.2	--	--
Construction	§§ OP 2.9, OP 2.11.1, OP 3.5,& Attachments OP-2 & OP-4	§§ 6.2.2, 6.2.4, 6.3.2, & 6.3.3	§§ 4.5.1.1.1, 4.5.1.2, 4.51.3, & 4.6.1.1.3	Condition 11.6
Operation			§§ 4.5.1.1.2, 4.5.1.2, & 4.51.3	
Reclamation	§§ RP 3.2 & RP 4.0	--	§§ 4.5.1.1.3, 4.5.1.1.4, 4.5.1.2, & 4.51.3	
Groundwater				
Baseline	Appendix D6 & § OP 3.6.4.1	§ 3.5.2	--	Conditions 10.9 through 10.12, & 11.3
Construction	§§ OP 2.9, OP 2.11.2, OP 3.0, & Attachments OP-2, OP-7, & OP-8	§§ 2.1.1.1.2.4.1 through 2.1.1.1.2.4.3, 6.2.5, 6.3.1, & 6.3.2	§§ 4.5.2.1.1, 4.5.2.2, & 4.5.2.3	Conditions 10.5, 11.6, 12.4, & 12.15
Operation		§§ 2.1.1.1.3.1.1 through 2.1.1.1.3.1.3, 6.2.5, 6.3.1, & 6.3.2	§ 4.5.2.1.2, 4.5.2.2, & 4.5.2.3	Conditions 10.1, 10.5, 10.7 through 10.9, 10.13, 11.1, 11.4 through 11.6, & 12.7
Reclamation	§§ RP 1.0 & RP 2.0	§§ 2.1.1.1.4, 6.2.5, & 6.3.1	§§ 4.5.2.1.3, 4.5.2.1.4, 4.5.2.2, & 4.5.2.3	Condition 10.6
Vegetation				
Baseline	Appendix D8	§ 4.3.4.1	--	--
Construction	§ OP 2.7	§ 2.1.1.1.2.1	§§ 4.6.1.1.1.1, 4.6.2, & 4.6.3	
Operation		§§ 6.2.3 & 6.5.1	§§ 4.6.1.2.1, 4.6.2, & 4.6.3	
Reclamation	§ RP 4.5	§§ 2.1.1.1.5.5 & 6.5.1	§§ 4.6.1.3, 4.6.1.4, 4.6.2, & 4.6.3	

Table 2.2-1 Cross-References to Environmental Protection Measures and Impacts in WDEQ-LQD and NRC Documents (Page 3 of 5)

Agency & Document	WDEQ-LQD Permit No. 766 [1]	NRC		
		SEIS [2]		License No. SUA-1598 [3]
		Proposed Action & Alternatives	Impacts	
Wildlife				
Baseline	Appendix D9	§§ 3.2.1, 3.6.1.2, & 3.6.3	--	--
Construction	§ OP 2.7 & Attachment OP-6	§§ 2.1.1.1.2.5, 6.2.3, 6.5.2, & Appendix F	§§ 4.6.1.1.1.2, 4.6.1.1.2, 4.6.1.1.4, 4.6.1.1.5, 4.6.2, & 4.6.3	
Operation		§§ 6.2.3, 6.5.2, & Appendix F	§§ 4.6.1.2.2, 4.6.2, & 4.6.3	
Reclamation		§§ 6.2.3, 6.5.2, & Appendix F	§§ 4.6.1.3, 4.6.1.4, 4.6.2, & 4.6.3	
Wild Horses				
Baseline	Appendix D9	§§ 3.2.1, & 3.6.1.2.7	--	--
Construction	§ OP 2.8 & Attachment OP-6	§ 2.1.1.1.2.5	§§ 4.2.1.1 & 4.6.1.1.1.2	
Operation		--	§ 4.2.1.2	
Reclamation	§§ RP 4.5.4 & 4.5.5		--	
Meteorology, Climatology, & Air Quality				
Baseline	Appendix D4	§ 3.7	--	Conditon 12.8
Construction	OP 5.1.1	§§ 2.1.1.1.6.1, 2.1.2, & 2.1.3	§§ 4.7.1.1, 4.7.3, & 4.7.3.1	--
Operation			§§ 4.7.1.2, 4.7.3, & 4.7.3.2	
Reclamation			§§ 4.7.1.3, 4.7.1.4, 4.7.3, 4.7.3.3, & 4.7.3.4	
Noise				
Baseline	--	§ 3.8	--	--
Construction	§ OP 2.8	--	§§ 4.8.1.1, 4.8.2, 4.8.3	
Operation			§§ 4.8.1.2, 4.8.2, 4.8.3	
Reclamation			§§ 4.8.1.3, 4.8.1.4, 4.8.2, 4.8.3	

Table 2.2-1 Cross-References to Environmental Protection Measures and Impacts in WDEQ-LQD and NRC Documents (Page 4 of 5)

Agency & Document	WDEQ-LQD Permit No. 766 [1]	NRC		
		SEIS [2]		License No. SUA-1598 [3]
		Proposed Action & Alternatives	Impacts	
Historic & Cultural Resources				
Baseline	Appendix D3	§ 3.9	--	--
Construction	§ OP 2.4	Appendix E	§§ 4.9.1.1, 4.9.2, 4.9.3	Condition 9.8
Operation		--	§§ 4.9.1.2, 4.9.2, 4.9.3	
Reclamation			§§ 4.9.1.3, 4.9.1.4, 4.9.2, 4.9.3	
Visual and Scenic Resources				
Baseline	--	§ 3.10	--	--
Construction		--	§§ 4.10.1.1, 4.10.2, 4.10.3	
Operation			§§ 4.10.1.2, 4.10.2, 4.10.3	
Reclamation			§§ 4.10.1.3, 4.10.1.4, 4.10.2, 4.10.3	
Socioeconomics				
Baseline	--	§ 3.11	--	--
Construction		§ 2.1.1.1.2.6	§§ 4.11.1.1, 4.11.2, & 4.11.3	
Operation		--	§§ 4.11.1.2, 4.11.2, & 4.11.3	
Reclamation		--	§§ 4.11.1.3, 4.11.1.4, 4.11.2, & 4.11.3	
Environmental Justice				
Baseline	--	§ 3.11	--	--
Construction		--	§ 4.12	
Operation				
Reclamation				

Table 2.2-1 Cross-References to Environmental Protection Measures and Impacts in WDEQ-LQD and NRC Documents (Page 5 of 5)

Agency & Document	WDEQ-LQD Permit No. 766 [1]	NRC		
		SEIS [2]		License No. SUA-1598 [3]
		Proposed Action & Alternatives	Impacts	
Public and Occupational Health (Radiological & NonRadiological Conditions)				
Baseline	Appendix D10	§ 3.12.2	--	Conditions 10.4, 12.2, 12.3, 12.5, 12.9 through 12.11, & 12.14
Construction	§§ OP 2.9, OP 5.0, OP 5.1.1, & OP 5.2.2.1	--	§§ 4.13.1.1, 4.13.2, 4.13.3	Conditions 9.7, 10.14 through 10.17, 11.2, 11.6, & 12.12
Operation		--	§§ 4.13.1.2, 4.13.2, 4.13.3	Conditions 9.7, 10.14 through - 10.17, 11.6 & 12.12
Reclamation	§§ RP 2.2, RP 4.0, & RP 4.1 through 4.3	§§ 2.1.1.1.4 through 2.1.1.1.6	§§ 4.13.1.3, 4.13.1.4, 4.13.2, 4.13.3	Conditions 9.7, 10.3, 10.14 through 10.17, 11.6, 12.12 & 12.13
Waste Management				
Baseline	--	§ 3.13	--	Conditions 10.4, 12.2, 12.3, 12.5, 12.9 through 12.11, & 12.14
Construction	§ OP 5.0	§§ 2.1.1.1.2.5 & 2.1.1.1.6	§§ 4.14.1.1 & 4.14.1.1.1	Conditions 9.6, 9.9, 11.1(D) & 12.6
Operation		§§ 2.1.1.1.3.2 & 2.1.1.1.6	§§ 4.14.1.1 & 4.14.1.1.2	
Reclamation	§§ RP 4.1 through 4.3	§§ 2.1.1.1.5 & 2.1.1.1.6	§§ 4.14.1.1, 4.14.1.1.3, & 4.14.1.1.4	
Financial Surety (Reclamation Bond)				
Amount determined by WDEQ-LQD, NRC, and BLM; approved surety instruments held by WDEQ-LQD and available to NRC and BLM. Amount reviewed at least annually, and instruments increased if review indicates increase required.				

[1] Posted on the BLM NEPA web site for the Lost Creek Project: http://www.blm.gov/wy/st/en/info/NEPA/documents/rfo/lostcreek.html

[2] Available from: http://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber='ML111940049'

[3] Available from: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1910/s3/

The baseline conditions for these resources are described in **Section 3.0** (Affected Environment). For easier reference, the agency-required measures and monitoring and the impacts are summarized, by resource, in **Section 4.0**. For each resource, the agency-required and additional measures are discussed first, followed by discussion of monitoring, impact significance criteria, and impacts.

The Proposed Action was analyzed with reference to the provisions of the 1872 Mining Law, the 43 CFR 3809 regulations, and the Rawlins RMP (BLM, 2008c). Based on the BLM's review and on comments received during the NEPA process, some additional measures would be needed to address concerns not previously addressed through the other processes. These measures are listed in **Table 2.2-2** and are included in the respective resource discussion in **Section 4.0**.

Table 2.2-2 Additional Measures (Page 1 of 2)

Resource	Aspect	Description of Measures
Surface Water	Ephemeral Drainages	Surface disturbing activities would be avoided within 20 feet of the inner gorge of ephemeral channels identified on **Figure 3.5-1** or identified in the field by best professional judgment as a channel that meets the BLM guideline criteria of a "defined channel formed in response to ephemeral surface conditions." Exceptions to this would be granted by the BLM based on an environmental analysis and site-specific engineering and mitigation plans as required per 43 CFR 3809.411(d)(2). Only those actions within areas that could not be avoided and that would provide protection for the resource identified would be approved.
Groundwater	Stability Monitoring	As part of the reclamation plan and associated monitoring, required per the 43 CFR 3809 regulations, at least two additional stability monitoring samples would be collected, once every three months over a six-month period, after the initial stability period. The monitoring information would also support combined agency review of current stability monitoring requirements.

Table 2.2-2 Additional Measures (Page 2 of 2)

Wildlife – Greater sage-grouse	Adaptive Management	To ensure continued coordination and consultation with other local, state, and federal agencies and consistency with other agency plans, policies, and agreements, a Technical Advisory Committee (BLM, WGFD, and LCI) would be established to develop the Adaptive Management Plan to complement on-going baseline data collection and existing stipulations.
Wildlife	Fencing	Fencing around the Storage Ponds would be upgraded to Type II fencing (WDEQ Guideline No. 10 [1994c]) to preclude deer, antelope and elk.
Wildlife	Fencing	New fence construction would be authorized according to BLM standards unless modified following consultation with affected parties. All fencing would be wildlife-friendly fencing, with appropriate collision deterrents, with the exception of the fencing around the Storage Ponds, which would be exclusion fencing.
Wildlife	Storage Ponds	If selenium levels were to reach 0.02 mg/L, or above, in the Storage Ponds, mitigation measures would be put in place to prevent birds from using the Storage Ponds. The mitigation measures used would be approved by the BLM, and would be monitored for effectiveness in preventing mortality of any protected birds in accordance with federal and state regulations, as required per 43 CFR 3809.401(b)(4).
Wildlife	Storage Ponds	The BLM would require the applicant to obtain a Pesticide Use Proposal with associated environmental analysis and consider other Integrated Pest Management techniques, prior to authorizing the use of pesticides.
Wild Horses	Access to Fenced Pattern Areas	To help protect healthy herds of wild horses, LCI would work with the BLM to determine if an automatic gate or pitless cattle guard would help deter wild horse access to a pattern area if the pattern gate were inadvertently left open.
Visual and Scenic Resources	Building Completion	To help maintain the overall objectives of visual resource class, paint colors would conform with BLM Standard Environmental Color Chart CC-001.

2.3 Alternatives Development

NEPA requires evaluation of a No Action Alternative and reasonable alternatives to the Proposed Action that may avoid or minimize Project impacts. A reasonable alternative is defined by NEPA as one that is technically, economically, and environmentally practical and feasible (BLM, 2011g). With the exception of the No Action Alternative, alternatives would need to meet the Project's objective of producing an estimated six million pounds of uranium over an operating period of 12 years. Several alternatives were identified from the BLM's review of the Proposed Action and from the issues and concerns raised from public scoping comments and in collaboration with cooperating federal, state, and local agencies, as well as tribal governments. As previously noted in **Section 1.5**, the public scoping period for this EIS was in February/March 2011. Two cooperating agency meetings were held in March and September 2011. In addition, public scoping and comment periods as well as meetings with federal, state, and local agencies and authorities were held for the NRC GEIS (2009) and SEIS (2011a).

The alternatives that were considered and evaluated in detail include:

- No Action Alternative (also evaluated in the NRC SEIS [2011a]);
- Not Fencing the Pattern Areas; and
- Drying Yellowcake On-Site (also evaluated in the NRC SEIS).

Alternatives considered but eliminated from detailed study include:

- Portable Drill Pits and Closed Loop Drilling Systems;
- Alternative Mining Methods (also an alternative eliminated from detailed analysis in the NRC SEIS [2011a]);
- Alternative Waste Water Disposal Methods (discussed in the NRC SEIS);
- Phased Development of Mine Units;
- Alternative Lixiviants (also an alternative eliminated from detailed analysis in the NRC SEIS);
- Shipping Uranium-Laden Resin;
- Alternate Plant Sites (evaluated by LCI prior to submittal of the NRC license application and WDEQ-LQD permit application); and
- Alternate Routes for the East and West Access Roads (reviewed and evaluated by the NRC, WDEQ-LQD, and WGFD).

2.3.1 Alternatives Evaluated in Detail

2.3.1.1 No Action Alternative

Under this alternative, no ISR operations would be conducted within the Permit Area, although activities currently on-going would continue. At the site, LCI would continue exploration activities, which would at least involve reclamation of

disturbance associated with LCI's Drilling Notification Permit (in which less than five acres may be disturbed at any given time). There would be no uranium produced from the Permit Area and no favorable or unfavorable impacts from this alternative. Current land uses, including livestock grazing, wildlife habitat, dispersed recreation, minerals and energy development, and infrastructure, would not be expected to change.

2.3.1.2 Alternative of Not Fencing the Pattern Areas

Under this alternative, pattern areas within the mine units would not be fenced. Temporary fencing, however, would be installed around all of the drill pits, including those drilled within the mine units. Fencing would be installed around the Plant and Storage Ponds.

The pattern area fencing under the Proposed Action would be wildlife-friendly, to allow passage of smaller animals but exclude cattle and wild horses. The purpose of the fencing would be to reduce damage to wells and subsequent risk of spills. However, if the pattern areas were fenced, grazing would not be possible in those areas, and if a gate to the fenced area were left open, cattle or wild horses could be injured if they entered the area and were startled. Therefore, the alternative of 'not fencing the pattern area' was evaluated in detail.

2.3.1.3 Drying Yellowcake On-Site Alternative (Preferred Alternative)

The BLM selects the Drying Yellowcake On-Site Alternative as the preferred alternative for this FEIS. The BLM's preferred alternative is the alternative which the BLM believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors. This action involves drying the mineral solution into a solid yellowcake form within the plant. Housing the drying-packing facility within the processing plant would reduce shipments from the site, resulting in fewer transportation-related impacts, wildlife disturbances, and cleaner air quality.

Under this alternative, LCI would construct, install and operate a yellowcake drying-packing facility at the Permit Area. As with the Proposed Action, yellowcake slurry (30 to 50 percent solids) would be produced. However, the slurry would be filter-pressed to remove additional water, vacuum-dried, and packaged on-site.

With a vacuum dryer, the heating system would be isolated from the yellowcake so no radioactive materials would be entrained in the heating system or its exhaust. The drying chamber that contains the yellowcake slurry would be under vacuum, so that any potential leak would cause air to flow into the chamber rather than out. Drying would take place at relatively low temperatures. Emissions from the drying chamber would normally be treated through a bag filter to remove

yellowcake particulates; and any water vapor exiting the drying chamber would be cooled and condensed.

The dried product (yellowcake) would be removed from the bottom of the dryer and packaged in drums for eventual off-site shipping for the next step in the production of fuel for commercial nuclear power plants. The packaging area would have a bag filter dust collection or comparable filtering system (e.g., HEPA, cyclone) to protect personnel and to minimize yellowcake release. An independent stand-alone filtration system would be used to remove particulates from the air that would allow for better employee protection and flexibility. During drum loading, the drum would also be kept under negative pressure via a drum hood with a suction line. The final, dried product would be cooled, packaged and shipped in 55-gallon drums.

Prior to constructing, installing and operating a yellowcake drying-packing facility, the NRC License and WDEQ-LQD Permit to Mine would both require modification with review and approval by those agencies. LCI notified the NRC in April 2011 of its intent to request an amendment to its NRC License to install a rotary vacuum dryer, and the application was submitted to the NRC in January 2012 (LCI, 2012). Use of a dryer would provide an economic benefit to the proponent because payment of processing fees to another operator would not be necessary. Use of a dryer would also result in fewer shipments from the site due to the difference in volume between yellowcake slurry and dried yellowcake. Fewer shipments would reduce traffic impacts, including the risk of transportation accidents and wildlife disturbance and collisions, and also reduce air quality impacts from travel on unpaved roads. The condensate volume from the dryer would be minimal and re-used in processing or disposed of through the disposal system used during slurry production.

2.3.2 Comparative Summary of Impacts

Table 2.3-1 presents a summary of the impacts of the Proposed Action and the alternatives evaluated in detail. **Section 4.0** provides discussion of the impacts, protective measures, and monitoring for each resource.

Table 2.3-1 Comparative Summary of Impacts (Page 1 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Land Use					
Livestock Grazing	Reduction in grazing: 0.7 % of the Stewart Creek grazing allotment; 0.7 % of the Cyclone Rim grazing allotment; and 0.2 % of the Green Mountain grazing allotment. If all mine unit pattern areas were fenced at the same time, it would create an oblong obstacle extending about 2.6 miles E-W and 0.5 miles N-S.	No reduction in current grazing allotment access or movement through Permit Area.	Physically restricted grazing acreage and cattle movement would be reduced from the Proposed Action. However, access to the pattern areas could be hazardous or harmful if cattle were to damage the infrastructure.	Same impact as Proposed Action.	Section 4.2
Wildlife Habitat	See discussion under Wildlife.	See discussion under Wildlife.	See discussion under Wildlife.	See discussion under Wildlife.	Section 4.9
Dispersed Recreation	Restricted access to the Permit Area, but continued access to the general area via existing roads (e.g., the Wamsutter-Crooks Gap Road, Sooner Road, East Access Road, and West Access Road).	No reduction in current recreation access.	Physically restricted recreational acreage would be reduced from the Proposed Action. However, access to the pattern areas could be hazardous or harmful if recreationists were to tamper with the infrastructure.	Same impact as Proposed Action.	Section 4.2
Minerals and Energy Development	May delay development of other resource extraction projects in the Permit Area until the Project is complete.	No impact to development of other resource extraction projects in the Permit Area.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.2

Table 2.3-1 Comparative Summary of Impacts (Page 2 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Infrastructure	Construction and reclamation of access roads, utility corridors, the Plant, Storage Ponds, fences, and mine units will occur; the use of preexisting roads and the transmission line will increase.	No impact on current infrastructure.	Traffic patterns may be slightly different than the Proposed Action, due to less physical restrictions to the Permit Area.	During construction, slight increase in traffic from Proposed Action due to additional equipment. During operations, decrease in traffic from shipping lower volume, dried yellowcake, rather than slurry.	Section 4.2
Transportation					
Road Improvements	Improvements to the existing East and West Access Roads.	No improvements would be made.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.3
Traffic volume	At most, during construction, traffic going to and from the site could increase by approximately 50 SUVs per day and 2-5 tractor/trailers per day.	Current traffic volume would continue.	Same impact as Proposed Action.	Reduction in the number of shipments of yellowcake from about one shipment every five days to about one shipment every 15 days.	Section 4.3
Geology					
Changes to Geologic Conditions	Removal of uranium from the target sandstones will result in a permanent change to the composition of these sandstones.	No changes to the geologic conditions. Existing land use activities that could potentially impact the geology (such as mineral and oil and gas drilling) could still occur.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.4

Table 2.3-1 Comparative Summary of Impacts (Page 3 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Soil					
Soils	Short term (5 years or less) - A total of about 72 acres disturbed and 231,295 cubic yards of topsoil removed and stockpiled, to be reapplied during reclamation. Long term (exceeding 5 years) - A total of about 103 acres and 332,238 cubic yards of topsoil removed and stockpiled, to be reapplied during reclamation.	No disturbance or topsoil removal related to the Project.	Slight reduction in the soil disturbance due to less construction, but reduction in the efficiency of mitigation measures in the pattern areas, which would reduce erosion risks and maintain topsoil viability.	Same impact as Proposed Action.	Section 4.5
Surface Water					
Surface Water Drainage Patterns (Ephemeral Drainages)	Alteration of stream channel geometry or gradient in the immediate vicinity of road crossings and the Plant. Culverts installed on road crossings as necessary to prevent erosion. Drainage plan developed around Plant.	No impacts to the existing ephemeral drainages related to the Project.	Potential for soil erosion and subsequent sediment in runoff to be slightly increased because of grazing in the pattern areas.	Same impact as Proposed Action.	Section 4.6
Spills and Leaks	The quality of surface water runoff could be impacted due to a spill or leak from wellheads, pipelines, or tanks.	No impacts to the existing surface water resources related to the Project.	Substantial increase in risk of spills and leaks because of livestock damage to wellheads and pipelines.	Same impact as Proposed Action.	Section 4.6

Table 2.3-1 Comparative Summary of Impacts (Page 4 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Groundwater					
Spills and Leaks	The quality of groundwater could be impacted due to a spill or leak from wells, pipelines, or storage ponds.	No impacts to the existing groundwater resources related to the Project.	May increase risk of spills and subsequent groundwater quality deterioration due to increased possibility of damage to the wellheads and other surface facilities by livestock and wild horses.	Same impact as Proposed Action.	Section 4.7
Groundwater Quality	Groundwater quality in each mine unit will be impacted during the life of a mine unit (2 to 3.5 years) due to the injection of the lixiviant and the subsequent mobilization of uranium and other metals into the groundwater. Water quality must be restored to pre-mining class of use after production ceases from mine unit.	No impacts to the existing groundwater resources related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.7

Table 2.3-1 Comparative Summary of Impacts (Page 5 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Groundwater Consumption During Operation and Restoration	Mine units will be operated with a 0.5 to 1.5 % bleed for 2 to 3.5 years. At the maximum rate of 1.5%, 90 gpm of liquid waste produced (47,304,000 gallons per year). Ground water modeling of production and restoration indicates drawdowns up to 5 feet within about 3.5 miles from Permit Area. Recovery of majority of drawdown within one year.	No impacts to the existing groundwater resources related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.7
Ground water Consumption for Other Uses	Groundwater for construction, dust control, drilling, aquifer testing, and employee use (e.g., showers, toilets) (estimated at a maximum of 35 gpm) will be pumped from the water supply wells. Drawdowns up to 5 feet within 3 miles from Permit Area. Recovery of majority of drawdown in one year	No impacts to the existing groundwater resources related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.7
Vegetation					
Vegetation Disturbance	Disturbance of approximately 345 acres (about 8% of Permit Area) during the life of the Project.	No impacts to vegetation related to the Project.	Slight reduction in the acres of vegetation disturbance due to less construction. But reduction in the efficiency of revegetation in the pattern areas.	Same impact as Proposed Action.	Section 4.8

Table 2.3-1 Comparative Summary of Impacts (Page 6 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Wildlife					
Habitat Disturbance	Disturbance of 345 acres (about 8% of Permit Area) over the life of the Project.	No impacts to wildlife related to the Project.	Slight reduction in the acres of habitat disturbance due to less construction. But reduction in the efficiency of habitat restoration in the pattern areas.	Same impact as Proposed Action.	Section 4.9
Potential Disturbance of Sage Grouse Leks- Surface Occupancy	Two Occupied-Inactive leks and one occupied, active lek are within 0.6 miles of the access roads, which will be upgraded.	No impacts to wildlife related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.9
Potential Disturbance of Sage Grouse Leks- Production Transportation	One Occupied-Inactive lek and two occupied, active leks are within 1.9 miles of roads used to transport production and waste.	No impacts to wildlife related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.9
Potential Disturbance of Raptor Nests- Production Transportation	Potential disturbance of one Ferruginous Hawk nest located along an existing transmission line and two-track road. A UIC Class I Well located SE of this nest was installed in 2010. A pipeline from this well is planned to be constructed along the existing road.	No impacts to wildlife related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.9
Pygmy Rabbits	Potential loss of pygmy rabbits in disturbed portions of Permit Area during the Project.	No impacts to wildlife related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.9

Table 2.3-1 Comparative Summary of Impacts (Page 7 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Wyoming Pocket Gophers	Potential loss burrow complexes in the disturbed portions of the Permit Area during the Project.	No impacts to wildlife related to the Project.	Slight reduction in disturbed acreage may decrease the impact on Wyoming pocket gophers.	Same impact as Proposed Action.	Section 4.9
Exposure of Wildlife to Toxic Materials	Potential for exposure of wildlife to toxic chemicals from spills or leaks.	No impacts to wildlife related to the Project.	Increased risk of exposure in pattern areas.	Same impact as Proposed Action.	Section 4.9
Fence Strikes and Increased Perching	Potential for increased risks of strikes and predation to sage grouse from fence construction.	No impacts to wildlife related to the Project.	Decreased risk of strikes and predation due to perching.	Same impact as Proposed Action.	Section 4.9
Exposure of Small Wildlife to Storage Ponds	Potential exposure of small mammals and birds to Storage Pond water via ingestion. Chronic exposures may be of toxicity concern.	No impacts to wildlife related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.9
Wild Horses					
Habitat Disturbance	Disturbance of 345 acres (about 8% of Permit Area) over the life of the Project.	No impacts to wild horses related to the Project.	Slight reduction in the acres of habitat disturbance due to less construction.	Same impact as Proposed Action.	Section 4.10
Restriction in Movement	Approximately 300 acres (at most) will be fenced, which may affect the movement of the horses, requiring them to travel around the fenced areas.	No impacts to wild horses related to the Project.	Reduction in restriction of movement of the wild horses.	Same impact as Proposed Action.	Section 4.10
Exposure to Toxic Materials	Potential for exposure of wild horses to toxic chemicals during spills and leaks.	No impacts to wild horses related to the Project.	Increased risk of exposure in pattern areas.	Slight increase of exposure to spills and leaks.	Section 4.10

Table 2.3-1 Comparative Summary of Impacts (Page 8 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Air Quality					
Overall Emissions	Not a major source under New Source Review or Title V of the Clean Air Act; would not impact attainment for ambient air quality standards in the surrounding region or in the Class I or Class II areas in the vicinity of the Project.	No impacts to air quality related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.11
Fugitive Dust	Dust generated per year is estimated at 180 tons of PM_{10}.	No impacts to air quality related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.11
Emissions from Materials used in Project	Approximately 13.5 pounds of soda ash and 17.5 pounds of salt released per year. May be fugitive releases of cement dust or welding fumes during mine unit construction.	No impacts to air quality related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.11
Noise					
Construction Equipment	Average noise levels 50 feet from the heavy construction equipment are between 75 and 110 dBA. Levels drop rapidly beyond 50 feet.	No impacts to noise related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.12
Historic and Cultural Resources					
Damage Due to Direct Surface Disturbance	After mitigation, Site 48SW16604 could be subject to surface scraping.	Historic and cultural resources will not be harmed due to activities related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.13

Table 2.3-1 Comparative Summary of Impacts (Page 9 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Erosion	Potential soil erosion may lead to site exposure or deposition onto a site.	Historic and cultural resources will not be harmed due to activities related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.13
Intrusion or looting	Increased number of people accessing the Permit Area may create a greater potential for intrusion or looting of sites, although routine inspection of the area may discourage intrusion or looting.	Historic and cultural resources will not be harmed due to activities related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.13
Visual and Scenic Resources					
Dust	Potential for reduced visibility due to dust generation.	No impacts to visual and scenic resources related to the Project	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.11
Vegetative Disturbance	An estimated 345 acres of land will be disturbed.	No impacts to visual and scenic resources related to the Project	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.8
Equipment and Project Facilities	Equipment and facilities will be discernable during the day and during occasional light use at night for safety and security.	No impacts to visual and scenic resources related to the Project.	Less fencing to impact visual and scenic resources.	Same impact as Proposed Action.	Section 4.14
Socioeconomic Conditions					
Local Demographics	The population of the region will increase by 298 to 340 people.	No impacts to socioeconomic conditions related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15

Table 2.3-1 Comparative Summary of Impacts (Page 10 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Gross Domestic Product	Project will contribute approximately $360,000,000 to the Nation's GDP.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15
Revenue Generated from Project Costs	Project costs will contribute approximately $225 million in revenue, not including local, state and federal taxes.	No impacts to socioeconomic conditions related to the Project. Baseline conditions. would continue.	Minimally reduce the Project's expenditures.	Same impact as Proposed Action.	Section 4.15
Taxation	Taxation contributions throughout Project life are estimated as follows: Federal income: $52,000,000 Wyoming Severance: $6,600,000 County Ad Valorem: $12,400,000 County Property: $1,600,000.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Minimally reduce the Project's expenditures.	Same impact as Proposed Action.	Section 4.15
Labor Employment and Income	Potential creation, both directly and indirectly, of 119 to 148 positions.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Minimally reduce the Project's employment.	Same impact as Proposed Action.	Section 4.15

Table 2.3-1 Comparative Summary of Impacts (Page 11 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Cost of Living and Housing Impacts	Increase regional housing demand. As many as 148 housing units would be required.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15
Infrastructure and Services	Increases in population create the potential for earlier than anticipated improvements to local infrastructure and services. Likely to be low costs.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15
Education	An estimate of 105 children will enter regional school systems.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15
Health Care	Minimal impact to existing health care system; necessary infrastructure already exists.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15
Recreation	Revenue generated by additional population will benefit the local communities and the State.	No impacts to socioeconomic conditions related to the Project. Baseline conditions would continue.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.15

Table 2.3-1 Comparative Summary of Impacts (Page 12 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Environmental Justice					
Minority Populations	Lack of significant minority population in the region. Disproportionately high or adverse impacts are not anticipated.	No impacts to environmental justice related to the project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.16
Low-Income Populations	Lack of significant low-income population in the region. Disproportionately high or adverse impacts are not anticipated.	No impacts to environmental justice related to the project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.16
Tribal Populations	Tribal populations reside outside the region directly impacted by the Project. Disproportionately high or adverse impacts are not anticipated.	No impacts to environmental justice related to the project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.16
Public and Occupational Health					
Radiological Exposure	Small amounts of radon will be released from the mine units and Plant and vented to the atmosphere. Potential for workers to be minimally affected.	No impacts to public and occupational health related to the Project.	Potential for wildlife and cattle to damage well heads, releasing radiological production fluids.	Potential for workers in the Plant to be exposed from an accidental release from dryer.	Section 4.17
Mechanical Hazards	Potential for injury from use of machinery or heavy equipment.	No impacts to public and occupational health related to the Project.	Lack of fence creates a higher potential for injuries associated with header houses for people unfamiliar with pattern area.	Addition of more complex equipment to processing area creates more potential mechanical hazards.	Section 4.17

Table 2.3-1 Comparative Summary of Impacts (Page 13 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Non-Radiological Exposure	Chemicals, fumes and emissions from equipment and processing. Potential for workers to be minimally affected.	No impacts to public and occupational health related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.17
Waste Management					
Non-Radioactive Airborne Emissions	Emissions from equipment and dust from traffic and earthmoving.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.11
Radioactive Airborne emissions	Small amounts of radon will be released from the mine units and Plant and vented to the atmosphere.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.17
Waste Petroleum Products and Chemicals	40 to 80 gallons of waste petroleum products per month. 5 to 10 gallons of waste chemicals per year.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.18
Native Groundwater Surface Discharge and Storm Water Runoff	Small quantities yield little potential for impacts. Discharge in accordance with WYPDES requirements.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.18
Domestic Sewage	Small quantities yield little potential for impacts. Septic system approved by County and maintained by licensed contractor.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.18
Liquid 11(e)(2) Byproduct Materials	Disposal of up to 250 gpm in UIC Class I wells permitted on site. Expected rate of 115 gpm.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Minimal addition of liquid for disposal.	Section 4.18

Table 2.3-1 Comparative Summary of Impacts (Page 14 of 14)

Impact Type	Proposed Action	No-Action Alternative	Not Fencing the Pattern Areas	Drying Yellowcake On-Site	Additional Discussion
Non-hazardous solid wastes	Potential maximum of 1,400 cubic yards of non-hazardous materials to be disposed of at designated facility off-site.	No impacts to waste management related to the Project.	Slightly less solid waste from lack of fencing materials.	Same impact as Proposed Action.	Section 4.18
Hazardous Solid Wastes	LCI would be Conditionally Exempt Small Quantity Generator of hazardous wastes per EPA definition. Wastes generated to be disposed of at EPA-licensed facility off-site.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Same impact as Proposed Action.	Section 4.18
Solid 11(e)(2) by-product materials	A total of 4,000 yd^3 estimated to be disposed of at NRC-licensed facility off-site.	No impacts to waste management related to the Project.	Same impact as Proposed Action.	Minimal addition of solids for disposal	Section 4.18

2.3.3 Alternatives Considered and Eliminated from Detailed Study

The following alternatives and management options were considered but were eliminated from detailed analysis as either unreasonable or impractical because of technical, legal, or policy considerations. Some other concepts were raised as potential independent alternatives, but were subsequently considered to be required stipulations, mitigation, or incorporated as part of another alternative. These alternatives and concepts were developed through interdisciplinary team meetings, meetings with agencies, and input received during public scoping.

2.3.3.1 Portable Drill Pits and Closed Loop Drilling Systems

Either portable above-ground metal tanks or excavated pits are used to circulate the drilling mud and allow drill cuttings to settle out of the mud. The above-ground metal tanks are usually referred to as portable drill pits. Closed loop drilling systems are an enhancement of the portable drill pits in that these systems allow for additional separation of drill cuttings from the mud. For simplicity in the following discussion, the above-ground tanks and closed loop drilling systems are referred to as portable drill pits. Components of the portable drill pits may include shakers, baffles, settling basins, centrifuges, and suction basins for separating the drill cuttings from the drilling mud. Depending upon the size and configuration of these components, they may be divided among two or more tanks. Depending on the required capacity of the portable drill pits, a flatbed trailer and additional equipment for loading and unloading the trailer may be required to transport the portable drill pits to the Permit Area and between drill holes. Some portable drill pits have bottom rails that allow them to be skidded from one drill hole to the next, providing the distance is short. Other portable drill pits are wheel-mounted, and smaller pits may be towed behind a pickup while larger pits would need to be towed with a tractor-trailer. For a portable drill pit of comparable capacity to the excavated pit in the Proposed Action, it is likely a flatbed trailer or tractor-trailer would be needed.

Portable drill pits were considered as an alternative to the excavated drill pits described for drilling the pattern areas and monitor wells in the Proposed Action (**Section 2.1.2.3**) as a potential way to reduce overall surface disturbance. After analysis, the use of portable drill pits was not evaluated in detail due to four primary concerns, which are discussed in the following subsections.

While portable drill pits have proven advantageous for much larger oil and gas drilling operations (and in some instances for individual water wells), their application to ISR drilling would not be as advantageous. Oil and gas mud pits are generally 0.3 acres or larger in size, as needed to handle the large volumes of drill mud and cuttings, and are open for months. ISR pits are significantly smaller (e.g., 0.003 acres [**Figure 2.1-7**]) and are open for a few days. Also, ISR drilling fluids and cuttings do not contain the oily/briny materials of concern in oil and

gas drilling. In addition, the safety advantage (reduction of gas kicks) in closed loop drilling for oil and gas is generally not a concern for ISR drilling. Surface reclamation, including topsoil replacement and vegetation re-establishment, has generally not been problematic at ISR projects where conventional mud pits were used, provided proper practices for topsoil protection and pit reclamation are followed during drilling and operation (e.g., stripping and stockpiling topsoil and timely revegetation of disturbed areas as required per the WDEQ-LQD Permit to Mine and mitigation measures in this EIS). The BLM and WDEQ-LQD site inspections, the annual report reviews, and the WDEQ-LQD permit revision process also provide an opportunity to consider future changes in drilling technology and associated mud and cuttings handling practices.

Analysis of Surface Disturbance Reduction

The acreages of vegetation and topsoil disturbance related to the Project are detailed by facility (e.g., Plant, Mine Units) in **Table 4.5-1** and discussed in detail in **Sections 4.5** (Soil) and **4.8** (Vegetation). As a conservative approach, based on experience at other ISR operations, vegetation disturbance includes areas on which vegetation is crushed, but not removed, as well as areas from which vegetation is removed. Therefore, there would be no change in the total vegetation disturbance because the portable mud pits and associated equipment would have similar impacts to the other drilling equipment. With respect to topsoil removal, topsoil would be removed and replaced from about 14 acres total for the mud pits at the monitor wells outside the pattern areas and from about 21 acres total for the mud pits in the pattern areas. Therefore, the potential difference in acreage of topsoil removal if portable mud pits were used, assuming off-site disposal of the drill fluids and cuttings, would be about 35 acres (less than 10 percent of the total acreage disturbance for the Project). If the drilling fluids and cuttings are disposed of on-site, the potential acreage difference would be less than 35 acres because of the need for topsoil removal at the disposal site.

LCI proposes using up to ten drilling rigs for mine unit development (drilling and installing injection wells, production wells and monitor wells) with additional rigs for exploration and delineation drilling. One portable drill pit would be required per drilling rig. Even if one larger pit could be placed at a central location for drilling more than one well (e.g., in the pattern areas), the need for longer hoses from the pit to the well locations increases the risk of spills and leaks and increases surface disturbance as the hoses are moved between holes. Although topsoil stripping might not be required for portable drill pits initially, the weight of the equipment and the additional traffic to place, clean out, and remove the portable drill pits could result in topsoil compaction and could result in requirements for removal of topsoil for subsequent drilling.

The drill cuttings and some or all of the drilling mud must be disposed of as the portable drill pit is filled. If this material is disposed of by drying and burying at a designated location on-site, additional surface disturbance and wildlife exclusion

would be needed at that location for the life of the Project. Therefore, using the excavated mud pits results in less surface disturbance than use of the portable mud pits and an on-site drying and disposal location.

The other concerns identified with respect to the Project-wide use of portable mud pits relate to transportation, wildlife, and logistics. These concerns are discussed below.

Transportation

If portable drill pits were used, the amount of equipment and personnel required on-site would increase. Initially, the portable drill pits and associated equipment would need to be brought to the site, and then would need to be moved with the drill rigs. In addition, the drilling mud and cuttings would need to be cleaned out of the portable drill pits, e.g., with a vacuum truck, dried, and disposed of at designated locations on-site and/or off-site. Alternately, the portable drill pits would need to be removed from the drill site and emptied at a designated location on-site or off-site. During installation of the pattern area, about 1.5 wells would be completed per day. The disposal of drilling mud and cuttings may require more than one trip per day from each well, depending on the portable pit size and subsurface conditions. Most vacuum trucks have capacities from 3,000 to 5,000 gallons. Presuming the larger trucks are available, then at least 1.5 trucks per day would be needed if the portable drill pits were of similar size to the excavated pits and depending on how much of the drilling mud could be reused. As not all of the wells would be finished on different days, a more realistic scenario would be an additional two to three trucks per day.

The potential increase in on-site traffic associated with the use of portable mud pits, the subsequent increase in emissions and the potential for more accidents, particularly with the equipment proximity in the pattern areas, are considered to weigh against any potential benefit if surface disturbance were reduced.

Wildlife

The potential increase in on-site traffic associated with use of portable mud pits could also increase the risk of wildlife injury or mortality due to collisions. Similarly, if the drilling fluids and cuttings were disposed of off-site, the increase in traffic to and from the site would also increase the potential for wildlife collisions.

Another concern pertaining to wildlife is the need for additional exclusion areas. The use of a centralized location for drying and disposal of the drill cuttings is considered more problematic than the use of excavated mud pits with respect to wildlife exclusion. Mud pits for the monitor wells and in the pattern areas are generally open less than a week. They are fenced while open, and then backfilled and topsoil is reapplied. In addition, they are usually in areas where there is

considerable human activity, deterring wildlife presence. A centralized disposal site would essentially be open for several years, which would require fencing, deterrence for birds, and similar measures to exclude wildlife from the disposal site.

Logistics

With respect to logistics, rig and driller availability have been at a premium in Wyoming, and the specialized equipment would further restrict the equipment and contractor availability and would increase costs.

In addition, during cold weather, keeping fluids in any additional above-ground equipment, such as tanks and hoses, from freezing would add to the drilling time and fuel use.

2.3.3.2 Alternative Mining Methods

Methods used to extract uranium resources include ISR mining, open pit mining, and underground mining. ISR mining is commonly used to recover uranium from low-grade ores where other mining and milling methods may cause significant environmental impacts or may not be economically feasible. As described in **Section 2.1.1**, ISR mining (otherwise known as 'solution' mining) involves injecting a lixiviant through a series of wells installed in the ore body. The lixiviant dissolves the uranium in the ore body. The resulting uranium-laden solution is then pumped to the surface through production wells. After moving through pipelines, the uranium in solution is then recovered in a processing plant. Open pit mining and underground mining methods, which are described below, were considered as alternatives to ISR mining.

Open Pit Mining

Open pit mining requires the removal of all material covering the ore body (overburden) and then the ore itself. The ore would then be transported to a conventional mill for further processing and extraction through grinding, leaching, purifying, concentrating, and drying.

From a technical standpoint, the mine pit and waste rock piles from excavation of the overburden would make permanent changes to the topography of the Permit Area (and the post-mine land uses). The pit, which would be on the order of 300 to 700 feet deep, would require a disturbed area approximately three times the area of the ore body mined in order to maintain slope stability. Open pit mining at the Permit Area would also require substantial dewatering of the pit to depress the potentiometric surface of all aquifers. Large quantities of groundwater would be discharged to the surface. Some of this groundwater would contain naturally elevated radium, radon and uranium, requiring treatment before discharge, and the treatment residue would need to be disposed of as radioactive solid waste.

Potential personnel injury rates and potential radiological exposures at the mining site would also be higher with open pit mining than what would be experienced with ISR mining.

A mill tailings pond would be required to contain the millions of tons of waste produced from the uranium mill. Although the mill would be at a different location, the additional material from the Project would contribute to the size of the tailings facility. This material would represent a large volume of radioactive tailings slurry covering a large area of ground surface. Conventional mill operation would involve higher risks of spillage and radiological exposure to both personnel and the environment than those associated with the proposed ISR operations.

Underground Mining

Underground mining of the uranium resources at the Permit Area would involve sinking of shafts to the vicinity of the ore bodies, horizontally driving crosscuts and drifts to the ore bodies at different levels, physically removing the ore, and transporting the mined ore to a conventional mill for further processing. Processes for milling and uranium extraction from underground mined ores would be the same as those for ores mined from the open pit.

The technical disadvantages of underground mining closely parallel those of open pit mining. These, as stated above, include permanent changes to the topography (though in a smaller scale than open pit mining because less amounts of waste rock would be generated), generation of a significant amount of water and mine tailings, increased risks of injury and potential exposure to radioactive materials during mining and milling, and large amounts of initial investment.

Another major concern for underground uranium mining is the potential exposure of miners to radon gas if the gas was not continuously vented to the atmosphere. Land surface subsidence could also occur after the completion of underground mining.

Because of the potential for additional risks to human safety, a greater amount of surface disturbance and other environmental impacts, and greater need for reclamation, Alternative Mining Methods were not considered in detail.

2.3.3.3 Alternative Waste Water Disposal Methods

The liquid process waste generated from uranium ore processing is an 11(e)(2) byproduct material. The Project would generate about 105 gallons of liquid process waste per minute, primarily from the production and eluate bleeds and the yellowcake wash water. The production bleed would generate between 30 and 90 gpm, totaling 100 gpm when combined with the restoration discharge. An additional 5 gpm would be generated from the eluate bleed and yellowcake wash

water. Laboratory analyses of the production fluid would produce another 25 gallons per day (Operations Plan, WDEQ-LQD Permit to Mine [LCI, 2011b]). Two alternative waste water disposal methods, evaporation ponds and land application, were considered.

Evaporation Ponds

Solar evaporation ponds are an alternative to the UIC Class I wells described in the Proposed Action. The primary function of the evaporation ponds would be to provide temporary storage of the liquid process waste as it is allowed to evaporate from natural solar radiation. The evaporation ponds must be designed to provide adequate storage with sufficient freeboard and must have liners that are designed, constructed, and installed to prevent any migration of wastes to the adjacent subsurface soil, groundwater or surface water during the active life of the ponds. A leak detection system must be installed immediately below the liner and a groundwater monitoring program must be established in accordance with the groundwater protection standards established by the EPA in 40 CFR Part 192, Subpart D and E.

The capacity of the evaporation ponds must account for the evaporation rate compared to the total liquid (liquid process waste plus precipitation) input into the ponds. In addition, evaporation rates would need to be determined for the liquid process waste. It has been demonstrated that fresh water evaporation rates decrease as the amount of solids and chemical concentrations increase in the solution (Pochop et al., 1985). An evaporation pond design based solely on fresh water evaporation rates may fail at some point due to overtopping.

The design of the evaporation ponds must provide resistance to wind and water erosion during the Project operations. The planning, siting, and design of the evaporation ponds are described by the NRC in 10 CFR Part 40, Appendix A. The design, construction, and inspection of embankment retention systems at Uranium Recovery Facilities are described in NRC Regulatory Guide 3.11 (2008a). The siting and design must also follow applicable EPA requirements contained in 40 CFR Part 264.

The construction and operation of evaporation ponds involves additional land disturbance compared to ISR. Based on the estimated production rate of 105 gpm of liquid process waste and an estimated average annual evaporation rate of 42.5 inches determined for Pathfinder Dam (Pochop et al., 1985), the minimum total pond area would be 40 acres. The area would also require exclusion fencing.

Productivity and efficiency would also be an issue. Due to the severe winter weather conditions at the Permit Area, the evaporation ponds would be frozen and covered with snow for several months, making any evaporation close to impossible. In addition, the solid wastes that precipitate from the process water would be radioactive and extensive efforts would be needed during the

reclamation phase to clean up and dispose of these solid wastes. Sludge accumulation could also decrease the useful life of the evaporation ponds.

Land Application

An alternative to the UIC Class I well liquid process waste disposal method is land application. Land application uses irrigation equipment to discharge treated process water to the land surface. The process water would have to be treated in accordance with the requirements contained in NRC 10 CFR Part 20, Subparts D and K and Appendix B before being broadcast onto the land surface. The treated process water would have to meet the requirements of WYPDES, and the NESHAP regulations contained in NRC's 10 CFR Part 61. A regular monitoring program would be required to ensure that soil loading and vegetation concentrations fall within the permit limits.

As with the evaporation ponds, severe winter conditions in the Permit Area would limit the efficiency of land application. Storage of the water would be necessary during the winter months. This would require an additional storage pond to hold the treated water during the winter months.

Since evaporation ponds and land application involve additional surface disturbance or impacts and are not practical considering the weather conditions of the Permit Area, these Alternative Waste Water Disposal Methods were not considered in detail.

2.3.3.4 Phased Development of Mine Units

A mine unit consists of ISR amenable production zones within a sandstone bounded by upper and lower hydrologic barriers. In the simplest scenario, a monitor well ring radially bounds the injection and production wells in the ore zone as one of the primary means of ensuring control of mining solutions within a mine unit. Monitor wells are also completed in underlying and overlying zones to ensure no vertical movement of fluid from the production zone (**Figure 2.1-4**). Mine units (and even the header houses within the mine units) are developed, produced, and reclaimed sequentially, i.e., the Proposed Action proceeds in phases. Two approaches to defining the phases were considered, one of which is primarily technical and the other of which is primarily regulatory. The first approach relates to the scale of the mine units, and the second approach relates to whether the phases are 'schedule-based' or 'standard-based'.

Scale of the Mine Units

The scale of the mine units for a given ISR operation depends on a variety of factors, including ore distribution, aquifer characteristics, plant capacity design, and operational feasibility. An alternative to the three mine units in the Proposed Action is the installation of larger or smaller mine units. Under the larger mine

unit scenario, there would be fewer mine units but more wells and associated production equipment per mine unit. Under the smaller scale mine unit scenario, there would be more mine units but fewer wells and associated production equipment per mine unit. For a larger mine unit, the time required for the activities associated with developing, producing, and reclaiming the mine unit would increase dramatically. Conversely, for a smaller mine unit, the time required for all activities associated with developing, producing, and reclaiming the mine unit would decrease. For a smaller mine unit, operation may not be feasible, e.g., due to increased potential for interference in ore production and groundwater restoration based on the aquifer conditions. In addition, from an economic standpoint, more mine units would need to be in operation at any one time under the smaller mine unit scenario.

Based on the aquifer testing conducted by LCI (Appendix D6 of the WDEQ-LQD Permit to Mine and Attachment MU1 2-1 of the WDEQ-LQD Mine Unit 1 documents [LCI, 2011b]), the ore distribution in the HJ Sand (Appendix D9 of the WDEQ-LQD Permit to Mine [LCI, 2011b]), operational feasibility, and WDEQ-LQD regulatory review, three mine units are currently considered the best approach to efficient mining and resource protection. Initially, the Project included six mine units in the same area as the three mine units. However, as described in Project Development of the Adjudication File of the WDEQ-LQD Permit to Mine (LCI, 2011b), consolidation to three mine units was considered more appropriate.

Regardless of the number of mine units in the Permit Area, the total disturbance area does not change because the footprint of the mine units follows the ore trend. Therefore, this alternative was not evaluated in detail. Due to the relatively short timeframe of the Project, the total disturbance area of the Project is considered rather than staged disturbance areas of the mine units when evaluating potential Project-related impacts and mitigation measures (**Section 4.0**).

Schedule-Based versus Restoration-and/or-Reclamation-Based Phases

In the Proposed Action, the schedule provides a basis for the Project phases. Similar to the requirements of other mining operations (e.g., coal), contemporaneous reclamation would be performed. For example, one mine unit would be in the Reclamation phase at the same time another mine unit would be in the Construction phase or Operation phase. However, in order to comply with the schedule, certain targets would be met for groundwater restoration, surface reclamation, and other aspects of the Project.

The proposed Project schedule and supporting information (e.g., the water balance and restoration rates) were reviewed by the WDEQ-LQD and the NRC. At least annually, LCI would review and revise the schedule and the WDEQ-LQD Permit to Mine as necessary to reflect the current Project status. These revisions would be reported to the WDEQ, the NRC, and the BLM in LCI's Annual Report.

Per WS §§35-11-411(a)(ii)(C) and 411(b), WDEQ-LQD may require information from LCI on schedule adjustments and permit revisions, and may object to the information provided in the Annual Report. In accordance with the 2005 rule changes, the WDEQ-LQD also reviews the permit once every five years to determine if any changes are necessary (WDEQ-LQD NonCoal Rules and Regulations Chapter 11, Section 18(b) [2005b]). Provisions are also included in the Proposed Action for review and approval of new mine units before installation and operation (Section OP 3.2, WDEQ-LQD Permit to Mine [LCI, 2011b]). Per the MOU between the BLM and the WDEQ-LQD (2003), concerns raised by either agency about an operation shall be communicated to the other.

A suggested alternative to using the schedule as the basis for the phases would be to use only groundwater concentrations and/or vegetation re-establishment criteria. To meet groundwater concentration and/or vegetation re-establishment criteria, a mine unit would be required to complete (or nearly complete) groundwater restoration and/or reclamation prior to the development or operation of another mine unit. In other words, operation of a new mine unit could not commence until groundwater restoration and reclamation were completed for the previous mine unit in accordance with the requirements contained in Sections RP 2.0 and 4.5 of the WDEQ-LQD Permit to Mine (LCI, 2011b). This alternative was suggested because of concerns about lengthy restoration times, in excess of the permitted schedule, in previous ISR operations. However, the regulatory mechanisms to address such lapses are in existence, as outlined in the previous paragraph. In addition, the lapses in previous ISR operations were not directly attributable to inadequate restoration methods, rather to the delays in implementing restoration in favor of production. In addition, more rigorous aquifer testing, mine unit balancing, and regulatory review are in place than when the older operations were first approved more than 20 years ago.

A critical component is that this alternative (groundwater concentrations and/or vegetation re-establishment criteria as the basis for the phases) would not be economically viable and would constrain some of the available technical options for more efficient mining and groundwater restoration. Most mining projects require a relatively high initial outlay of capital. However, subsequent operations are a balance of income (mining) and expense (operating, maintenance, and reclamation) throughout the life of the mine until the final removal of the mine facilities. With this groundwater and/or vegetation criteria alternative, the Project would alternate between periods of income and expense (during mining) and just expense (during restoration), which would be contrary to the requirements for other mining operations, e.g., coal, in which contemporaneous reclamation is required, but not complete closure of one mine pit before starting another.

Using the criteria in **Figure 2.1-8**, groundwater restoration would be required in one mine unit before development of the next mine unit, there would be a two-year hiatus between Mine Units 1 and 2 because that is the elapsed time for restoration of Mine Unit 1. There would be a four-year hiatus between Mine Units 2 and 3; the hiatus would be longer because Mine Unit 2 is anticipated to be

larger than Mine Unit 1. This would extend the schedule, and associated disturbance, from 11 years to 17 years. The income-generating portion of the Project, i.e., Production, would still take place during six years, less than one-half the Project life. Currently, Production would take place during about two-thirds of the Project life. (If surface reclamation were required in one mine unit before development of the next mine unit, the hiatus between mine units would be even longer to allow for revegetation after groundwater restoration.) Even if some or all of the Plant, offices, disposal wells, and associated equipment could be 'mothballed' and restarted without undue maintenance or replacement expenses, it is unlikely that a skilled employee base could be retained throughout the Project life as the number of employees needed would vary radically. Similarly, it would be difficult for LCI to effectively negotiate supply or sales contracts if the need for supplies or the amount of yellowcake produced varied substantially over the life of the Project. The income to municipalities, counties, and the state would also vary, making it more difficult for them to effectively plan for services.

From a technical standpoint, a hiatus between mine units for completion of groundwater restoration or revegetation raises several concerns. First, the option for groundwater transfer (or exchange) between a mine unit in restoration and another mine unit in production is no longer available. This option, which is discussed in more detail in Section RP 2.3.1 of the WDEQ-LQD Permit to Mine (LCI, 2011b), allows for some reduction in consumptive use of groundwater, a reduction which would no longer be available. Second, revegetation would be 'on hold' in some areas because of the overlap of facilities. As currently envisioned (Figure OP-2a of the WDEQ-LQD Permit to Mine), Mine Unit 3 would share some of the same road and pipeline access as Mine Unit 1; therefore, some of that area would remain disturbed for twice as long as currently planned. This would also require that the associated topsoil stockpiles, erosion protection measures, and weed control would need to be in place for longer than currently planned. Third, the reclamation 'bond clock' for revegetation is a minimum of five years; however, circumstances beyond LCI's control, such as drought or fire, could extend this time frame, making it even more difficult to plan for the time lapse between mine units.

In essence, the schedule-based approach in the Proposed Action would include the specific restoration and reclamation parameters along with how they would be evaluated (e.g., Section 6.1.3 of the WDEQ-LQD Mine Unit 1 document [LCI, 2011b]) and would allow for the evaluation of other considerations in determining whether the operation is progressing as planned. Therefore, the schedule-based approach is considered effective and is economically practicable.

2.3.3.5 Alternative Lixiviants

Since uranium is soluble under both acidic and alkaline conditions, it is possible to use either acid or alkaline based lixiviant reagents. The main criteria for using acid or alkaline leaching agents are:

- Potential or desired rates of dissolution or the rate that uranium enters solution;
- Effects of leaching solutions on aquifer formation properties (such as aquifer permeability reduction);
- The cost of the chemicals and associated safe-handling practices;
- The reactions between leaching solutions and gangue minerals; and
- The requirement (and ability) to restore groundwater quality to pre-mining levels after the completion of ISR mining (Mudd, 1998).

For acid uranium leaching, sulfuric acid is the cheapest and most common acid used, although it has rarely been used in the US. Hydrochloric acid and nitric acid could also be used but at a much higher cost. The oxidizing agents used in conjunction with acid leaching include sodium chlorate, oxygen, manganese dioxide, and ferric sulfate (Mudd, 1998).

Alkaline leaching agents include carbon dioxide, sodium carbonate-bicarbonate, and ammonium carbonate-bicarbonate. Common oxidizing agents include hydrogen peroxide and oxygen (Mudd, 1998).

The advantage of acid leaching is achieving higher extraction of uranium in a shorter timeframe. Acid leaching also results in the dissolution of higher concentrations of gangue minerals, but the migration of the dissolved ions is limited by the natural neutralization of the acid. Alkaline leaching introduces fewer ions into solution; however, dissolved ions can migrate further (Taylor et al., 2004). Alternative lixiviants, such as sulfuric acid or ammonium carbonate solutions, are being used in other countries and have been used in the past at ISR operations in the US. However, they are not currently used in Wyoming because of the geochemical conditions and difficulties in restoring and stabilizing the affected aquifers. Furthermore, the composition of the ore-bearing sandstones in the Permit Area (i.e., relatively high carbonate content) makes acid lixiviants not technically feasible. Ammonia-based lixiviants are generally not used because the ammonia tends to adsorb onto clay minerals in the subsurface and then slowly desorb from the clay during restoration, requiring larger amounts of groundwater to be removed and processed during aquifer restoration. For these reasons, lixiviants other than alkaline-based lixiviants were eliminated from detailed analysis.

The Proposed Action includes the use of a sodium carbonate-bicarbonate based lixiviant (Section OP 3.1 of the WDEQ-LQD Permit to Mine [LCI, 2011b]). LCI currently plans to use soda ash to prepare this lixiviant, although caustic soda

could also be used but is currently more expensive. A concern was raised as to the potential risks if caustic soda were used. However, caustic soda is already used as part of the uranium processing in the Plant (Section OP 4.3 of the WDEQ-LQD Permit to Mine [LCI, 2011b]), so appropriate precautions for storage and handling of the material are in place. The lixiviant would be prepared within the Plant, and once prepared, would not be different than the lixiviant prepared using soda ash. Therefore, different preparations of the sodium carbonate-bicarbonate based lixiviant have not been evaluated separately.

2.3.3.6 Shipping Uranium-Laden Resin

The uranium can be shipped off-site in three different forms, uranium-laden resin, yellowcake slurry, or dried yellowcake, depending on the extent of processing. After ion exchange, which is the first process circuit in the Plant, the uranium-laden resin could be shipped off-site for additional processing to produce dried yellowcake. After the precipitation/filtration circuit, the third process circuit, the yellowcake slurry could be shipped off-site for additional processing to produce dried yellowcake.

Shipping uranium-laden resin is a standard industry practice for satellite processing plants in conjunction with processing facilities. At the satellite processing plant, uranium is oxidized, mobilized and pumped out of the sandstone formation into a loaded pipeline and ends up in ion exchange columns. Inside the columns, uranium is extracted through an ion exchange process - a chloride ion on a resin bead exchanges for a uranium ion. After the fluid has been stripped of uranium, it is sent back to the mine unit as barren solution, minus the bleed. Uranium is adsorbed onto negatively charged polymer or plastic particles in the ion exchange columns. When the resin beads in the ion exchange columns become saturated with uranium, the columns are taken offline and the loaded resin is transported by truck to a central uranium processing facility.

Semi-trailer trucks hauling the loaded resin carry modified bulk cement trailers with three compartments. The three compartments, or cells, each have a function. One cell holds the uranium-loaded resin, one cell is empty and the third has unloaded resin. As per DOT regulations, no liquids are permitted during the transportation process (Finch, 2007).

LCI anticipates a production rate of one million pounds U_3O_8 per year. The average load of resin would be 500 cubic feet at a loading rate of eight pounds per cubic foot, or 4,000 pounds U_3O_8 per transfer (load). This would require a shipment of loaded resin to a separate facility approximately every 1.5 days. In the Proposed Action, the Project would process slurry and require the transport of approximately 15,000 pounds U_3O_8 to a drying facility at a time. This would require a shipment every 5.5 days. Therefore, for the above reason, the option of shipping loaded resin for processing and drying was eliminated.

2.3.3.7 Alternate Plant Locations

Prior to 2007, two locations were considered for the Plant based on the information available at the time. The location which was selected, the 'northern' location is in the Northwest Quarter of the Southeast Quarter of Section 18, Township 25 North, Range 92 West. The other location, the 'southern' location was in the Northeast Quarter of the Southeast Quarter of Section 19, Township 25 North, Range 92 West. The northern location was selected based on several criteria. First, the results of exploration drilling indicated the southern location could interfere with potential mine unit development. Second, the southern location was within a drainage area. Third, both locations were about equidistant to Greater sage-grouse leks, but the southern location was closer to active raptor nests. Fourth, the potential radiation risk to the public was slightly higher at the southern location. Therefore, by the time the license application and related documents were submitted to the NRC and the WDEQ, the northern location was incorporated into the Proposed Action and the southern location was omitted from further consideration (LCI, 2008 and 2011b).

2.3.3.8 Alternate Routes for the East and West Access Roads

The access routes to the Permit Area must satisfy requirements of the County, the State, the BLM, and the NRC, including:

- For emergency purposes, Sweetwater County requires two access roads for ingress and egress (LCI, 2011a).
- The BLM and the State require that roads meet specific design criteria, depending on road usage, to minimize soil loss and surface water impacts from erosion. For example, culverts may be required on some stream crossings. Road treatments to reduce dust or improve traction must also be identified.
- The BLM and the State require that routes for new or improved roads address soil and vegetation impacts, including identification of soil types and vegetation, to minimize disturbance of sensitive areas.
- The BLM and the State require that the impacts of roads on wildlife be identified and mitigated. In particular, the impacts on Greater sage-grouse and raptors are of concern.
- The NRC requires the evaluation of environmental and safety aspects of the roads with particular attention to radiation concerns.

Sweetwater County has determined the Project's transport routes provide adequate access with regard to fire and safety; and the County and LCI are working on a maintenance agreement to ensure adequate access. The NRC, the WDEQ-LQD, and the WGFD have reviewed the routing of the East and West Access Roads and evaluated potential impacts. The NRC evaluated these transport routes for environmental impacts and safety in the SEIS (2011a). **Section 4.3** provides detailed information concerning Project transport, such as

the number and type of vehicles, and materials transported, including equipment, supplies, wastes, and products. The WDEQ-LQD reviewed LCI's Permit to Mine for compliance with State environmental requirements (LCI, 2011b); and the WGFD analyzed the WDEQ-LQD Permit to Mine (LCI, 2011b) for compliance with the Wyoming Sage Grouse Executive Order 2011-5 (EO 2011-5) as signed by Governor Matt Mead (Mead, 2011). The existing routes met the criteria established by these agencies. However, to ensure that options for potentially better routes were not overlooked, alternate routes were reviewed.

Current Routes

As shown in **Figure 2.3-1**, the East Access Road is a bladed dirt road that extends 2.2 miles from the Sooner Road to the east Permit Area boundary. In the Proposed Action, the East Access Road would primarily provide access to employees commuting from the east of the Permit Area. Some supplies, materials, and waste would also be transported on this road, depending on the origin or destination of the shipment. **Figure 2.3-2** is a photograph of the West Access Road, which is a 2.8-mile existing two-track dirt road from the Wamsutter-Crooks Gap Road to the west Permit Area boundary. Both of these roads have existed for many years. The West Access Road was reportedly constructed (including ditch and crown) for access to a potential oil and gas drill site, but the road was not maintained and has partially filled in with soil and vegetation.

In the Proposed Action, the West Access Road would provide access to employees commuting from the west of the Permit Area. In addition, the West Access Road would provide the most direct route to the railroad and to roads capable of accommodating large, heavy-duty trucks carrying materials, supplies, products, including yellowcake slurry, and waste – following the West Access Road west to the Wamsutter-Crooks Gap Road and south to I-80. In the Proposed Action, the East and West Access Roads would be upgraded for Project use according to seasonal restrictions and BLM standards (**Section 2.1.2.5**).

The major concern regarding the East and West Access Roads is their location with respect to Greater sage-grouse leks. The Permit Area lies within the Greater sage-grouse Core Area; and the East and West Access Roads pass through buffers for occupied Greater sage-grouse leks. The EO 2011-5 states that no roads shall be placed within 0.6 miles of an occupied Greater sage-grouse lek, and main roads used to transport production and/or waste products shall be located at least 1.9 miles from an occupied Greater sage-grouse lek. However, the EO does allow for exceptions to be considered on a case-by-case basis (Mead, 2011).

Figure 2.3-1 Photo of the East Access Road

Looking west, 0.7 miles west of the Sooner Road, July 2009

Figure 2.3-2 Photo of the West Access Road

Looking west, one mile east of the Wamsutter-Crooks Gap Road, July 2009

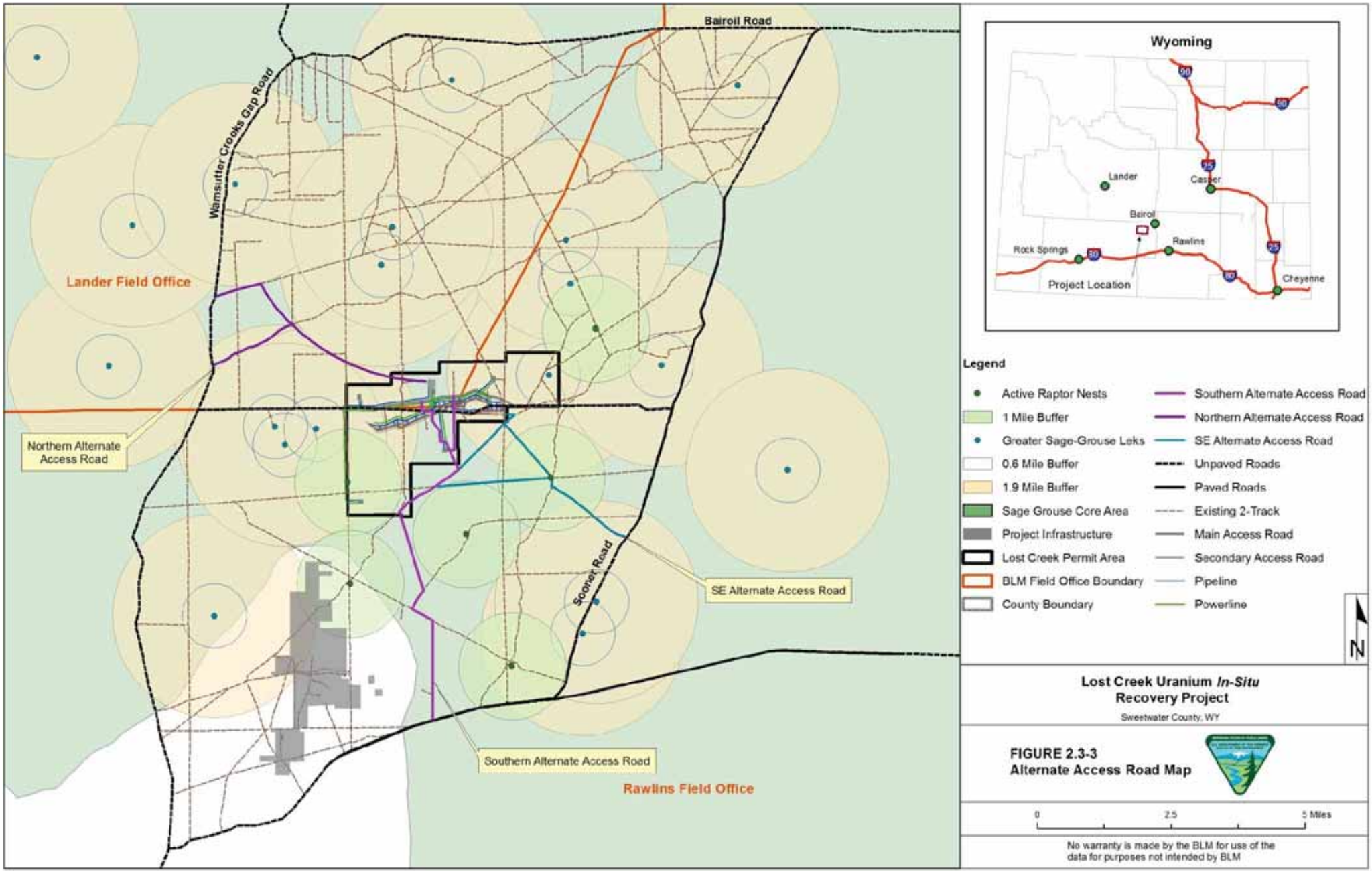
Figure 2.3-3 shows the relative locations of the access roads to Greater sage-grouse leks in the Permit Area. The existing East Access Road passes through the edge of the 0.6-mile buffer of a Greater sage-grouse lek. The existing West Access Road passes through the 0.6-mile buffer of two Greater sage-grouse leks. The proximity of the East and West Access Roads to these three leks could impact Greater sage-grouse use of these leks. In the consideration of the Project, the WGFD reviewed the potential impacts to Greater sage-grouse associated with upgrading the existing two-track roads and determined that upgrading the existing roads to provide access to the Permit Area would have less impact to the Greater sage-grouse than creating new roads outside the 0.6-mile lek buffer (WDEQ, 2011a).

The West Access Road intersects the 1.9-mile buffer of three Greater sage-grouse leks. To assess potential impacts from upgrading this road, topographical visual assessments were prepared, along with an analysis of opportunity costs of habitat fragmentation. The WGFD reviewed the assessments and analysis and determined that this option would have less impact to the Greater sage-grouse than creating new roads outside the 1.9-mile lek buffer (WDEQ, 2011a). Furthermore, the estimated production transport of one 18-wheeler truck per day was not expected to have significant impacts.

Alternate Routes

Three alternate routes were considered, as shown on **Figure 2.3-3**. The BLM considered two alternate routes to avoid the 0.6-mile Greater sage-grouse lek buffer and, if possible, the 1.9-mile Greater sage-grouse lek buffer. The Northern Alternate Access Road approaches the Permit Area from the northwest, off of the Wamsutter-Crooks Gap Road. The Southern Alternate Access Road is south of the Permit Area, from the Mineral Exploration Road. Although these routes are potentially viable, they are less preferable relative to the existing routes, as outlined below. The third alternative, the Southeast Alternate Road, was proposed during public review and comment on the WDEQ-LQD Permit to Mine Application; however, for the reasons outlined below, it was not considered viable.

The Northern Alternate Access Road uses one of two existing two-track roads that extend northeast from the Wamsutter-Crooks Gap Road north of the proposed West Access Road, and then continues southeast to the Permit Area via a new road. This option would require the improvement of one to two miles of existing two-track road and the construction of three to four miles of new road. This option avoids the one-mile buffer around raptor nests and the 0.6-mile buffer of occupied Greater sage-grouse leks, but is within the 1.9-mile buffer of several occupied Greater sage-grouse leks. In addition, depending on the exact route, this road would require a new crossing over a major drainage, Eagles Nest Draw, or would require a new road along the more dense vegetation following the Draw.


Bairoil Road
Wamsutter Crooks Gap Road
Lander Field Office
Northern Alternate Access Road
SE Alternate Access Road
Sooner Road
Southern Alternate Access Road
Rawlins Field Office
Wyoming
Lander
Casper
Bairoil
Rawlins
Rock Springs
Cheyenne
Project Location
Legend
Active Raptor Nests
1 Mile Buffer
Greater Sage-Grouse Leks
0.6 Mile Buffer
1.9 Mile Buffer
Sage Grouse Core Area
Project Infrastructure
Lost Creek Permit Area
BLM Field Office Boundary
County Boundary
Southern Alternate Access Road
Northern Alternate Access Road
SE Alternate Access Road
Unpaved Roads
Paved Roads
Existing 2-Track
Main Access Road
Secondary Access Road
Pipeline
Powerline
N
Lost Creek Uranium In-Situ Recovery Project
Sweetwater County, WY
FIGURE 2.3-3
Alternate Access Road Map
0
2.5
5 Miles
No warranty is made by the BLM for use of the data for purposes not intended by BLM

The option for the Southern Alternate Access Road, off of the Mineral Exploration Road, includes the use of several existing two-track roads as well as the development of new sections of road. This alternate road would require the improvement of a total of three miles of two-track roads and the construction of approximately four miles of new road. This option does not intersect Greater sage-grouse lek buffers or raptor nest buffers; however, both new and existing roads associated with this alternative are still entirely within the Greater sage-grouse Core Area. In addition, it would require upgrading a road through the more dense vegetation along several draws, including Battle Springs Draw, and upgrading several drainage crossings. Also, because the road has several twists and turns, the potential for accidents increases. The road could potentially be straighter, but this would result in essentially all new road and the subsequent increase in soil, vegetation, and drainage disturbance.

During public review and comment on the WDEQ-LQD Permit to Mine, the Wyoming Outdoor Council (WOC) suggested the Southeast Alternate Road (WOC, 2011). However, this alternate route is within the 1.9-mile buffer of two Greater sage-grouse leks, which were not identified in WOC's analysis. In addition, WOC's alternate route is within one mile of two active raptor nests; therefore, a seasonal restriction would apply according to the BLM Rawlins RMP (2008c). Additionally, no surface disturbance can occur within 1,200 feet of an active nest; this alternative would violate this regulation as well. Upgrades to existing two-track roads and the construction of new road would be required, along with new drainage crossings over Stratton Draw and Battle Springs Draw. Therefore, this alternative was determined unsatisfactory.

In summary, the Northern and Southern Alternate Access Roads avoid the 0.6-mile buffer around Greater sage-grouse leks, and the Southern Alternate also avoids the 1.9-mile Greater sage-grouse buffer. In this respect, these alternatives seem preferable to the West Access Road. However, the North and South alternatives involve not only the improvement of existing two-track roads, but the development of miles of entirely new road and new drainage crossings. The construction of new roads disturbs previously untouched Greater sage-grouse habitat and contributes to habitat fragmentation, which is one of the bigger threats to Greater sage-grouse populations. The WGFD determined that construction of new roads would have a greater negative impact on Greater sage-grouse populations than the improvements made to existing two-track roads (LCI, 2011a).

Additionally, as noted in the topographical visual assessments of the West Access Road, the topography creates a barrier between the West Access Road and the nearby leks, reducing the impact this road could have on the neighboring leks. The WGFD examined the transportation options for the site, and believed the proposed East and West Access Roads to be in compliance with the EO 2011-5 (WDEQ, 2011a). If an alternative to the East (or West) Access Road were chosen, another impact could be the reclamation of the East (or West) Road to

ensure it was not used as a 'short-cut' for easier access to the Permit Area, particularly if the Northern Alternate Access Road were selected. Under the Proposed Action, the East and West Access Roads would both be completely reclaimed upon Project completion. However, the BLM would be consulted and given the option to retain the roads established for the Project, reclaim the roads to accommodate their current two-track uses, or to completely reclaim the roads for no vehicular use.

For the reasons outlined above, the Northern and Southern Alternate Access Roads were not included for a more in-depth analysis, and the East and West Access Roads were included in the Proposed Action.