4.10 Wild Horses

4.10.1 Agency-Required Measures

The management practices for wildlife (**Section 4.9**) would be beneficial to wild horses as well as wildlife and are established in conjunction with the BLM, WGFD, and USFWS guidelines and regional recommendations (BLM, 2008b; WGFD 2008c; and WGFD, 2009). In addition to the measures discussed in **Section 4.9**, the installation of pitless cattle guards under the gates to the mine units would be used as an additional protection measure. The purpose of these cattle guards is to deter wild horses from entering a mine unit should the gate to that mine unit be left open inadvertently. Alternately, an automatic closure would be put on the gate.

The management practices would also help minimize impacts to plant communities and associated forage and habitat. Standard construction, erosion control, and other agency-required measures described in other sections would also help to minimize impacts to wild horses.

4.10.2 Monitoring of Wild Horse Impacts

An annual record of all wild horse mortality due to fence entanglements, vehicle collisions, and other factors would be completed to help minimize adverse impacts to wild horses.

4.10.3 Impact Significance Criteria

Habitat loss or alteration, incremental habitat fragmentation, displacement of, and stresses on, wild horses, and direct or indirect mortalities were considered in order to assess the significance of impacts on wild horses. The availability of adjacent habitat and the size of the horse population were also considered.

These criteria are in accordance with the Rawlins RMP Management Goals, which aim to protect the health and viability of herds while retaining the free-roaming nature of wild horses.

4.10.4 Impacts from the Proposed Action

Wild horses rely on the same available habitats for survival as wildlife big game; as a result, direct habitat impacts would generally be similar to Project impacts to big game in the region (**Section 4.9**).

4.10.4.1 Construction

The Construction phase includes the Initial Construction and progressive Mine Unit Development. Initial Construction would require about one year. Most of the disturbance during Initial Construction would be long-term, i.e., lasting for the duration of the Project, because it would include vegetation removal from the areas on which Project facilities would be built. During Mine Unit Development, the impacts would be similar to those during Initial Construction, but the facilities being constructed would be smaller, e.g., header houses, and the facilities would be in place for the life of the mine unit, but not the life of the Project. **Section 4.8.4.1** includes a more detailed discussion.

During the Construction phase, potential impacts to wild horses include loss and/or modification of habitat, increased disturbances due to human presence, and direct mortality (from vehicle collisions, entanglement in new fences or cattle guards, or getting stuck in trenches).

During Initial Construction, approximately 95 acres (rounded to closest 5 acres) would be disturbed (two percent of the total Permit Area). Approximately 80 percent of this disturbance is in the Upland Big Sagebrush Shrubland, with the rest, about 20 percent, in the Lowland Big Sagebrush Shrubland (**Table 4.5-1**).

These 95 acres of disturbed land represent a long-term direct impact of a small percentage of available habitat within any of the HMAs (**Figure 3.9-1**). Since only a small percent of the total Permit Area would be disturbed, wild horses are expected to disperse from the Permit Area as Construction activities approach. During Initial Construction, approximately ten acres within the Permit Area would be restricted from wild horses due to fencing around the Plant (**Section 2.1.2.6**).

During Mine Unit Development, the habitat disturbance would be similar to that during Initial Construction, but the facilities being constructed would be smaller, e.g., header houses, and the facilities would be in place for the life of the mine unit, but not the life of the Project. The total area of vegetation disturbance (primarily vegetation crushing in the pattern areas) during Mine Unit Development of all mine units is on the order of 240 acres. All but about 85 percent of this disturbance is in the Upland Big Sagebrush Shrubland, with the rest, about 15 percent, in the Lowland Big Sagebrush Shrubland. Approximately 50 acres of disturbance would occur for the first mine unit, and 95 acres for the next two mine units (**Section 4.8**). The pattern areas within these mine units would be fenced to restrict wild horses from entering (**Figure 2.1-5** and **Section 2.1.2.6**). The ISR process is iterative; new mine units are brought into production as older mine units are reclaimed. Therefore, not all of the disturbance would occur at once, and the disturbance is clustered, which would help minimize disruptions to wild horses.

Increased noise from Construction equipment could cause wild horses on-site to relocate; however, the equipment noise is expected to be indistinguishable from the wind noise at the Permit Area boundary nearest to the Construction activity (**Section 3.11**). Therefore, noise from Construction activities would not affect wild horses outside of the Permit Area and is not expected to impact horses in many parts of the Permit Area that are further from the Construction activities.

Increased traffic in the Permit Area could impact wild horses due to an increase in noise and an increased chance of direct casualties due to vehicle collisions. During Construction, increased heavy equipment would be transported to the Permit Area. The volume of traffic associated with the Project is expected to be relatively small; and, due to the concentrated nature of the resource, the comparatively small workforce associated with the Project; and the restricted time of work hours, impacts to wild horses from increased traffic would be negligible. The increased traffic would create dust that may settle on vegetation, making it temporarily less palatable and creating a short-term reduction in forage available to the wild horses.

Increased human presence due to Construction may affect wild horse use of areas adjacent to the Permit Area (e.g., the stock pond south of the East Access Road). Although these indirect impacts are possible, wild horses are transitory and would likely find nearby suitable habitat free from areas of human activity and disturbance. More detrimental impacts could occur if the disturbed area included a source of water for the wild horses, but, as discussed in **Section 3.5**, the Permit Area has no standing water for nearly the entire growing season, and no wetlands were identified. Forage losses due to Construction would be mitigated via staged reclamation of disturbed areas, providing grass and forb forage within a few years of habitat disturbance. Impacts to wild horses would be minimal because these species are highly mobile, the area of disturbance is relatively small compared to adjacent similar habitats, and on-site water sources are not present. Therefore, impacts are not expected to threaten the continued existence of the wild horse population in the Permit Area and surrounding habitat.

Section 4.6 of the NRC SEIS summarizes the potential impacts to wildlife in the Permit Area and includes an analysis of wild horses. Since wild horses are mobile and only a small percentage of the land would be influenced by the Construction, Operation, and Reclamation associated with this Project, no significant impacts to the population are expected (NRC, 2011a).

4.10.4.2 Operation

The Operation phase of the Project includes the production from the mine units. During the Operation phase, there would be little, if any, new habitat disturbance.

The primary impacts of Operation on wild horses are habitat alteration and incremental habitat fragmentation, displacement/stress from human activity, and

direct and/or indirect mortalities. There is also a potential for exposure to spills containing trace quantities of toxic chemicals and compounds during the Operation phase.

Approximately 300 acres within the Permit Area would be fenced to keep out cattle and wild horses. While this fencing may affect the movement of horses, requiring them to travel around the fenced areas, the fencing is not expected to increase fragmentation of herds, due to the relatively small fenced area. Temporary mud pits would be fenced if they are located outside of the fenced portion of the mine units. Inside the fenced portion of the mine units, mud pits would not be fenced, in part due to the limited time the pits are open and the level of activity around the pits while they are open. Temporary mud pits (within the fenced pattern area or individually fenced if not within the pattern area) have not been the cause of significant mortality to big game at other ISR operations. (Most other ISR operations are in areas with more domestic than wild horses.) Therefore, the mud pits are not anticipated to impact wild horses.

During Operation, spills around wellheads and leaks from pipelines could expose wild horses to trace quantities of toxic chemicals. LCI's leak detection systems and SPCC plan to remove affected soils and capture release fluids would eliminate or reduce such impacts.

Similarly to the Construction phase, increased traffic creates dust that could land on the adjacent vegetation, reducing the quality of available forage in the short-term, and creating a higher competition for the remaining plant resources.

Wild horse use of areas adjacent to ISR operations is anticipated to increase as animals become habituated to mining activity. Because wild horses may be in proximity to Project buildings, roads, and mine units, some impacts to the horses, such as collisions with fences, would be expected to occur.

Traffic volume during the Operation phase would likely be on the same order as for Construction; however, there would be less transport of heavy equipment and more transport of wastes and yellowcake slurry off-site (**Section 4.3**). These activities could reduce wild horse use within the Permit Area, resulting in a higher concentration of animals in the surrounding habitat. Noise from Operation activities is expected to be lower than that generated during Construction activities (**Section 4.12**). Also, considering the size of the comparable surrounding habitat, impacts would are expected to be minimal because only a few bands of wild horses would be affected in each HMA. Operational impacts are not expected to threaten the continued existence of the wild horse population in the Permit Area and surrounding habitats.

Section 4.6 of the NRC SEIS summarizes the potential impacts to wildlife in the Permit area and includes an analysis of wild horses. Since wild horses are mobile and only a small percentage of the land would be influenced by the Construction,

Operation, and Reclamation associated with this Project, no significant impacts to the population are expected (NRC, 2011a).

4.10.4.3 Reclamation

There should be no additional habitat disturbance during Mine Unit or Final Reclamation. Short-term land disturbance would occur during decommissioning of supporting facilities and roads, as soils are excavated, buried piping is recovered and removed, and structures are demolished and removed. Revegetation and recontouring would restore habitat previously altered during Construction and Operation. Once the structures were removed, the area of the Plant and Storage Ponds would be regraded to pre-construction contours, and then topsoil would be reapplied and seeded with native vegetation.

No loss of additional vegetative communities is expected beyond those previously disturbed during Construction and Operation. The removal of piping would impact vegetation that has reestablished itself, although this, too, would be temporary once the disturbed soil is reseeded. Wild horses would be temporarily displaced, but are expected to return after Reclamation is completed and vegetation and habitat are reestablished. As the areas are reseeded with the permanent seed mix, there could be changes in the proportion of various species, including an increase in weeds. The presence of weeds could potentially affect habitat desirability and forage availability. However, actions would be taken to mitigate weed invasion. Wild horses are mainly grazers, increased grazing intensity could occur on newly seeded areas. Fences would be removed after ISR operation is complete and vegetation has become reestablished in accordance with permit requirements (Section RP 4.5.4 of the WDEQ-LQD Permit to Mine [LCI, 2011b]) unless otherwise approved and agreed upon with the landowners (BLM and the State of Wyoming). Overall, impacts from Reclamation would be considerably less than those associated with Construction and Operation.

Soil contamination could result from leaks and spills during Reclamation, and wild horses could then be exposed to the contaminated soils. However, detection and response techniques, and survey and treatment (if necessary) of all impacted soils, would limit the magnitude of overall impacts to wild horses.

The Reclamation activities are expected to create temporary increases in noise and traffic (in comparison with the Operation phase) as buildings are taken down and hauled away. During this time, wild horses could come in conflict with heavy equipment, or may move elsewhere on the property due to higher-than-normal noise. However, these impacts would be short-term in nature.

Section 4.6 of the NRC SEIS summarizes the potential impacts to wildlife in the Permit area and includes an analysis of wild horses. Since wild horses are mobile and only a small percentage of the land would be influenced by the Construction,

Operation, and Reclamation associated with this Project, no significant impacts to the wild horse population are expected (NRC, 2011a).

4.10.5 Wild Horse Impacts from Other Alternatives

4.10.5.1 No Action Alternative

Under the No Action Alternative, there would be no ISR facility construction associated with the Project, and therefore no habitat disturbance associated with Construction, Operation, and Reclamation would occur. The area would continue to provide vegetation communities and habitat typical of the region. Land would continue to be used for rangeland available to wild horses within the HMAs. Impacts from other existing activities, such as cattle grazing, mineral exploration, recreation, and hunting would continue.

4.10.5.2 Not Fencing the Pattern Areas

There would be a slight reduction in the acres of vegetation and habitat disturbance if the fences around the patterns areas are not constructed. However, the protection measures in the pattern areas, specifically reseeding, would be adversely impacted as the new vegetation growth in the reseeded areas would be preferred by livestock and wild horses. Also, without the fencing in place, collisions or entanglement of wild horses with fences would not occur. Without fencing there would be a higher likelihood of wild horse exposure to spills containing trace quantities of toxic substances and other operational hazards, such as collision with well heads.

4.10.5.3 Drying Yellowcake On-Site

This alternative would have minimal additional impacts on habitat resources at the Permit Area, as the dryer would be within the Plant. There would be an added potential for harmful leaks to occur; however, this potential would be mitigated through proper operational precautions and risk management.

4.11 Air Quality

4.11.1 Agency-Required Measures

The required environmental protection measures are summarized below from Sections OP 2.10 and OP 5.1.1 of the WDEQ-LQD Permit to Mine (LCI, 2011b), the WDEQ-AQD Permit, Section 7.5 of the NRC Technical Report (LCI, 2010), Sections 2.1.1.1.6.1 and 6.4 of the NRC SEIS (NRC, 2011a), and Condition 12.8 of the NRC License (NRC, 2011b). Emissions and potential impacts from radon gas are discussed in **Section 4.17**.

LCI would use BMPs to reduce fugitive dust and emissions. These BMPs include:

- Per the Air Quality Permit issued by WDEQ-AQD (Permit CT-7896), LCI would necessarily reduce fugitive dust emissions using standard dust control measures (e.g., water or chemical dust suppressant application on roads controlled by LCI on a schedule "sufficient to control fugitive dust from vehicular traffic", reduced speed limits, encourage employee carpooling, etc.);
- Reduce maximum fugitive dust by coordinating dust-producing activities;
- Use fossil-fuel vehicles that meet applicable emission standards;
- Reclaim or revegetate disturbed areas;
- Reduce diesel particulate matter emissions using measures such as particle traps and other technological or operational methods;
- Ensure that diesel-powered construction equipment is properly tuned and maintained;
- Use ultra-low sulfur diesel fuel;
- Use newer, cleaner equipment;
- Avoid leaving equipment unnecessarily idling or operating;
- Standardize delivery procedures to minimize material loss (as well as address health and safety concerns);
- Use efficient construction and demolition practices;
- Ensure vapor control equipment (e.g., laboratory hoods) is operating correctly to both reduce emissions and protect personnel; and
- Per the Air Quality Permit issued by WDEQ-AQD (Permit # CT-7896), a scrubber would install and maintain a scrubber for used during loading of the HCl storage tank.

Many of the above BMPs address minimizing use of or burning fossil fuels more efficiently. These practices would effectively reduce GHG emissions as well.

4.11.2 Monitoring of Air Quality Impacts

Specific monitoring is not required per the provisions of the WDEQ-AQD Air Quality Permit. Dust would be the most visible component of the emissions from the Project; therefore, attention to visibility conditions would be necessary to ensure the environmental protection measures required by the permit are applied timely for best effect. Several air monitoring networks exist in the region of the Permit Area, as outlined below.

There are three State and Local Air Monitoring Sites (SLAMs) in Sweetwater County; the sites are located in Rock Springs, Moxa, and Wamsutter. The closest SLAM to the Permit Area is in Wamsutter (approximately 25 miles south-southwest of the Permit Area), which records NOx, ozone, and continuous particulate concentrations (PM_{10} tapered element oscillating microbalance (TEOM)) and houses a camera system and meteorology monitors. The Wamsutter site is upwind, as is the Rock Springs site (approximately 80 miles southwest of the Permit Area), which records $PM_{2.5}$ and PM_{10} concentrations. The site in Moxa (approximately 110 miles west-southwest of the Permit Area) has the same capabilities as the Wamsutter site and also monitors SO_2. There are no SLAMS in Carbon County, the nearest downwind county. However, there are SLAMs in Natrona County and Albany County (approximately 100 miles northeast and approximately 150 miles southeast of the Permit Area, respectively). Both of these downwind sites collect only $PM_{2.5}$ and PM_{10} concentrations. The nearest downwind site measuring gaseous emissions is in Campbell County (approximately 200 miles northeast (WDEQ, 2010b).

The purpose of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network is to establish current visibility and aerosol conditions along with characterization of broad regional trends and visibility conditions using monitoring data collected in or near Class I Areas across the United States. Wyoming has five IMPROVE locations which include: Yellowstone National Park (approximately 200 miles northwest of the Permit Area), Bridger Wilderness Area (approximately 100 miles northwest of the Permit Area), North Absaroka Wilderness Area (approximately 180 miles northwest of the Permit Area), Thunder Basin National Grasslands (approximately 200 miles northeast of the Permit Area), and Cloud Peak Wilderness Area (approximately 180 miles north of the Permit Area) (WDEQ, 2010b). There are no IMPROVE sites downwind of the Permit Area in Wyoming.

The purpose of the National Atmospheric Deposition Program (NADP) is to measure atmospheric deposition and study its effects on the environment. Deposition is measured at various sites, nationwide, through the National Trends Network (NTN). There are currently eight active NTN sites in Wyoming. The nearest NTN site to the Permit Area is in South Pass City (approximately 60 miles west-northwest of the Permit Area. The nearest upwind site is in Murphy Ridge, Utah (approximately 180 miles southwest of the Permit Area). The nearest

downwind site is in Newcastle (approximately 200 miles northeast of the Permit Area) (NADP, 2011).

Finally, there are three active Clean Air Status and Trends Network (CASTNET) sites in Wyoming: Centennial, Pinedale, and Yellowstone National Park. These sites have been designed to provide data to assess trends in air quality, atmospheric deposition, and ecological effects due to changes in air pollutant emissions. The closest site to the Permit Area is in Centennial (approximately 100 miles southeast of the Permit Area. There are no nearby upwind CASTNET sites and the closest downwind site is in Wind Cave National Park in South Dakota (approximately 200 miles northeast of the Permit Area) (EPA, 2011a).

4.11.3 Impact Significance Criteria

The airborne emissions of the Project are identifiable, and emission levels are estimated to evaluate the potential impacts on ambient air quality from the different phases of the Project, i.e., Construction, Operation, and Reclamation. Potential impacts on air quality from the Project are evaluated in consideration of the WAAQS, NAAQS, PSD, and Regional Haze Regulations. The WAAQS and NAAQS set legally enforceable upper limits for specific air pollutant concentrations. If an area meets the standards, it is considered to be in "attainment". PSD requirements provide maximum allowable increases in concentrations of pollutants for areas already in compliance with the NAAQS. PSD standards are, therefore, expressed as allowable increments in the atmospheric concentrations of specific pollutants. Allowable PSD increments currently exist for three pollutants: NO_2, SO_2, and PM_{10}. One set of allowable increments exists for Class II areas, which cover most of the US. A much more stringent set of allowable increments exists for Class I areas, which are specifically designated areas where the degradation of ambient air quality is severely restricted. Regional Haze Regulations were developed to maintain and improve visibility in PSD Class I areas.

The Project was also evaluated in consideration of whether it would be a major source in accordance with WDEQ regulations and whether any Hazardous Air Pollutants (HAPs) would be present. The potential impacts of those portions of the emissions that are greenhouse gases and contribute to climate change are more difficult to quantify and depend on relative comparisons to other sources. Therefore, the potential impacts of greenhouse gases and climate change from the Project as a whole are evaluated by comparing Project greenhouse gases (GHGs) emissions to statewide emissions.

4.11.4 Air Quality Impacts from the Proposed Action

The Project is expected to be a source of airborne emissions throughout its life. Emissions would include:

- fugitive dust;
- combustion engine exhausts;
- particulates and gaseous emissions from materials used in Project activities, such as drilling (e.g., drilling mud) and ore processing (e.g., salt); and
- radon gas.

The significance of the impacts of fugitive dust, engine exhausts, particulates, and other gaseous emissions on the ambient air quality from the Project depends on the emission levels of the Proposed Action, the existing air quality in the region of influence, and the threshold to separate significant from non-significant effects. This section discusses predicted emissions from each phase of the Project in relation to relevant air quality regulations and potential impacts with consideration of site-specific conditions. Emissions and potential impacts from radon gas are discussed in **Section 4.17**. The only potential non-radiological HAP emission is hydrogen chloride, which is used for ore processing in the Plant and is discussed in **Section 4.11.4.2**.

PSD applies to new major sources or major modifications at existing sources for pollutants when the area the source is located is in attainment or unclassifiable with the NAAQS. The Permit Area and surrounding land is classified as in attainment for NAAQS and WAAQS, and does not include any PSD Class I or Sensitive Class II areas. The nearest PSD Class I areas, Bridger Wilderness, Fitzpatrick Wilderness, and Mt Zirkel (WDEQ, 2011b), are located about 60, 100, and 90 miles, respectively, to the northwest and south (Mt. Zirkel) of the Lost Creek site. The Popo Agie Wilderness area is the closest Sensitive Class II area and is located about 58 miles to the northwest of the Lost Creek site (NRC, 2011a).

WDEQ-AQD issued an air quality permit for the Project on January 4, 2010. The Project is not considered a "major source" as defined in Chapter 6, Section 3 of the Wyoming Air Quality Standards and Regulations (WDEQ, 2010a). Therefore, air quality modeling is not necessary. Air emissions from the proposed Lost Creek ISR Project would comply with the conditions of the WDEQ-approved construction air permit and the required WDEQ minor source operating permit. Due to the wind and relative instability of the air, emissions would generally be quickly dispersed (**Section 3.10**). As such, it is not expected that the predicted Project emissions would impact attainment for ambient air quality standards in the region surrounding the Permit Area. Furthermore, emissions are not expected to impact air quality in the Class I or Class II areas in the vicinity of the proposed Lost Creek ISR Project, as the areas are located at least 50 miles from the Permit Area and are upwind the majority of the time (**Figure 3.10-4**).

4.11.4.1 Construction

Air quality impacts during Initial Construction would come primarily from ground-clearing activities and transportation of materials and personnel. The primary emissions would be dust and emissions from combustion engines, which would power equipment ranging from light trucks to heavy equipment. Emissions other than dust or engine exhausts would be minimal.

Mine Unit Development is included under construction, although the development of the mine units is progressive (one mine unit may be under development while another mine unit is in operation). During Mine Unit Development, there would be some air quality impacts from emissions and dirt-moving activities during header house and pipeline installation. However, the quantity of dust from these activities would be a small fraction of that from road traffic.

According to Section 4.7.1.1 of the NRC SEIS, potential impacts to air quality in the region during Construction result from fugitive dust and combustion emissions from the vehicles and equipment used. It is believed that all of these emissions would not result in concentrations above the air quality standards, and that the only potentially significant impact would be the visual impact the fugitive dust emissions could have (NRC, 2011a).

Dust

Localized, short-term and intermittent visible dust would be possible in the immediate vicinity of the Permit Area (i.e., when vehicles travel on unpaved roads). These impacts would be reduced, but not eliminated, by road treatments required per the WDEQ-AQD permit (WDEQ, 2010a). To estimate the maximum annual amount of dust generated from Project traffic, calculations using EPA Emission Factors for unpaved and paved roads were made. These calculations do not include any reduction for road treatment. The equations and assumptions for these calculations can be found in **Appendix H**.

Most of the dust, generated from all vehicles, originates from travel on unpaved roads. The greatest amount of dust, assuming no road treatment, would be generated from employee and contractor vehicles during Initial Construction (approximately 170 tons per year of PM_{10}). Mine Unit Development would also generate dust emissions, but less than during Initial Construction due to the reduced vehicular traffic (e.g., less than half the number of commuting vehicles with some vehicles remaining on-site).

Combustion Engines

Emissions would originate from a variety of engines on employee vehicles, tractor/trailers delivering equipment and supplies, scrapers and other earth moving equipment, welding machines, drilling rigs, and other equipment used for

Construction. Most of the combustion emissions from the employee vehicles are expected to be from gasoline engines and from the heavier equipment are expected to be from diesel engines.

Table 4.11-1 includes the estimated engine emissions during Initial Construction. Estimating the number of vehicles and type of equipment is difficult because of overlapping uses of the equipment for different Project phases. In addition, to simplify the estimate, it is assumed that some activities all occur during the initial seven-month period. For example, it was assumed that all of the UIC Class I wells would be drilled during the initial seven-month Construction period. However, one of the wells was installed in 2008 to provide the necessary subsurface information to determine the feasibility of deep well disposal, and it is unlikely that the other four would be drilled in the same year, due in part to rig availability and expense. In addition, only those wells needed would be drilled.

Table 4.11-1 Estimated Engine Emissions during Initial Construction (tons/year)

Drilling Activity	NO_x	CO	SO_2	PM_{10}	CO_2	Formaldehyde	VOCs
Commuting Traffic [1]	0.66	8.6	-- [2]	<0.01	279	--	--
Truck Deliveries [3]	5.24	0.48	--	<0.1	251	--	<0.1
Construction Equipment [4]	2.5	0.55	0.17	0.18	94	0.00068	0.20
Total Estimate	**8.40**	**9.63**	**0.17**	**0.18**	**624**	**0.00068**	**0.20**

[1] Using emission factors from EPA (2005) for a single vehicle multiplied by the expected number of vehicles in **Table 4.3-1**, for initial construction this was estimated to be 33 trucks/SUVs.

[2] Dashes (--) indicate information not provided in reference.

[3] Using emission factors from Federal Highway Administration (2005) for combination (tractor/trailer) diesel trucks built in 2002 on rural freeways for all parameters except CO_2; using emission factors from EPA (2004b) for CO_2 from moderate, heavy duty diesel vehicles. Mileage for calculating emissions assumed two 500-mile round trips (1,000 miles total) per week for seven months. Emissions were then multiplied by the expected number of vehicles in **Table 4.3-1,** for initial construction this was estimated to be five tractor/trailers.

[4] Table D.3-2 of Appendix D of NRC SEIS (NRC, 2011a).

It should also be noted that this estimate includes emissions from activities that do not occur exclusively on-site. In particular, the emissions attributable to off-site employee traffic and truck deliveries are included. Another important consideration is that the definition of Initial Construction for this estimate includes the installation of the Plant and associated facilities, but not Mine Unit Development, which is considered separately. This was done because the equipment needed for installation of the Plant and associated facilities, such as scrapers and dozers, is not the same as that needed for installation of the mine units, such as drill rigs and backhoes. Estimated engine emissions during Mine Unit Development are included in **Table 4.11-2**. The estimate is provided on an annual basis because the work would progress throughout each year mine units are being installed, which occurs over about five years.

Other Particulate or Gaseous Emissions

Construction activities may also generate airborne particulates other than dust or those generated during combustion. Examples of such particulates during the Initial Construction might be welding fumes or dust from grinding on steel, and examples of such particulates during Mine Unit Development might be drilling mud or cement dust during the installation of wells. However, because of the relatively small size of the Project facilities, these emissions are estimated to be negligible and the primary concern would be potential health impacts to workers in the immediate vicinity of the emission-generating activity.

Table 4.11-2 Estimated Annual Engine Emissions during Mine Unit Development (tons/year)

Drilling Activity	NO_x	CO	SO_2	PM_{10}	CO_2	Formaldehyde	VOCs
Commuting Traffic [1]	0.3	3.9	-- [2]	<0.01	126	--	--
Truck Deliveries [3]	3.6	0.33	--	<0.1	186	--	<0.1
Mine Unit Well Drilling & Support Equipment [4]	17	4.2	0.44	0.66	800	0.0013	0.66
Total Annual Estimate	**20.9**	**8.43**	**0.44**	**0.66**	**1112**	**0.0013**	**0.66**

[1] Using emission factors from EPA (2005) for a single vehicle multiplied by the expected number of vehicles in **Table 4.3-1;** for mine unit development, this was estimated to be 15 trucks/SUVs.

[2] Dashes (--) indicate information not provided in reference.

[3] Using emission factors from Federal Highway Administration (2005) for combination (tractor/trailer) diesel trucks built in 2002 on rural freeways for all parameters except CO_2; using emission factors from EPA (2004b) for CO_2 from moderate, heavy duty diesel vehicles. Mileage for calculating emissions assumed two 500-mile round trips (1,000 miles total) per week. Emissions were then multiplied by the expected number of vehicles in **Table 4.3-1,** for mine unit development this was estimated to be two tractor/trailers.

[4] Table D.3-1 of Appendix D of NRC SEIS (NRC, 2011a).

4.11.4.2 Operation

Air quality impacts during the Operation phase would come primarily from transportation of personnel and materials, and the primary emissions would be dust and emissions from combustion engines on lighter vehicles, such as SUVs, and heavier equipment, such as drill rigs. In addition to dust and to emissions from combustion engines, small amounts of particulates from materials used in Project activities, such as ore processing (e.g., salt) would be emitted.

Section 4.7.1.2 of the NRC SEIS discusses the potential impacts to air quality during the Operation phase. Several concerns involve fugitive dust, combustion emissions from the vehicles and equipment used, and the release of radon during Operation. It is believed that all of these emissions would generate concentrations

below the air quality standards, and that the only potentially significant impact would be the visual impact the fugitive dust emissions could have (NRC, 2011a).

Dust

Significantly fewer personnel vehicles are needed during Operation than during Construction, so the quantity of dust generated would be less than that during Construction. Trucks used for resin shipments are estimated to generate 4.3 tons of dust per year; and delivery trucks are estimated to generate 2.7 tons per year.

Combustion Engines

Most of the emissions during Operation would originate from a variety of engines in employee vehicles, and tractor/trailers delivering equipment and supplies. Most of the combustion emissions from employee vehicles are expected to be from gasoline engines and those from heavier equipment are expected to be from diesel engines. The quantities would be significantly less than those generated by the Mine Unit Development activities.

Other Particulate or Gaseous Emissions

Airborne particulates may include minor amounts of salt and soda ash releases during deliveries to and use at the Plant. An analysis of soda ash emissions shows that approximately 13.5 pounds of particulate would be released per year. The analysis assumes that 5.2 pounds of particulate is created per ton used, and 521.1 tons of soda ash would be used each year. Although 1.35 tons of particulate is created each year, a standard passive bag house filter would capture 99.5 percent of the material (using emission factors from EPA's AP-42, Compilation of Air Pollutant Emission Factors, Volume 1 (EPA, 2006), resulting in a total emission of 13.5 pounds. A similar analysis of salt emissions, using a passive bag house filter, indicates that approximately 17.5 pounds of salt would be emitted per year, a minor contribution to the Project PM_{10} emissions, which are primarily dust.

Liquid chemicals may be used in controlled amounts during groundwater restoration and for laboratory procedures. Venting of pressure at the mine units and supporting facilities would occasionally produce a low volume of non-radioactive gaseous emissions, such as CO_2, oxygen, and water vapor. These can come out of solution from the lixiviant or from the underground environment.

The only potential HAP emission is hydrogen chloride (HCl), which is used for ore precipitation at the Plant (**Section 2.1.4**). Permit # CT-7896, issued to LCI by WDEQ-AQD, includes specific conditions for use of a scrubber during loading of the HCl storage tank; therefore, no discernible impact is anticipated.

Table 4.11-3 shows the estimated annual emissions during Operation, which is expected to be approximately seven years in duration.

Table 4.11-3 Estimated Annual Emissions during Operation (tons/year, unless otherwise noted)

Drilling Activity	NO_x	CO	SO_2	PM_{10}	CO_2	Formaldehyde	VOCs	Soda Ash (lbs/yr)	Salt (lbs/yr)
Commuting Traffic [1]	0.06	0.78	-- [2]	<0.01	25.4	--	--	--	--
Truck Deliveries [3]	5.39	0.50	--	<0.1	258	--	<0.1	--	--
Plant Deliveries & Drilling[4]	--	--	--	--	--	--	--	13.5	17.5
Total Annual Estimate	**5.45**	**1.28**	**--**	**0.1**	**283**	**--**	**<0.1**	**13.5 lbs**	**17.5 lbs**

[1] Using emission factors from EPA (2005) for a single vehicle multiplied by the expected number of vehicles in **Table 4.3-1;** for mine unit development, this was estimated to be three trucks/SUVs.

[2] Dashes (--) indicate information not provided in reference.

[3] Using emission factors from Federal Highway Administration (2005) for combination (tractor/trailer) diesel trucks built in 2002 on rural freeways for all parameters except CO_2; using emission factors from EPA (2004b) for CO_2 from moderate, heavy duty diesel vehicles. Mileage for calculating emissions assumed two 500-mile round trips (1,000 miles total) per week. Emissions were then multiplied by the expected number of vehicles in **Table 4.3-1,** for mine unit development this was estimated to be three tractor/trailers.

[4] Using emission factors from EPA's AP-42, Compilation of Air Pollutant Emission Factors, Volume 1 (EPA, 2006) and usage information discussed above.

4.11.4.3 Reclamation

Reclamation would occur after completion of each mine unit (Mine Unit Restoration) as well as at the end of the project (Final Reclamation). Restoration of each mine unit is expected to take approximately one year, while Final Reclamation would take approximately three years. Potential air quality impacts during reclamation would include fugitive dust and emissions from combustion engines from many of the same sources identified for Construction. Impacts during Mine Unit Reclamation would be similar to those during Mine Unit Development, though of smaller quantities. During Final Reclamation, emission levels could increase in the short term, especially for particulate matter from activities such as dismantling buildings and equipment and grading the surface as part of Reclamation activities. Potential air quality impacts from Final Reclamation are initially expected to be similar to Initial Construction impacts and would decrease significantly as reclamation proceeds. **Table 4.11-4** shows the upper limit of emissions during reclamation for the final year of the Project, where Mine Unit Restoration would overlap with Final Reclamation. Emissions would be far less during the remainder of reclamation.

According to Section 4.7.1.1 of the NRC SEIS, potential impacts to air quality in the region from the Reclamation phase result from fugitive dust and combustion

emissions from the vehicles and equipment used. It is believed that all of these emissions would result in air concentrations below the air quality standards, and that the only potentially significant impact would be the visual impact the fugitive dust emissions could have (NRC, 2011a).

Table 4.11-4 Estimated Annual Engine Emissions during Reclamation (tons/year)

Drilling Activity	NO_x	CO	SO_2	PM_{10}	CO_2	Formaldehyde	VOCs
Commuting Traffic [1]	0.24	3.1	-- [2]	<0.01	101	--	--
Truck Deliveries [3]	8.98	0.83	--	0.11	430	--	0.11
Construction Equipment Needed for Reclamation of One Mine Unit & Plant Facilities[3]	17	3.6	1.1	1.2	620	0.0045	1.3
Total Annual Estimate	**26.2**	**7.53**	**1.1**	**1.31**	**1151**	**0.0045**	**1.41**

[1] Using emission factors from EPA (2005) for a single vehicle multiplied by the expected number of vehicles in **Table 4.3-1;** for reclamation, this was estimated to be 12 trucks/SUVs.
[2] Dashes (--) indicate information not provided in reference.
[3] Using emission factors from Federal Highway Administration (2005) for combination (tractor/trailer) diesel trucks built in 2002 on rural freeways for all parameters except CO_2; using emission factors from EPA (2004b) for CO_2 from moderate, heavy duty diesel vehicles. Mileage for calculating emissions assumed two 500-mile round trips (1,000 miles total) per week. Emissions were then multiplied by the expected number of vehicles in **Table 4.3-1,** for reclamation this was estimated to be five tractor/trailers.
[3] Table D.3-6 of Appendix D of NRC SEIS (NRC, 2011a).

4.11.4.4 Greenhouse Gases and Climate Change

With respect to evaluation of the cumulative impacts on air quality of energy-related projects with overlapping potentially affected areas, e.g., coal mining and oil and gas drilling, there are often concerns not only on the impacts of mining of the materials, but also on the impacts of the complete fuel cycle for those materials, especially as it relates to greenhouse gases and climate change. Conversely, there may also be concerns about the impacts of climate change on the Project.

No practical methods exist to evaluate the contribution to climate change in a particular place from a single project. The Center for Climate Strategies generated a report for the WDEQ, showing the inventory and future greenhouse gas emissions for the State of Wyoming (CCS, 2007). Carbon dioxide is expected to be emitted at much higher levels than other GHGs during all phases of the Project. Comparing the annual emissions of CO_2 from the Project to the statewide CO_2 estimated annual emissions, the Project would produce less than 0.01 percent

of the net total greenhouse gases produced in Wyoming (NRC, 2011a). The percentages for other GHGs would be even less. The potential impacts of CO_2 and the other GHGs from the Project would thus be negligible. Evaluating the contribution to climate change from the complete nuclear fuel cycle indicates a low impact compared to other energy-related projects (IAEA, 1999).

Due to the negligible CO_2 contribution, and the natural decreases and increases in temperature in this part of Wyoming, attributing part of the climate change to the Project is speculative. In turn, the projected temperature change would have little, if any, impact on the Project (GCRP, 2009). With respect to an increase in precipitation, the natural variability is greater than 10 to 15 percent per year. Therefore, presuming the projected precipitation change was incremental over the next century, the impact on the Project would be negligible (GCRP, 2009).

In Section 4.7 of the NRC SEIS, the amount of greenhouse gases emitted as a result of this Project is calculated to be a small fraction of the total projected emissions from the entire state of Wyoming and is considered insignificant (NRC, 2011a).

4.11.5 Air Quality Impacts from Other Alternatives

4.11.5.1 No Action Alternative

Under the No Action Alternative, there would be no change in the air quality at the Permit Area or at any surrounding receptor sites. The Permit Area currently meets the NAAQS for attainment status, and it is expected that this area would continue to meet the NAAQS. As noted in **Section 3.10**, current activities in the vicinity, including ranching, hunting, and grazing, do produce some emissions.

4.11.5.2 Other Action Alternatives

The impacts on air quality from the Other Action Alternatives (Not Fencing the Pattern Areas and Drying Yellowcake On-Site) would not increase the impacts of the Proposed Action in terms of duration, significance and scale. Historically, vacuum drying of yellowcake in ISR has resulted in no measurable emissions to the environment, because the vacuum system is designed to prevent any releases (NRC, 2011a). Potential impacts from the yellowcake dryer are also discussed in **Section 4.17.5.2**.

4.12 Noise

4.12.1 Agency-Required Measures

The required environmental protection measures are summarized below from Section OP 2.8 of the WDEQ-LQD Permit to Mine (LCI, 2011b), and Sections 3.8, 4.8.1.1, 4.8.1.2, 4.8.1.3, 4.8.1.4, 4.8.2, and 4.8.3 of the NRC SEIS (NRC, 2011a). The required environmental protection measures are primarily associated with wildlife and public and occupational health, which are discussed in **Sections 4.9** and **4.17**, respectively. The discussion in this section focuses on off-site human receptors.

The noisiest aspects of the Project would be during Initial Construction and Final Reclamation, due to the heavy equipment that would be in use. To reduce the noise generated, these activities would primarily occur during daylight hours (between 7 a.m. and 5 p.m.), and the 70 dBA 24-hour average sound-energy guideline to protect hearing (EPA, 1978) would not be exceeded. Once mining operations begin, i.e., pumping and injection of production solutions, the operations would continue around the clock, but continuously operating equipment (e.g., pumps) would be located inside buildings. During a routine night shift, only one employee would be in the field in a light truck to monitor equipment. Use of protective devices, such as mufflers and personal hearing protection, would be used to maintain noise levels in work areas in the immediate vicinity of the equipment below Occupational Health and Safety Administration (OSHA) regulatory limits.

4.12.2 Noise Monitoring

Because Project noise is not expected to cause any substantial impact, no monitoring is planned.

4.12.3 Impact Significance Criteria

The 55-dBA guideline, which was established by the EPA's Office of Noise Abatement and Control to protect against activity interference and annoyance (1978), was used to assess the significance of noise impacts on the human environment. The Rawlins RMP does not specifically state any pertinent factors concerning noise with respect to activities such as those of the Proposed Action.

4.12.4 Noise Impacts from the Proposed Action

Unlike conventional open-pit mine sites, impacts from increased noise levels are minimal at ISR project sites because major dirt-moving equipment is used for

only a short period of time as large-scale excavations are not conducted. Noise impacts were assessed by comparing background noise levels with projected noise levels on-site and off-site during Construction, Operation, and Reclamation. The proximity of sensitive receptors was considered in the impact analysis. The closest residence, church, or school (i.e., Bairoil) is about 15 miles from the northeast Permit Area boundary and would be more than 16 miles from the nearest mine unit or the Plant.

4.12.4.1 Construction

During Initial Construction, noise would be created due to the use of heavy equipment (e.g., dozers, graders, and cranes). Construction would occur for about seven months at the beginning of the Project, and would be concentrated near the Plant. Average noise levels 50 feet from the heavy construction equipment are on the order of 75 to 110 dBA, as shown in Table 4.2-1 of the GEIS (NRC and WDEQ, 2009). Beginning at a distance of 50 feet, noise levels diminish by six dBA for each doubling of the distance from the source (Golden et al., 1979). The Plant is about 1,000 feet from the closest Permit Area boundary (**Figure 1.2-2**), and, given the ambient wind noise (**Sections 3.10** and **3.11**), the equipment noise would be indistinguishable from the wind noise at that boundary.

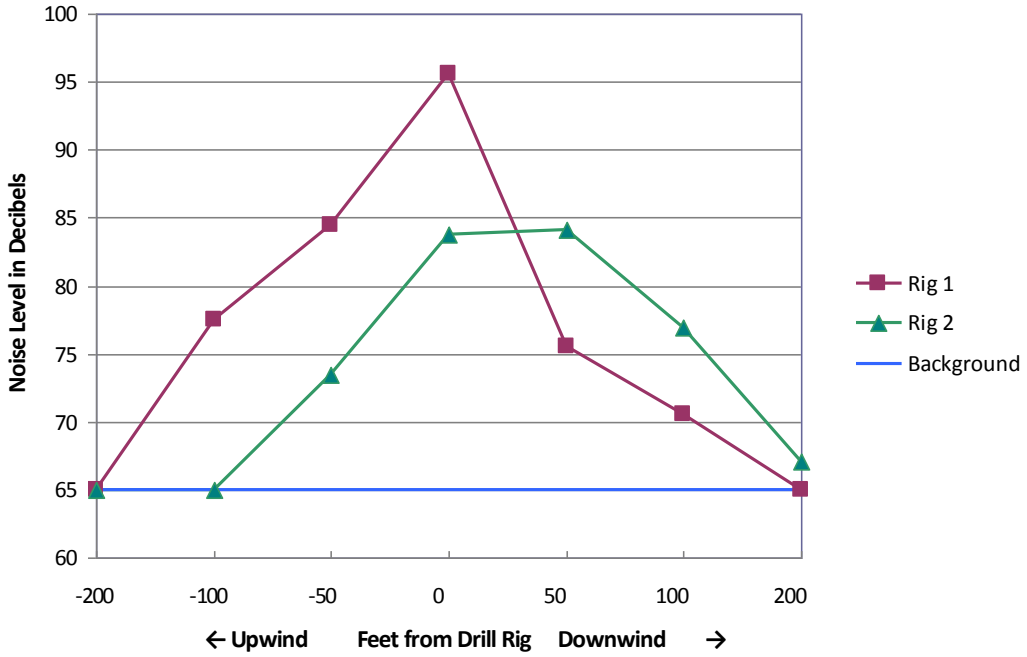
There would be negligible adverse effects from on-site noise to the nearest off-site receptors due to the considerable distance from the Plant to the nearest populated area. Workers commuting to the site and the transport of materials, via truck, would be the sources of off-site noise impacting off-site receptors, and these would be distributed among the three access routes to the Permit Area. Less than ten deliveries per day would be required during the Construction phase, and heavy trucks would only pass occupied residences once they reached US-287. This is a well-traveled road, and the increase in heavy truck traffic and commuters caused by the Project would be approximately two percent (**Sections 3.2** and **4.3**). This incremental increase is not expected to be noticeable. Due to the limited need for materials transport and the existing noise created by the highway, adverse effects from noise by the Project would be negligible.

During the Construction for Mine Unit Development, smaller equipment would generally be needed, with a corresponding decrease in the noise generated. On-site measurements of the noise from equipment that would be commonly used at the site confirm that the noise levels reduce quickly with distance from the equipment, particularly given the generally windy conditions (**Figure 4.12-1** and **Table 4.12-1**).

The above assessment of Construction impacts is in agreement with that in the NRC SEIS and includes more specific on-site noise measurements. Section 4.8.1.1 of the NRC SEIS discusses noise generation during Construction. Specifically, noise is generated from the construction equipment and the increased traffic to and from the site. The SEIS suggests that the smaller roads would be

more impacted than the larger, heavily travelled roads by the increase in traffic, and that the construction noise impacts would largely depend on distance from the source of the sound (NRC, 2011a).

Figure 4.12-1 Drilling Rig Noise versus Distance



4.12.4.2 Operation

Overall, noise levels during Operation would be expected to be lower than during Construction. Noise generated during the Operation phase would be mostly attributed to operation of pumps inside the header houses.

During Operation, periodic truck traffic for material transport, worker commuting, and traffic for maintenance and inspections would also contribute noise off-site. Less than one delivery per day would be required, and the associated increase in truck traffic on US-287 would be less than 0.1 percent, which would not be noticeable. Therefore, on-site sources would result in negligible noise increases to off-site receptors during this phase. No exceedance of any applicable noise criteria for off-site receptors or for on-site personnel is expected during the Operation phase.

The above assessment of Operation impacts is in agreement with that in the NRC SEIS and is based on more specific on-site noise measurements. Section 4.8.1.2 of the NRC SEIS discusses noise generation as a result of the Operation phase. Specifically, noise is generated from the increased traffic to and from the site and

the processing equipment. The SEIS suggests that the smaller roads would be more impacted than the larger, heavily travelled roads by the increase in traffic, and that the processing noise impacts would largely depend on distance from the source of the sound (NRC, 2011a).

Table 4.12-1 Field Measurements of Equipment Noise in the Permit Area

Equipment	Location	Comment	Noise Level in Decibels		
			Low	High	Average
Background	Northwest HiVol Station	HiVol station off and no other equipment running; light breeze	60.1	70.1	65.7
Pulling Unit (swabbing)	100 feet upwind	Light breeze blowing east; unit running	60.0	70.0	65.0
	50 feet upwind	Light breeze blowing east; unit running	60.0	68.0	65.0
	At operators station at end of truck	Light breeze blowing east; unit running	66.0	77.0	70.0
	50 feet downwind	Light breeze blowing east; unit running	64.0	70.0	67.0
	100 feet downwind	Light breeze blowing east; unit running	64.0	67.0	65.0
Eu 6500is Honda Generator	100 feet upwind	Light breeze blowing east; unit running	65.0	65.0	65.0
	50 feet upwind	Light breeze blowing east; unit running	65.0	65.8	65.2
	At unit	Light breeze blowing east; unit running			80.9
	50 feet downwind	Light breeze blowing east; unit running	65.0	66.1	65.3
	100 feet downwind	Light breeze blowing east; unit running	65.0	65.1	65.0
110KeV 75 HP Generator	100 feet upwind	Light breeze blowing east; unit running	65.0	65.1	65.1
	50 feet upwind	Light breeze blowing east; unit running	65.0	65.0	65.0
	At fender of unit	Light breeze blowing east; unit running			76.6
	50 feet downwind	Light breeze blowing east; unit running	65.0	65.3	65.0
	100 feet downwind	Light breeze blowing east; unit running	65.0	65.2	65.1
John Deere 710J Backhoe (idling)	100 feet upwind	Light breeze blowing east; unit running	65.0	65.0	65.0
	50 feet upwind	Light breeze blowing east; unit running	65.0	65.1	65.1
	At unit	Light breeze blowing east; unit running			81.5
	50 feet downwind	Light breeze blowing east; unit running	65.0	65.7	65.4
	100 feet downwind	Light breeze blowing east; unit running	65.0	65.0	65.0
Water Truck (idling)	100 feet upwind	Light breeze blowing east; unit running	65.0	65.1	65.0
	50 feet upwind	Light breeze blowing east; unit running	65.0	65.8	65.1
	At front left fender	Light breeze blowing east; unit running			76.6
	50 feet downwind	Light breeze blowing east; unit running	65.0	65.2	65.1
	100 feet downwind	Light breeze blowing east; unit running	65.0	65.0	65.0

* Measurements were performed on February 6, 2009, using a Metrosonics Model db-4000EZ Dosimeter, which accurately measures noise between 40 and 140 dBA with a resolution of 0.1 dBA. The instrument was checked against a calibrated standard both before and after the spot surveys were completed and found to be within 0.1 dB of the standard. The standard had been calibrated within the past year by the manufacturer.

4.12.4.3 Reclamation

During Mine Unit Reclamation and Final Reclamation, noise impacts are anticipated to be similar to Construction for Mine Unit Development and Initial Construction, respectively. During Mine Unit Reclamation, equipment would be used for well abandonment rather than well drilling, with similar or lower noise impacts. Truck traffic and heavy equipment activity would be similar to the Construction phase due to transportation of waste material to disposal sites and decommissioning of structures.

The above assessment of Reclamation impacts is in agreement with that in the NRC SEIS and is based on more specific on-site noise measurements. In Section 4.8.1.4 of the NRC SEIS, noise generated from Reclamation is expected to be the same, or less than, the noise generated during Construction, due to the earth moving and deconstruction of the site, and the impacts are not expected to be significant (NRC, 2011a).

4.12.5 Noise Impact from Other Alternatives

4.12.5.1 No Action Alternative

Under the No Action Alternative, baseline levels of noise would remain and not be increased. Baseline noise levels at the site are described in **Section 3.11**.

4.12.5.2 Other Action Alternatives

The impacts on noise from other alternatives (Not Fencing the Pattern Areas and Drying Yellowcake On-Site) would not be appreciably different than those from the Proposed Action. The dryer would be located inside the Plant, so no additional noise from the dryer operation would be anticipated. Traffic noise would be reduced because fewer shipments of dried yellowcake would be needed, as compared to yellowcake slurry shipments.

4.13 Historic and Cultural Resources

Discussion of specific locations and characteristics of archaeological resources are confidential; disclosure of site locations are prohibited under 43 CFR 7.18. Therefore, the information in this section is presented in general terms.

4.13.1 Agency-Required Measures

The required environmental protection measures are summarized below from Sections OP 2.4 of the WDEQ-LQD Permit to Mine (LCI, 2011b), Section 3.9 of the NRC SEIS (NRC, 2011a), and Condition 9.8 of the NRC License (NRC, 2011b).

The best mitigation for known sites is avoidance whenever possible. If avoidance of a site is not possible, regulatory requirements exist for mitigation of the impacts to a site. Because the locations of the sites eligible for the NRHP are already known, the potential impacts on those sites have been evaluated, and appropriate mitigation measures have been prepared.

Site 48SW16604, which is one of three sites determined eligible for the NRHP, would be disturbed by Project activities. Therefore, a treatment plan was developed in consultation with the BLM, NRC, Wyoming SHPO, the Eastern Shoshone Tribe and the Northern Arapaho Tribe (Appendix E of the NRC SEIS [NRC, 2011a]). Implementation of the treatment plan would mitigate the adverse effects to site 48SW16604.

Mitigation also includes procedures to be taken after unanticipated discovery of archaeological resources. As noted in Section OP 2.4 of the WDEQ-LQD Permit to Mine (LCI, 2011b) and the memorandum of agreement among NRC, BLM, Wyoming SHPO, the Eastern Shoshone Tribe and Northern Arapaho Tribe (Appendix E of the NRC SEIS [NRC, 2011a]), LCI would halt work in the immediate area of any such discovery and stabilize the location, so further degradation would not occur. An archaeologist would examine and evaluate the discovery for significance in accordance with applicable laws and regulations including the Archaeological Resources Protection Act, National Historic Preservation Act, American Indian Religious Freedom Act, and Native American Graves Protection and Repatriation Act.

4.13.2 Monitoring of Historic and Cultural Resources Impacts

The restrictions to keep archaeological information confidential are intended to prevent intrusion for curiosity or looting. Therefore, information on archaeological site boundaries is maintained on controlled maps, and monitoring of Project activities near the NRHP sites must be done by an archaeologist.

4.13.3 Criteria for Significance Evaluation and Impacts

Cultural resources are regarded as significant if they are enrolled in, or meet the eligibility criteria of, the NRHP. NRHP eligibility criteria are enumerated in Title 36 CFR Part 60 and are described as follows:

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that:

- are associated with events that have made a significant contribution to the broad patterns of our history; or
- are associated with the lives of persons significant in our past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield, information important in prehistory or history.

To qualify for NRHP eligibility, a property must meet two separate types of requirements. It must exhibit integrity of location, design, materials, and related criteria, and it must meet one or more of the four additional criteria. The National Historic Preservation Act makes it clear that a site need not be of national historic significance to be considered eligible (Advisory Council on Historic Preservation, 2006). Sites of local, state, and regional importance may also be listed and, thus, are significant in the legal sense. The phrasing of the National Historic Preservation Act of 1966 (as amended) is critical with respect to actual management of cultural resources. A site does not have to be included on the NRHP to receive protection under the law, but must simply meet the requirements of eligibility (Kinneer et al., 2007).

Under NEPA, impacts to cultural resources may be direct (the result of an action that occurs at the same time and place), indirect (the result of an action that occurs at a later time or in a different place), or cumulative (incremental, resulting from accrued past, present, and reasonably foreseeable future actions). Under Section 106 of the National Historic Preservation Act, an adverse effect is any impact that alters the attributes that qualify the site for inclusion on the NRHP by diminishing the integrity of the site. Possible adverse impacts might include physical damage or destruction, alternation, deterioration, or modification of original setting. An adverse effect on a cultural property would constitute a significant impact unless mitigation measures are undertaken to reduce or counter the harm that an undertaking would cause.

4.13.4 Historic and Cultural Resources Impacts from the Proposed Action

Direct impacts on cultural resources would come from the surface disturbance in the footprint of the Project infrastructure. During the life of the Project, a total of approximately 345 acres of the land surface would be disturbed, which is eight percent of the 4,254 acres in the total Permit Area. The surface disturbance would occur during the Construction phases. There should be no additional surface disturbance during the Operation and Reclamation.

Indirect impacts could result from erosion of soils after surface disturbance and vegetation removal. The erosion could result in deposition of material onto archaeological sites or removal of soil and subsequent exposure of sites. The increased number of people accessing the Permit Area could also lead to intrusion onto or looting of sites.

One prehistoric archaeological site recorded in the Project Area, 48SW16604, would incur adverse effects. Site 48SW16604 lies within an area where construction related to the well field, an access road, and a pipeline would occur. It is anticipated that the entire site would be subjected to surface scraping. As described in **Section 4.13.1**, above, mitigative excavation would take place prior to initiation of these activities, and the impacts would therefore not be significant.

Section 4.9 of the NRC SEIS (NRC, 2011a) discusses the potential impacts to the historic and cultural resources in the Permit area. The largest potential for impacts occurs during the Construction phase, when resources could potentially be excavated or damaged. There is also a potential for the construction process to temporarily restrict access to these resources. Management practices that would be used during construction with regards to discovery of historical or cultural artifacts serve to protect these resources, which would result in a smaller potential for significant impacts to the resources (NRC, 2011a).

4.13.5 Historic and Cultural Resources Impacts from Other Alternatives

4.13.5.1 No Action Alternative

Under the No Action Alternative, there would be no impacts to the cultural resources related to the Project, although on-going activities, such as livestock grazing, could disturb surface archaeological sites. The No Action Alternative would not create significant impacts to cultural properties.

4.13.5.3 Other Action Alternatives

Not Fencing the Pattern Areas

The fences are included within the mine unit boundaries; therefore, this alternative would not reduce potential impacts on archaeological resources. This alternative would not avoid site 48SW16604, and adverse effects to that site would occur. Impacts to site 48SW16604 would not be regarded as significant because mitigation would take place prior to the time that impacts are sustained.

Drying Yellowcake On-Site

The dryer would be located within the Plant; therefore, this alternative would create no additional impacts on the archaeological resources at the Permit Area. This alternative would not avoid site 48SW16604, and adverse effects to that site would occur. Impacts to site 48SW16604 would not be regarded as significant because mitigation would take place prior to the time that impacts are sustained.

4.14 Visual and Scenic Resource Impacts

4.14.1 Agency-Required Measures

The required environmental protection measures for visual and scenic resources are summarized below from Sections 3.10, 4.10.1.1, 4.10.1.2, 4.10.1.3, 4.10.1.4, 4.10.2 and 4.10.3 of the NRC SEIS (NRC, 2011a).

The following protection measures are planned to minimize the Project impacts on visual and scenic resources.

- building materials and paint would be chosen to blend with the natural environment, according to BLM guidelines;
- all structures have been designed to be low profile, in order to minimize the number of vantage points from which they would be visible;
- the site would remain clean and well-maintained according to operational protocols; and
- Any necessary night lights would be designed to reduce light pollution.

4.14.2 Monitoring of Visual and Scenic Resource Impacts

Since impacts to visual and scenic resources would be negligible, no monitoring is currently planned. The Annual Report submitted to NRC and WDEQ would document any changes to the status of the visual resources, as necessary.

4.14.3 Impact Significance Criteria

The significance of the impacts was evaluated by determining if the visual changes would be consistent with the BLM visual resource classification of the area, discussed in the Rawlins RMP in the Visual Resource Management Section. The Permit Area is within a BLM-designated VRM Class III area and proximal to a VRM Class IV area. The management objective for Visual Resource Management Class III areas is to, "Partially retain the existing character of the landscape. The level of change to the landscape should be moderate. Management activities may attract the attention of the casual observer but should not dominate the view of the casual observer. Changes should repeat the basic natural elements found in the predominant natural features of the characteristic landscape" (BLM, 1984).

4.14.4 Visual and Scenic Resource Impacts from the Proposed Action

As outlined below, the nature of the Project impacts would be consistent with the visual resource classification of the area. Project facilities would be discernible during the day, but would not be a dominant landscape feature to observers outside the Permit Area. Night time operations would be minimal.

4.14.4.1 Construction

During the seven months of Construction, there would be short-term visual impacts due to on-site equipment for the construction of the Project facilities and road improvements. This equipment will likely contrast with the forms, lines, colors, and textures present in the area, but will only be on-site during Construction, not posing a long-term impact on the visual resources of the area. Construction activities would result in an increase of vehicles and traffic in the area. (The increased potential for dust is discussed in **Section 4.11**). Vegetation disturbance would also take place during Construction. As discussed in **Section 4.8.4.1**, the total disturbance acreage during Construction would be on the order of 345 acres, which would be scattered throughout the Permit Area. Construction activities would occur during the day, so other than occasional lights for safety and security, night time impacts would be minimal.

Section 4.10.1.1 of the NRC SEIS examines the impacts to the visual and scenic resources from Construction. The impacts are primarily related to construction equipment, the infrastructure being built, land alterations, emissions, and lighting. According to the SEIS, the topography is such that most of the infrastructure would not be visible from more than one kilometer away. Additionally, the short-term nature of Construction activities limits the time that the equipment and land disturbances would be impacting the visual resources. As such, the impacts to visual and scenic resources are not expected to be significant (NRC, 2011a).

4.14.4.2 Operation

After Construction, the majority of visual impacts would occur from the facilities used during the Operation phase, in particular, the Plant. In general, ISR uranium mines can retain the form and line of the existing landscape better than open pit or surface mines because less earthwork is necessary. Header houses, wellheads, and roads would contribute to the visual impacts, but less so than the Plant. Header houses may be visible from the Sooner Road, which is about two miles from the site, and the closest road other than the Project access roads. However, the header houses, which would be about 12 feet in height at the roof apex and painted to blend with the landscape, would only have a weak effect on the form and line of the landscape from the key observation points (**Appendix I**). The wellheads, which would be on the order of four feet in height or less, would not be noticeable from Sooner Road because they would have weak to no effect on

the form, line, color, or texture of the landscape from that distance. Due to the height and abundance of sagebrush throughout the Permit Area (**Section 3.7**), as well as the rolling topography, the on-site roads would not be visible unless the angle of view is directly in-line with the road. The Plant would be the largest building on-site, about 160 feet wide, 260 feet long, with a wall height of 22 feet and a peak roof height of 29 feet.

Figure 4.14-1 is a photograph taken slightly less than 0.25 miles from an existing ISR project in Nebraska and helps to visualize how the Permit Area will look. However, there are important differences between this project in Nebraska and the Project. First, the Plant at the Nebraska site is taller than the Plant would be at the Permit Area because of different configurations of the ion exchange columns. Second, the vegetation is primarily grassland at the Nebraska site, rather than the shrubland at the Permit Area. **Figure 4.14-2** is a photograph of the Project Area taken from the Sooner road (4.4 miles from the proposed Project). Even though there are two white trailers (approximately 4 miles from the photographer and approximately 10 feet in height and 20 feet in length) in this photograph, one cannot locate them without magnifying the photograph. The trailers are visible from the location of the photograph, but are difficult to locate without prior knowledge of their location.

Because of the varying topography of the area, and the presence of the Continental Divide Trail and the Rawlins-Ft. Washakie Stage Road in the vicinity of the Permit Area, a viewshed analysis was conducted for the Plant using a Spatial Analyst add-on to ArcGIS 9.3. The height of the Plant was estimated to be ten meters and the viewshed was limited to approximately 25 miles from the Plant. **Figure 4.14-3** shows the result of the viewshed analysis, illustrating areas within 25 miles that are visible from the Plant and from which the Plant would be reciprocally visible. The analysis allows identification of any local potential visual receptor sites such as the Sooner Road, Wamsutter Crooks Gap Road, the Continental Divide Trail, the Rawlins-Ft. Washakie Stage Road, and dispersed recreational areas.

Figure 4.14-1 Photograph of Existing ISR Project in Nebraska, July 2010

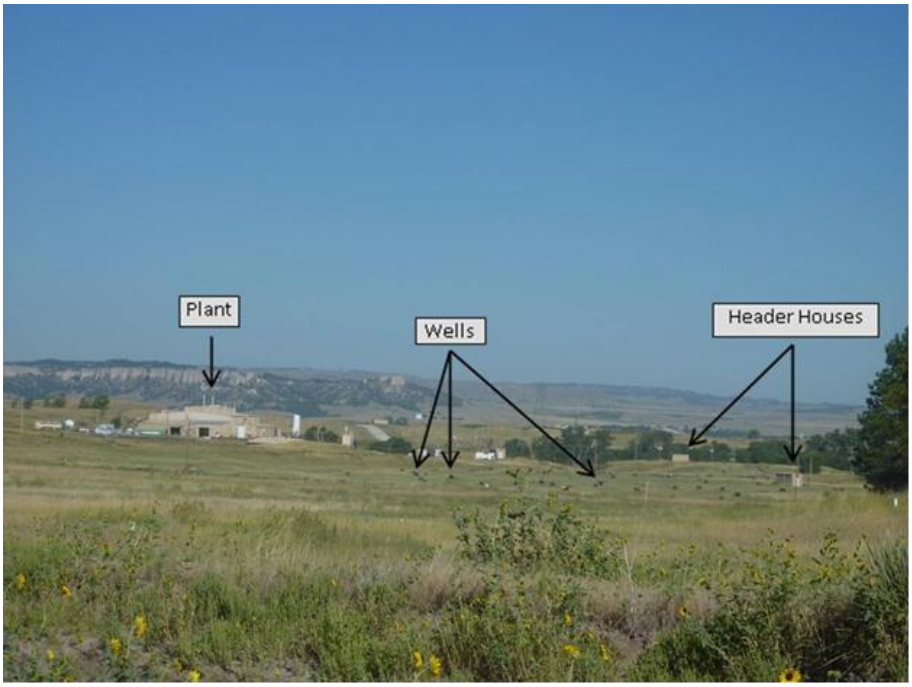


Figure 4.14-2 Photograph of Project Area from Sooner Road, October 2011

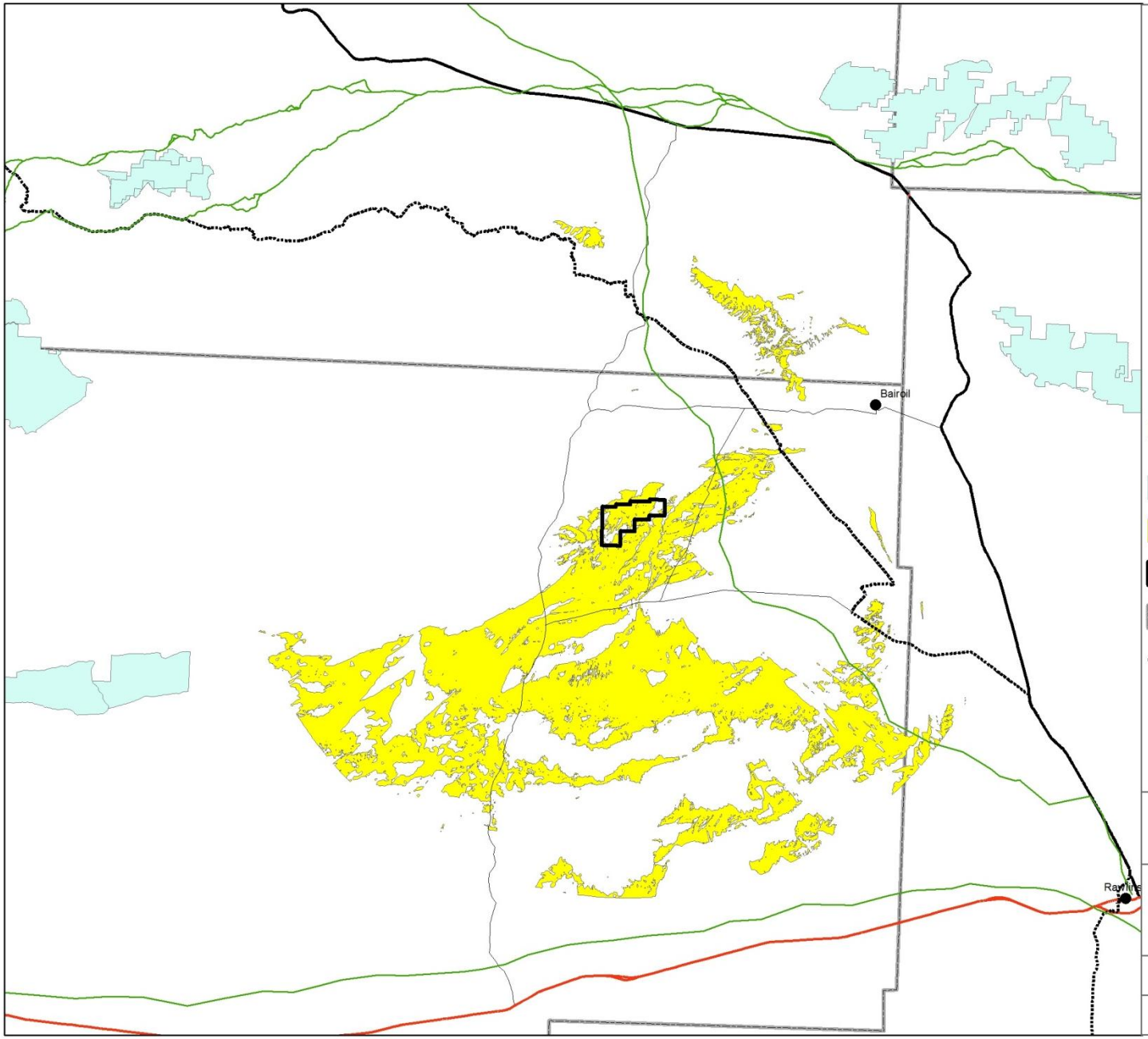
Figure 4.14-3 illustrates that the largest potential impacts from the Plant to the local visual resources lie in the southwesterly to southeasterly directions. The Plant would be viewable from the Mineral Exploration Road (County Road 63), Sooner Road (BLM 3215), and Wamsutter Crooks Gap Road (County Road 23). The Plant would potentially be visible from the Continental Divide Trail, but in only very limited areas (less than 0.5 miles in total). However, at a distance of about 8 miles away, the Plant would not dominate the landscape from the closest viewpoints along the Continental Divide Trail. The plant would be visible for 6.9 miles along the Rawlins-Ft. Washakie Stage Road. Of this total distance, approximately half (3.5 miles) is within 6.5 miles of the Plant, and half (3.4 miles) is over 17 miles from the proposed Project (**Figure 4.14-3**). These distances limit the impact that Plant can have on the view from the road. The Plant would not be visible from Bairoil (the closest town) or Jeffery City (the next closest town).

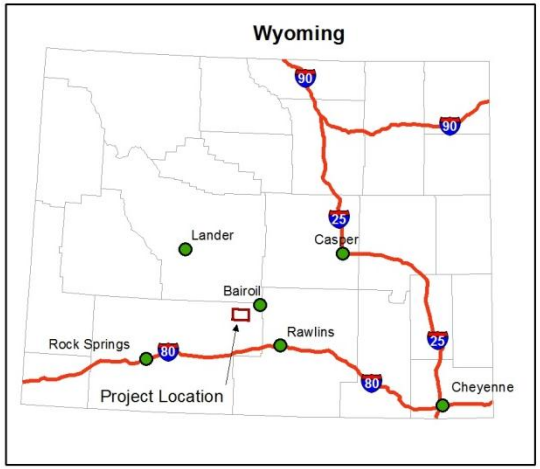
Figure 4.14-4 illustrates that most of the areas where visual resources may be impacted are within the Visual Resource Inventory Class IV. Although VRI classes do not establish management direction, Class IV represents areas with the least amount of visual value.

A Visual Contrast Rating Worksheet was completed for an observation point on the Sooner Road (**Appendix I**).

As during Construction, night time activities would be minimal. Therefore, other than occasional lights for safety and security, there should be only minimal visual impact.

In Section 4.10.1.2 of the NRC SEIS, the NRC discusses that the size or color of most of the infrastructure reduces the potential for a significant impacts and the visual impacts associated with the Operation phase would be less than the Construction phase. (NRC, 2011a).





Legend

- Wilderness Study Area
- 25 Mile Visibility (from facility)
- Lost Creek Permit Area
- State and County Line
- Continental Divide Trail
- Historic Trail
- Interstate
- Major Road
- Secondary Road

N

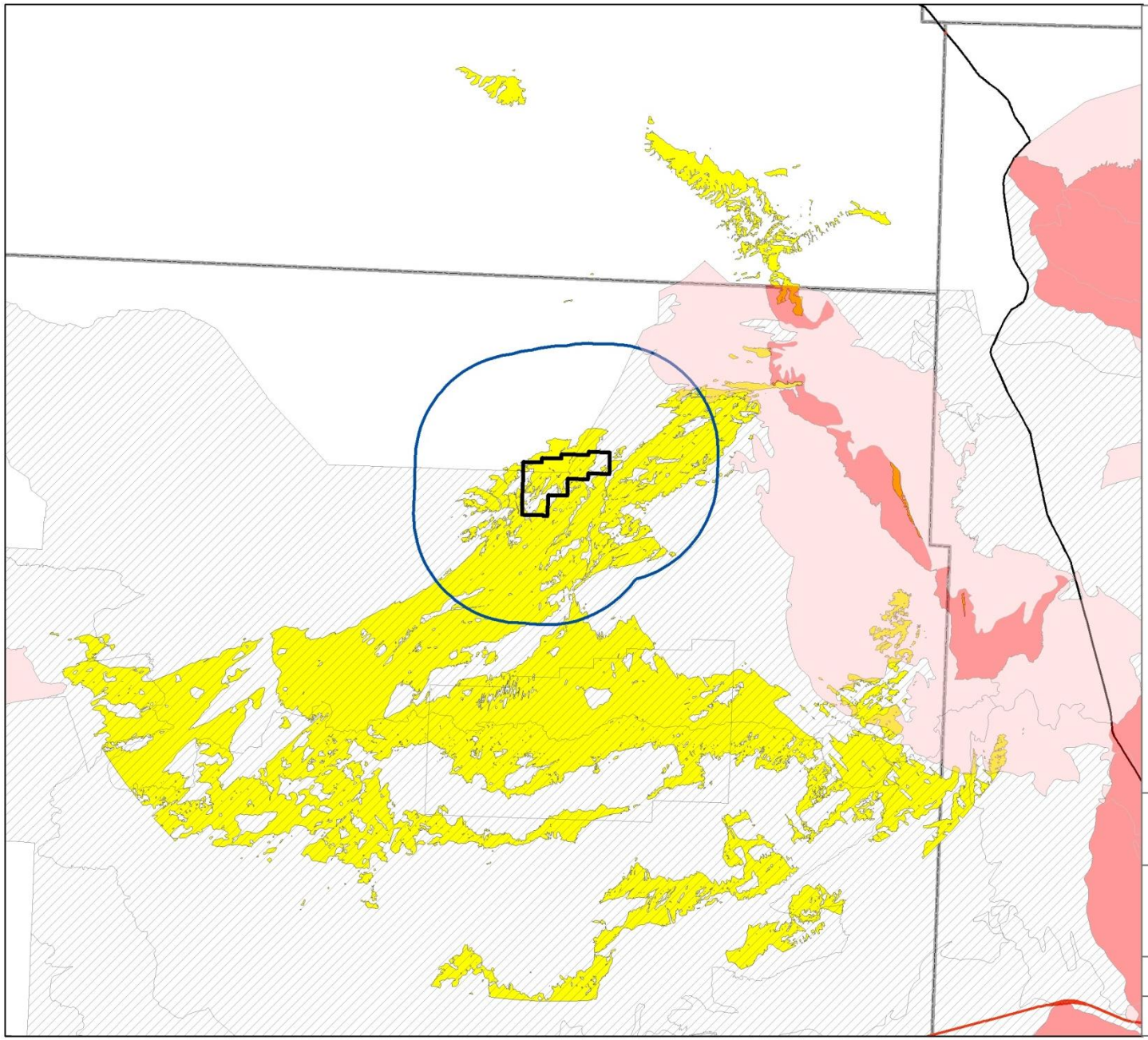
Lost Creek Uranium *In-Situ* Recovery Project

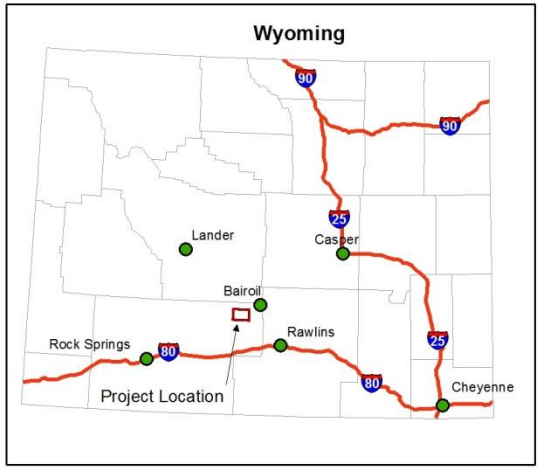
Sweetwater County, WY

FIGURE 4.14-3
Viewshed Analysis

0 5 10 Miles

No warranty is made by the BLM for use of the data for purposes not intended by BLM





Legend

VRM Class

- II
- III
- IV
- 5 Mile Buffer
- 25 Mile Visibility (from facility)
- Lost Creek Permit Area
- State and County Lines
- Interstate
- Major Road

N

Lost Creek Uranium *In-Situ* Recovery Project

Sweetwater County, WY

FIGURE 4.14-4
Viewshed and VRM Classes

0 5 10 Miles

No warranty is made by the BLM for use of the data for purposes not intended by BLM

4.14.4.3 Reclamation

The Reclamation of the Project would not introduce any new visual impacts. When Reclamation begins, the impacts are anticipated to be similar to those during the Construction because there would be an influx in construction equipment (for decommissioning and demolition of certain facilities) and in traffic due to the increase in personnel. The visual impact would decline as decommissioning progresses. The Project would not cause modifications to scenery or topography that would persist after Reclamation. It is unlikely that any Reclamation activities would occur at night, so, other than occasional lights for security and safety, no impacts are anticipated.

In Sections 4.10.1.3 and 4.10.1.4 of the NRC SEIS, the Reclamation phase is compared to the Construction phase, stating that since the two phases require similar equipment and short time frames, the overall visual impact of the phase would be minimal (NRC, 2011a).

4.14.5 Visual and Scenic Resource Impacts from Other Alternatives

4.14.5.1 No Action Alternative

The No Action Alternative would present no change to the visual resources of the area.

4.14.5.2 Other Action Alternatives

If no fences were installed around the pattern areas, there would be a slight reduction to the visual impact of the Project. However, fences are not likely to be more visible than the wellheads, which may be visible, but would not dominate the landscape or distract potential observers from the natural landscape. In addition, the types of fences around the pattern areas are typical of most fences in the vicinity. Since the dryer for the Drying Yellowcake On-site alternative would be inside the Plant, there would be minimal additional impact to the visual resources.

4.15 Socioeconomic Conditions

4.15.1 Agency-Required Measures

While there are no agency-required measures related to socioeconomic conditions, LCI and LCI's contractors and subcontractors would be encouraged to deliver construction materials "Free on Board" to the County in which the materials would be used to help ensure that the sales tax would be properly allocated and paid to the County where construction and related impacts would occur.

In addition, LCI has commitments and initiatives to minimize socioeconomic impacts. LCI would support local hiring and procurement to the extent practicable and would continue working with Sweetwater and Carbon Counties on topics of interest.

4.15.2 Monitoring of Socioeconomic Impacts

Significant socioeconomic impacts are not anticipated, so no monitoring is planned.

4.15.3 Impact Significance Criteria

In accordance with the Rawlins RMP Management Goals, the Proposed Action provides an opportunity to develop a national energy source on BLM-administered lands while not interfering substantially with development of other resources, such as tourism, and provides for mitigation of impacts to development of other resources (e.g., grazing and wildlife). The following criteria were used to assess the significance of socioeconomic impacts to ensure the continued viability of the local and regional communities:

- An increase of the local and regional population that would strain the ability of communities and/or counties to provide adequate housing and services;
- Increasing demands on government expenditures that would inhibit the maintenance and/or provision of infrastructure and services;
- An increase in the local or regional cost of living;
- A reduction in socioeconomic viability of local and regional communities; and conversely,
- An increase in government revenues that would offset increased demands for services; and
- An improvement in socioeconomic viability due to indirect economic activity (e.g., purchase of local goods).

Socioeconomic impacts would occur during all phases of the Project, and LCI has met with county and local governments to help ensure a cooperative effort to sustain and improve the economies and conditions. The potential impacts to demographics, economic trends and characteristics, and infrastructure and services are discussed in the following sections by subject. Each subject is then described by Project phase unless the socioeconomic impact is similar throughout the Project phases or is generally evaluated over the life of the Project.

4.15.4 Demographic Impacts from the Proposed Action

4.15.4.1 Construction

The local population is anticipated to increase as a result of increased employment opportunities generated both directly and indirectly by the Project. Direct employment during Initial Construction is anticipated to peak at 94 employees.

It is assumed the majority of the workforce would come from outside the region. Although many towns are within the region, much of the workforce is anticipated to reside in larger, more economically diversified population centers, such as Rawlins and Casper. The duration of Construction would be less than one year. If the majority of the Construction workforce is from outside of the region, demographics would change. If the majority of the Construction workforce is from within the region, demographic impacts would be negligible.

Indirect employment is estimated by assuming an employment multiplier. Assuming an employment multiplier of 0.7 for the milling/mining industry (NRC, 2011a), an estimated 65 to 66 additional jobs would be generated (i.e., 94 positions multiplied by 0.7).

The total of direct and indirect employment would range from 159 to 160 positions. Assuming an average of 2.5 people per household, the population of the region would increase by 397 to 400 people (i.e., 159 to 160 positions multiplied by 2.5). However, since a portion of the Construction workforce already resides in the region, the population increase would be less than this estimate. In an extreme case, if the population did increase by 397 to 400 people, in Rawlins alone, the population would increase by four to five percent. Realistically, migrants would be dispersed throughout other communities in the region as well.

The assessment of Initial Construction impacts in this EIS is similar to that of the Construction assessment in the NRC SEIS with more focus on whether the workforce would come from outside or within the region. Section 4.11.1.1 of the NRC SEIS discusses how in the short-term, the influx of Construction employees would likely not significantly impact the demographics of the region. Since the

Construction phase is for a short time, the long-term impact would be negligible, and the overall impact would be small (NRC, 2011a).

During Mine Unit Development, direct employment is expected to average 106 employees. Of these 106 employees, about 54 are anticipated to have been employed during Initial Construction. The remaining 52 employees would be technical staff trained in health physics, chemistry, geology, hydrogeology, and engineering and would likely come from outside the region. As during Initial Construction, the Mine Unit Development workforce is anticipated to reside in larger population centers that offer more amenities and economic diversity.

Because the majority of the workforce would work through Initial Construction and Mine Unit Development, the demographic change during Mine Unit Development would be less than during Initial Construction. Overall, the number of employees would increase by 12 employees from Initial Construction (94 employees) to Mine Unit Development (106 employees). However, as noted in the paragraph above, 52 of the average 106 employees would likely be hired from outside of the region for their technical skills. Therefore, it is deduced that as little as 12 people to as many as 52 people would be new, direct employees of the Project during Mine Unit Development. Assuming an employment multiplier of 0.7 for the milling/mining industry (NRC, 2011a), an estimated 8 to 37 indirect jobs would be generated (i.e., 12 to 52 positions multiplied by 0.7).

The total of additional direct and indirect employment from Initial Construction to Mine Unit Development would range from 20 to 89 positions. Assuming an average of 2.5 people per household, the population of the Project region would increase by 50 to 222 people (i.e., 20 to 89 positions multiplied by 2.5). In an extreme case, if the population did increase by 50 to 222 people in Rawlins alone, the population would increase by 0.5 to 2.7 percent. Realistically, migrants would be dispersed throughout other communities in the region as well.

The Mine Unit Development assessment in this EIS is similar to that of the Operation assessment in the NRC SEIS with more focus on whether the workforce would come from outside or within the region. Section 4.11.1.2 of the NRC SEIS (NRC, 2011a) describes how the workforce associated with the Operation phase might change the socioeconomic conditions. However, because of the small number of Operation employees, the impact to demographics is not expected to be significant (NRC, 2011a).

4.15.4.2 Operation

Demographics are not anticipated to change from Mine Unit Development to Operation.

4.15.4.3 Reclamation

Demographics are not anticipated to change from Operation to Mine Unit Reclamation.

Final Reclamation would require a similar, if not the same, workforce of Initial Construction. As such, demographics are not anticipated to change until Project closure. At that time, the Project workforce would likely be drawn to other ISR facilities or other regional extractive industries.

The overall assessment of Final Reclamation in this EIS is similar to the assessment of Reclamation in the NRC SEIS with more focus on where the workforce could go after Project Closure. Section 4.11.1.4 of the NRC SEIS discusses how in the short-term, the influx of Reclamation employees could impact the region. However, since it is for a short time, the long-term impact to demographics would be negligible (NRC, 2011a).

4.15.5 Revenue and Taxation Impacts from the Proposed Action

The Project would contribute to the local economy through taxes generated, job creation, employee wages, and direct and indirect economic activity in the local, regional, and national economies.

4.15.5.1 Gross Domestic Product

The Project would contribute to Wyoming's dominant GDP industry: mining. Using February 2010's market price of U_3O_8 (about $42 per pound), the Project would contribute $360,000,000 to the nation's GDP. The price increased to about $73 per pound at the beginning of 2011, and the price has been about $52 per pound in the first part of 2012. The Project would boost the immediate area's diversity and economic health.

The NRC SEIS does not specifically address the nation's or the State's GDP.

4.15.5.2 Revenue and Taxation

The purchases made by and the taxes collected from the Project would generate revenue. The primary internal costs of the Project would include:

- capital costs associated with obtaining claims and regulatory approvals, including permits, and environmental studies;
- capital costs of facility construction;
- operation and maintenance costs;
- costs of groundwater restoration;

- costs of facility decommissioning, including radiological decontamination; and
- costs of surface reclamation.

These estimated costs are provided in **Table 4.15-1**. The total Project costs are estimated at $225 million, not including local, state and federal taxes. A portion of this would be spent in the local area (Rawlins) for diesel fuel, propane, and miscellaneous supplies and repairs. This would be considered a positive impact to the local economy. The majority of supplies would come from Casper. Oxygen and CO_2 would come from Wyoming or Colorado, and soda ash would come from Green River, Wyoming. Major construction materials would be bid out regionally, with a large portion anticipated to come from the Colorado-Wyoming-Utah region.

Table 4.15-1 Estimated Internal Project Costs

Item	Present Worth (US dollars x 1,000)
Obtaining the right to mine (claims and permits)	13,000
Facility construction	68,000
Operation and maintenance	74,000
Groundwater restoration	13,000
Decommissioning (including decontamination)	12,000
Surface reclamation	3,000

The Project would contribute substantially to the local and state economies in the form of tax revenues generated. Tax revenues from the Project would depend on the production of U_3O_8 and the cost of production. Future tax revenues are dependent on uranium prices, which may considerably fluctuate. To the extent that uranium prices remain at current levels, uranium production would contribute significantly to local tax revenues.

As shown in **Table 4.15-2**, tax revenues generated from the Project would include property taxes and ad valorem (gross products) taxes in Sweetwater County, severance taxes for the State of Wyoming, and federal income taxes. Equipment would be registered at the County Assessor's Office and a discount (50 percent) would be applied to the market value, then 11.5 percent of the adjusted value would be taxed at a rate of 63.088 mills (NRC, 2011a). This property tax revenue would accrue to Sweetwater County. Since the Permit Area is located in Sweetwater County, ad valorem taxes would also accrue in Sweetwater County.

Table 4.15-2 Estimated Tax Revenues Based on Project's Annual Production

Year	U_3O_8 Production [1]	Estimated Federal Income Taxes	Wyoming Severance Taxes	County Ad Valorem Taxes	County Property Taxes
1	45,000				
2	1,000,000		900,000	1,600,000	300,000
3	1,000,000	9,000,000	1,000,000	1,900,000	300,000
4	1,000,000	10,000,000	1,000,000	2,000,000	300,000
5	1,000,000	10,000,000	1,000,000	2,000,000	250,000
6	1,000,000	10,000,000	1,000,000	2,000,000	250,000
7	1,000,000	10,000,000	1,000,000	2,000,000	100,000
8	400,000	3,000,000	700,000	900,000	50,000
9					50,000
Total	**6,445,000**	**52,000,000**	**6,600,000**	**12,400,000**	**1,600,000**

[1] Assuming a realized sales price of 60.00 US dollars per pound U_3O_8

Section 4.11.1 of the NRC SEIS discusses the potential impacts to taxes and revenue. The region would benefit slightly from the small increase in spending from the additional workforce, however, this impact is expected to be small. The State of Wyoming would benefit from mining taxes on the Project, but this is also expected to be fairly small relative to the total State revenue (NRC, 2011a).

A four-percent severance tax of taxable market value would be levied by the State of Wyoming's Mineral Tax Division of the Department of Revenue. Assuming an estimated production of 8,000,000 pounds of U_3O_8 over the life of the Project and a market value of $60 per pound of U_3O_8, the severance tax revenues generated from the Project would equal $19,200,000.

Other tax revenues include sales, use, and lodging taxes. These amounts would represent an increase in local revenues throughout the region. The Project's operation and its employees would contribute to local, regional, and state revenues through the purchase of goods and services and through the taxes levied on such goods and services. Sales taxes and increased demand for goods and services would support the local economy. Additional spending would result from payrolls and other on-going expenditures. Expenditures generally multiply as the monies are circulated throughout the community several times.

Money would be reinvested in the community as the Project replenishes its resources and operates throughout the life of the mine, including costs associated with exploration and evaluation, maintenance, sustaining capital, and routine operation. Increases in taxes and revenues would provide counties and communities with more discretionary dollars to develop infrastructure and support

the population. However, short-term budgetary impacts to local governments would occur, due to population growth and its effects on housing and local infrastructure and services. Receipt of taxes generally lags one year behind production; therefore, affected counties and communities would not receive any funds until two years after the beginning of the Construction phase.

4.15.6 Labor, Employment and Income Impacts from the Proposed Action

Nationally, the Project would reduce dependence on foreign sources of uranium while helping to maintain a viable domestic workforce with the necessary technical skills to recover uranium resources. Due to market conditions over the past 20 years, the technical expertise required to recover uranium has declined. LCI estimates that less than 20 engineers and 20 geologists in the US have adequate experience to successfully and safely operate an ISR uranium facility. A large percentage of these experts are at retirement age.

The Project would increase the number of jobs and employment in the counties of interest without federal assistance. Given the existing economic downturn and associated unemployment, the Project would increase regional construction and service industry jobs. Throughout its life, the Project would support about 106 direct jobs locally and a number of indirect jobs. However, similar to tax revenue, labor and employment would depend on the amount of U_3O_8 produced.

Federal income tax would be collected from the Project's workforce. Since Wyoming does not tax personal income, local, regional, and state income benefits would be related to the purchase of goods and services and through the taxes levied on such goods and services. As previously discussed, sales and use taxes and increased demand for goods and services would support the local economy. Additional spending would result from payrolls and other on-going expenditures. The economic benefit of expenditures related to the Project would magnify as funds are dispersed throughout the communities.

4.15.6.1 Construction

During Construction, the Project would require approximately 70 independent contractors, 24 LCI employees, and other intermittent contract employees at the Permit Area. Once the Plant is constructed, the number of independent contractors would be reduced to 30 drillers in order to focus on Mine Unit Development. In total, the Project would employ 94 people throughout Construction. The estimated direct-hire labor force is presented and described in **Table 4.15-3**. As previously discussed, the total of direct and indirect employment is estimated to range from 159 to 160 positions.

Table 4.15-3 Estimated Labor and Employment

Project Phase/Stage	Labor	Employees
Initial Construction Stage	Drill contractors (10)	30
	LCI construction employees	7
	Other LCI employees (samplers, geologists, supervision, drilling support)	17
	Plant construction contractors	40
	Total	94
Mine Unit Development Stage, Operation Phase, Mine Unit Reclamation Stage	LCI construction employees	7
	LCI employees (Plant & mine units)	69
	Drilling contractors	30
	Total	106
Final Reclamation Stage	LCI employees	11
	Total	11

Local contractors would be hired, as available, and local building materials and building supplies would be used to the extent practicable. Many of the workers are anticipated to come from Casper. Some workers may commute from Casper on a daily basis; others coming from Casper would stay in temporary accommodations during the week and commute back to Casper on the weekend. Construction workers coming from outside the region would likely use local temporary housing (e.g., apartments, hotels, motels, trailers, RVs). Some workers would commute to and from their permanent residence on a daily basis if within a one-hour drive of the Permit Area.

The mean earnings rate for construction workers was $26,239 per year in 2008 (Wyoming Department of Employment, 2009). The mean earnings rate for natural resources and mining workers was $54,183 per year in 2008. Workers would be paid wages typical of the area.

The Initial Construction assessment in this EIS is similar to that of the Construction assessment in the NRC SEIS. Section 4.11.1.1 of the NRC SEIS discusses how in the short-term, the influx of Construction employees could impact the income and employment in the region. However, since it is for a short time and the pay rates would be typical of the region, the long-term impact would be negligible (NRC, 2011a).

During Mine Unit Development, the Project would require an additional 52 LCI employees. In total, approximately 106 people (30 contract drillers and 76 LCI personnel) would be employed. LCI personnel would include: Project and operation managers; a Project engineer; a chief site geologist; a drill foreman; a casing crew; a restoration engineer and crew; a construction foreman and crew; geologists; a secretary; personnel responsible for environmental, health, and

safety related tasks; a plant manager; plant operators; equipment operators; an electrician; a chemist; and lab technicians.

Impacts to income during Operation would be similar to those of Construction. Technical LCI employees would average approximately $45,000, with an estimated total annual payroll of $2,900,000.

The combination of Mine Unit Development, Operation, and Mine Unit Reclamation is similar to that of the Operation phase evaluated in the NRC SEIS. Section 4.11.1.2 of the NRC SEIS describes how the workforce associated with the Operation phase might change the income and employment in the region. However, since it is for a short time and the pay rates would be typical of the region, the long-term impact would be negligible (NRC, 2011a).

4.15.6.2 Operation

The labor, employment, and income impacts during the Operation phase are not anticipated to differ from Mine Unit Development.

4.15.6.3 Reclamation

The labor, employment, and income impacts during Mine Unit Reclamation are not anticipated to differ from the Operation phase.

During Final Reclamation, technical staff would decrease to less than the Initial Construction staff (11 LCI employees). Additional contract employees would be hired as necessary during Project decommissioning. The income levels during Final Reclamation are anticipated to be similar to those during Initial Construction.

The staff would decrease as the Project nears completion. At that time, the Project workforce would likely apply their skills at other ISR facilities or extractive industries.

Final Reclamation in this EIS is similar to that of the Reclamation phase evaluated in the NRC SEIS. Section 4.11.1.4 of the NRC SEIS discusses how, in the short-term, the influx of Reclamation employees could impact the income and employment in the region. However, because of the short duration and pay rates typical of the region, the long-term impact would be negligible (NRC, 2011a).

4.15.7 Cost of Living and Housing Impacts from the Proposed Action

Due to the size and duration of the Project as well as the anticipated population centers of residence for personnel, impacts to the cost of living are not anticipated.

The increase in population directly and indirectly caused by the Project would increase regional housing demand. In the recent past, housing availability has increased in Casper and Rawlins, where the majority of the Project's workforce is anticipated to live.

Since 2007, Wyoming's active residential real estate markets have eased somewhat with increased inventories and lower transactions in many communities (EAD, 2010e). As of January 13, 2010, 504 homes were listed under the Multi-Listing Service in Casper (Glasspoole, T. GRI, CRS Sales Associate/Owner, RE/MAX, The Group. Personal communication. January, 2010.). This total does not include the homes that were for sale by owners, without the aid of a listing agency. The largest rental agency in Casper, Casper Rental Agency, had a total of 173 vacant rental properties on January 12, 2010. Rawlins had at least 88 homes on the market on January 25, 2010 (Shepard, A. Broker/Owner, ERA Shepard & Associates. Personal communication. January, 2010.). This total does not include homes for sale by owners, without the assistance of a listing agency. Rawlins had a total of 30 vacant rental units on January 16, 2010 (based on a count of rentals advertised in the Rawlins Daily Times and information from contacting rental agencies). Additionally, both Casper and Rawlins have a large number of residential lots for sale. Therefore, the minimum number of rentals and homes available as of January 2010 in Casper and Rawlins is 795.

Data were not collected for other communities within driving distance from the Permit Area, such as Wamsutter, Bairoil, and Jeffrey City.

4.15.7.1 Construction

As previously noted, 94 people would be directly employed by the Project during the Initial Construction stage. Indirect and direct employment by the Project would range from 159 to 160 positions. Therefore, as many as 160 housing units would be required during the Initial Construction stage. However, a portion of the workforce already resides in the area.

The Plant construction workforce and intermittent contractors are anticipated to commute from their residences within the region or use local temporary housing (e.g., apartments, hotels, motels, trailers, RVs). The remainder of the Initial Construction workforce (54 personnel) would likely support activities of the Mine Unit Development stage, Operation phase and Reclamation phase; therefore, the majority of the workforce would likely rent or purchase houses.

Initial Construction in this EIS is similar to that of the Construction phase evaluated in the NRC SEIS. Section 4.11.1.1 of the NRC SEIS discusses how in the short-term, the influx of Construction employees could impact the demand for rental units in the region. However, since it is for a short time, the long-term impact would be negligible (NRC, 2011a).

Upon starting Mine Unit Development, the majority of the workforce (54 personnel) would already have established residence in the region during Initial Construction. An additional 12 to 52 technical LCI employees would likely move from outside of the region. Thus, 20 to 89 housing units would be required to support the direct (12 to 52 employees) and indirect (8 to 37 employees) employees of the Project.

The combination of Mine Unit Development, Operation, and Mine Unit Reclamation in this EIS is similar to that of the Operation phase evaluated in the NRC SEIS. Section 4.11.1.2 of the NRC SEIS describes how the workforce associated with the Operation phase might increase the demand for permanent housing in the region. However, since there is a small number of Operation phase employees and the housing development in the region has kept pace with the population changes, the impact is not expected to be significant.

4.15.7.2 Operation

The cost of living and housing impacts during Operation are not anticipated to differ from those during Mine Unit Development.

4.15.7.3 Reclamation

The cost of living and housing impacts during Mine Unit Reclamation are not anticipated to differ from the Operation phase.

The housing required during Final Reclamation would be similar to that required during Initial Construction. The technical staff from Mine Unit Development, Operation, and Mine Unit Reclamation would be reduced and would likely apply their skills at other nearby ISR facilities or extractive industries. Meanwhile, the contract employees hired for deconstruction and decommissioning would likely commute from their residences within the region or use local temporary housing (e.g., apartments, hotels, motels, trailers, RVs). Similar to the reduced technical staff at the beginning of the Final Reclamation stage, the LCI employees and contractors that remain at the time of Project completion would likely apply their skills at other nearby ISR facilities or extractive industries.

Final Reclamation in this EIS is similar to that of the Reclamation phase evaluated in the NRC SEIS. Section 4.11.1.4 of the NRC SEIS discusses how in the short-term, the influx of Reclamation employees could impact the demand for

rental units in the region. However, since it is for a short time, the long-term impact would be negligible (NRC, 2011a).

4.15.8 Impacts to Infrastructure and Services from the Proposed Action

With a population influx, improvements to infrastructure and services may be required sooner than anticipated and, if so, would have budgetary effects on local governments. Increases in taxes and revenues would provide counties and communities with funding to develop and/or maintain infrastructure and to support the increased population.

Due to the taxing system, impacted localities may not receive adequate funds in a timely manner to keep pace with increased demand. As previously noted, receipt of taxes generally lags one year behind production; therefore, affected counties and communities would not receive funds until two years after construction begins. Therefore, the following discussion is based on the impacts from the Project as a whole to specific items (e.g., education) rather than the individual phases of the Project.

Additionally, the distribution of increased tax revenue generated by the Project may not accrue or be proportionately distributed to the localities experiencing increased demand. Tax revenue would accrue mainly in Sweetwater County and in the State, even though the majority of the Project's workforce is anticipated to reside in Carbon and Natrona counties. Similarly, communities experiencing increased infrastructure and service demand may not receive a proportionate level of tax increase as sales tax tends to accrue in the larger population centers with more amenities. For example, even though Sweetwater County communities near the Permit Area would experience increased demand on infrastructure and services, a large portion of goods and services would be purchased in Carbon and Natrona counties. However, the costs associated with increased demand of public facilities and services are expected to be minimal.

4.15.8.1 Education

The Project's peak direct employment would be about 106 employees, with an indirect employment of 74 people. Assuming each employee has a family that would move from outside of the region, the children of about 180 families would be enrolled in the region's school districts. If an average person has a working career of 45 years and school-age children reside in the household for approximately 17 years, then 38 percent of the employee's working career would be associated with school-age children. Assuming each family has 1.86 children (US Census Bureau, 2004), the following equation would be used to estimate the number of school-age children:

180 families	x	1.86 children per family	x	38 % of time	=	127 school-age children

The Project region's school capacity is sufficient for a conservative estimate of an additional 127 students. In 2008, Bairoil enrolled 5 elementary school students; Wamsutter enrolled 83 elementary and middle school students; Rawlins enrolled 1,569 elementary, middle, and high school students; and Casper enrolled 10,786 elementary, middle, and high school students. Thus, an increase of 127 students in these schools would increase student enrollment by 1.0 percent. Impacts to education would likely be minimal because: a portion of the anticipated families already reside in the region; the majority of the families are anticipated to reside in Rawlins or Casper, which would easily accommodate this increase; and the schools that could be impacted (in Bairoil and Wamsutter) already use Rawlins' schools for at least high school if not middle school and high school. In addition, the regional school districts have accommodated more students than those enrolled in 2008. For example, Sweetwater School District One's enrollment was 5,033 students in 2009 and was 6,127 students in 1991 (Wyoming Department of Education, 2010). Carbon County School District One's enrollment was 1,803 students in 2009 and was 2,420 students in 1991. Natrona School District One's enrollment was 11,743 students in 2009 and was 13,100 students in 1994.

According to Section 4.11.1.2.6 of the NRC SEIS, the Operation phase may have a small impact to the number of students in the schools. (The combination of the Mine Unit Development stage, Operation phase, and Mine Unit Reclamation stage is similar to that of the Operation phase evaluated in the NRC SEIS.) However, the number is expected to be so small that the schools would not experience any significant changes (NRC, 2011a).

4.15.8.2 Health Care

Basic medical and emergency services that may be required in the event of an accident would be available at the Permit Area. Potential impacts to local health services, such as hospitals or emergency clinics, would be minimal. Local communities would need a minimal increase in emergency response and medical treatment capabilities due to the small risk of industrial accident of the Project.

Existing emergency response and medical treatment capabilities handle industrial accidents similar to those that could occur at the Permit Area; and a variety of industrial and hazardous materials are transported on Interstate 80 through Rawlins, which is about a 50-mile drive southeast of the Permit Area. Therefore, basic services are already established that can support the Project.

According to Section 4.11.1 of the NRC SEIS, the demand for health services would increase with the influx of new employees. However, the small number of workers would have a small influence on the region (NRC, 2011a).

4.15.8.3 Law Enforcement and Fire Protection

Law enforcement and fire protection services have adequate capacity for the increased population.

4.15.8.4 Communications and Utilities

Communication services have adequate capacity for the increased population.

An overhead electrical power line would be constructed to supply power for the Project at the Permit Area. The power line would connect to the pre-existing transmission line located directly west of the Permit Area. In addition, water supply and some waste disposal facilities for the Project would be developed by LCI due to the lack of such facilities in the vicinity of the Permit Area.

The communities of interest have ample utilities to accommodate the increase in population. However, the Rawlins utility infrastructure is in need of repair. With the population influx, improvements to public water, sewer, and street facilities and services may be required sooner than anticipated and would have budgetary effects on the local government.

4.15.8.5 Recreation

The population increase would directly affect recreational use and participation. Since the current recreational infrastructure and regulatory oversight are adequate to accommodate the population increase, the revenue generated by the increased recreation would benefit the local communities and the State.

In addition, data collection and increased economic activity would enhance cultural, educational, and recreational opportunities. The social, cultural, and environmental data collected for the Project would enhance the understanding and value of the Permit Area and its environs.

As discussed in **Section 4.2**, impacts to recreational land use would be negligible due to the short-term duration of the Project and the small area of disturbance and/or restriction. For instance, hunting, which is the primary recreational activity, would be restricted to areas outside fenced portions of the Permit Area for safety reasons, but would not be permanently affected, and may be improved due to wildlife habitat reclamation and improved transportation routes.

4.15.9 Socioeconomic Impacts from Other Alternatives

4.15.9.1 No Action Alternative

Under the No Action Alternative, the local, regional and national socioeconomics would reflect the baseline conditions described in **Section 3.14**.

4.15.9.2 Other Action Alternatives

Not Fencing the Pattern Areas would minimally reduce the Project's expenditures (thus, revenue and taxation) and employment. The overall socioeconomic impact of Drying Yellowcake On-Site would be limited compared to the socioeconomic impact of the Project as a whole.

4.16 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income. In 1994, President Bill Clinton passed Executive Order 12898 to address environmental justice through federal agencies.

Per this executive order and subsequent guidelines, this section identifies known minority, low-income, and Tribal populations within the socioeconomic study area, evaluates whether or not these populations may have disproportionately high or adverse human health or environmental effects from the Project, and discusses the manner in which all populations would be treated fairly and meaningfully involved.

The results of the following assessment are in general agreement with the Section 4.12 of the NRC SEIS which determined that the environmental and socioeconomic impacts of the Proposed Action would not disproportionately affect the populations of concern. The NRC SEIS also evaluated potential radiological impacts from subsistence consumption of fish and wildlife as part of traditional lifestyles and concluded there would not be any disproportionate impacts (NRC, 2011a).

4.16.1 Agency-Required Measures

The need for protective measures of environmental justice impacts is not anticipated.

4.16.2 Monitoring of Environmental Justice Impacts

Monitoring of environmental justice impacts is not anticipated.

4.16.3 Environmental Justice Impacts from the Proposed Action

4.16.3.1 Identification of Minority, Low-Income, and Tribal Populations

Minority Populations

Consequent to Executive Order 12898, the Interagency Working Group on Environmental Justice was created, comprising twelve federal agencies and several White House offices (EPA, 2010b). The Interagency Working Group developed guidance on key environmental justice terms. The Interagency

Working Group defines a minority as an individual who is a member of the following races and ethnicity: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (Council on Environmental Quality, 1997). A minority population is a population in which: the minority population represents more than 50 percent of the total population; or the minority to general population ratio of the affected area is meaningfully greater than the minority to general population ratio of the larger, general area. A minority population may be either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (e.g., migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.

As shown in **Table 4.16-1**, at least 90 percent of the population of each county of interest and the State of Wyoming was white in 2000, with the exception of Fremont County. Fremont County's population was 77 percent white and 20 percent American Indian or Alaskan Native (largely from the Wind River Indian Reservation). The communities of interest were also predominantly white. The white population in Bairoil, Wamsutter, Jeffrey City, and Casper represented 94 to 100 percent of the total population. Rawlins had the lowest percentage (86 percent) of white population; the general remainder of Rawlins' population was either some other race (eight percent) or more than two races (three percent).

As noted in **Section 3.14**, six percent of the State's population was of Hispanic or Latino ethnicity in 2000. About four to five percent of Fremont and Natrona counties' populations were of Hispanic or Latino ethnicity, whereas Sweetwater and Carbon counties' Hispanic or Latino ethnic populations were 9 and 14 percent, respectively. The Hispanic or Latino population in Bairoil, Jeffrey City, and Casper represented no more than five percent of the total population. Wamsutter's and Rawlins' Hispanic or Latino populations were 13 and 21 percent of the total population, respectively.

In 2000, within the socioeconomic study area, the population of minorities was less than 50 percent of the total population. In addition, the minority to general population ratio of the affected area was comparable (within 20 percent) to the minority to general population ratio of the larger, general area. Therefore, disproportionately high or adverse impacts to any minority race or ethnicity are not anticipated.

Low-Income Populations

Low-income populations are identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty (Council on Environmental Quality, 1997). The

thresholds represent the minimal annual cash income to support various-sized families, and are updated annually to account for inflation.

As shown in **Table 4.16-2**, from zero to 13 percent of families and from four to 17 percent of individuals within the places and areas of interest lived in poverty in 1999. These percentages are similar (within 20 percent) to the State-wide average of 8 and 11 percent for families and individuals below the poverty level, respectively. Based on the data above, low-income populations are not anticipated to be disproportionately affected by the Project.

Table 4.16-1 Populations by Race and Ethnicity, 2000

Place	Race														Ethnicity	
	White		Black or African American		American Indian & Alaska Native		Asian		Native Hawaiian & Other Pacific Islander		Some Other Race		Two or More Races		Hispanic or Latino	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
State of Wyoming	454,670	92	3,722	1	11,133	2	2,771	1	302	0	12,301	2	8,883	2	31,669	6
Sweetwater County	34,461	92	275	1	380	1	240	1	16	0	1,349	4	892	2	3,545	9
Bairoil	97	100	0	0	0	0	0	0	0	0	0	0	0	0	4	4
Wamsutter	245	94	0	0	2	1	0	0	0	0	8	3	6	2	34	13
Carbon County	14,092	90	105	1	199	1	105	1	9	0	808	5	321	2	2,163	14
Rawlins	7,331	86	69	1	125	1	72	1	8	0	707	8	226	3	1,797	21
Fremont County	27,388	76	44	0	7,047	20	106	0	9	0	417	1	793	2	1,566	4
Jeffrey City [1]	104	98	0	0	1	1	0	0	0	0	0	0	1	1	2	2
Natrona County	62,644	94	505	1	686	1	277	0	25	0	1,275	2	1,121	2	3,257	5
Casper	46,680	94	428	1	495	1	245	0	10	0	1,011	2	775	2	2,656	5

* US Census Bureau, 2000
[1] Census Designated Place

Table 4.16-2 Low Income Populations, 1999

Place	Families				Individuals			
	Families Below Poverty Level		Total Families		Individuals Below Poverty Level		Total Individuals	
	#	%	#	%	#	%	#	%
State of Wyoming	10,585	8	131,508	100	54,777	11	493,782	100
Sweetwater County	548	5	10,194	100	2,871	8	37,613	100
Bairoil	2	8	25	100	4	4	97	100
Wamsutter	8	11	70	100	28	11	261	100
Carbon County	411	10	4,180	100	1,879	12	15,639	100
Rawlins	235	10	2,259	100	1,114	13	8,538	100
Fremont County	1,267	13	9,495	100	6,155	17	35,804	100
Jeffrey City [1]	0	0	27	100	7	7	106	100
Natrona County	1,548	9	17,772	100	7,695	12	66,533	100
Casper	1,122	8	13,238	100	5,546	11	49,644	100

* US Census Bureau, 2000
[1] Census Designated Place

Tribal Populations

Table 4.16-1 shows the American Indian and Alaskan Native populations within the socioeconomic study area. Fremont County has 63 percent of the American Indian and Alaskan Native population of the State of Wyoming. A large portion of the tribal population in Fremont County resides at the Wind River Indian Reservation, which is centered approximately 75 miles north-northwest of the Permit Area and would not be directly impacted by the Project. The tribal populations in other places and areas of interest represent less than two percent of the total populations. As such, tribal populations would not be disproportionately or adversely impacted by the Project.

4.16.3.2 Fair Treatment and Meaningful Involvement

To ensure environmental justice, all people are and would be treated fairly and meaningfully involved. Fair treatment is defined as when no group of people bears a disproportionate share of negative environmental consequences resulting from industrial, governmental, and commercial operations or policies (EPA, 2010a). Meaningful involvement is defined as when: people have the opportunity to participate in decisions about activities that may affect their environment and/or health; the public can influence the regulatory agency's decision; public

concerns are considered in the decision making process; and the decision makers seek out and facilitate the involvement of potentially affected people.

Fair treatment and meaningful involvement has been and would continue to be implemented by the following:

- publishing Notices of Intent and Notices of Availability to announce the scoping meeting(s) and document accessibility in the Federal Register and/or the local media (e.g., newspaper, radio, television);
- consulting with other federal agencies, Tribal leaders, the State and local governments, community groups, and similar groups (**Section 6.0**);
- developing stakeholder mailing lists;
- overcoming linguistic, cultural, institutional, and geographic barriers;
- providing public access to pertinent notices, documents, and meetings;
- scheduling meetings at convenient times and places that are local and accessible;
- sharing information through different meeting sizes, formats, media, or other methods;
- soliciting feedback and recommendations through written communication, personal interviews, audio/video recording devices, or other methods; and
- periodically updating stakeholders about the NEPA process.

4.16.4 Environmental Justice Impacts from Other Alternatives

4.16.4.1 No Action Alternative

The No Action Alternative would have no environmental justice impacts.

4.16.4.2 Other Action Alternatives

Differences in environmental justice impacts are not anticipated between the Proposed Action and Other Action Alternatives described in **Section 2.0**.

4.17 Public and Occupational Health

Potential impacts on public and occupation health are discussed on the basis of radiological and non-radiological impacts.

4.17.1 Agency-Required Measures

The required environmental protection measures are summarized below from Appendix D10 of the WDEQ-LQD Permit to Mine (LCI, 2011b), Sections 3.12.1, 3.12.2, 3.12.3, 4.13.1.1, 4.13.1.2, 4.13.1.3, 4.13.1.4, .4.13.2, and.4.13.3 of the of the NRC SEIS (NRC, 2011a), and Conditions 9.7, 10.4, 10.14, 10.15, 10.16, 10.17, 11.6, 12.2, 12.3, 12.5, 12.10, 12.11, and 12.14 of the NRC License (NRC, 2011b).

Efficient ISR operation, including mine unit balancing and monitoring, and up-to-date techniques for ore processing and for waste storage, handling, and disposal, would be used to keep contaminants of concern out of any pathways that could result in impacts to public or occupational health. Employee training for both routine procedures and for unseen circumstances would help reduce the potential for accidents. There are requirements for personnel training, specifying the chain of command, equipment calibration, record keeping, and reporting to both the agencies and workers. Because of the relatively remote location of the Project, mitigation of impacts to the public comes from primarily ensuring visitors to the site receive the appropriate training and monitoring, and are only allowed access to areas outside of the established exclusion zones.

4.17.1.1 Protection Measures for Radiological Impacts

As previously discussed, radiological impacts from the Project are minimal. Mine unit and Plant design are intended to result in effective and efficient mining and ore processing. For example, the water balance details, the mine unit instrumentation, and the Plant design are described in Sections OP 3.6.3.1, OP 3.6.1.1, and OP 4.4 of the WDEQ-LQD Permit to Mine (LCI, 2011b), respectively. Worker training and worker and environmental monitoring would be conducted throughout the life of the Project, to ensure that the practices and procedures developed prior to the Project are properly implemented and effective (Section 5.0 of the NRC Technical Report [LCI, 2010]). In addition to the practices and procedures developed before the Project is started, periodic reporting to and inspections by the NRC are also required throughout the life of the Project.

As discussed in Section 6.0 of the NRC Technical Report (LCI, 2010), the NRC also requires licensed facilities to submit a decommissioning plan for review prior to the reclamation of each Mine Unit and prior to Final Reclamation. The plan would include details of how a radiation safety program, compliant with 10 CFR

Part 20, would be implemented during decommissioning to ensure the safety of workers and the public is maintained and applicable safety regulations are followed. The existing reclamation plan in the NRC Technical Report specifies the necessary surveys prior to reclamation to double check that no unanticipated, elevated radiation levels exist in the area to be reclaimed. The plan also specifies the radiation levels for determining whether decontaminated equipment must be disposed of in a licensed facility or can be reused.

4.17.1.2 Protection Measures for Non-Radiological Impacts

Similar to the protection measures of radiological impacts, measures used for non-radiological impacts depend on proper facility design, operation, and maintenance and on worker training and worker and environmental monitoring. The Wyoming Department of Employment (State OSHA Program) requirements and regulations will be followed. In addition to general practices and procedures, specific requirements for unique situations are also required. For example, protection practices related to facility design and handling and storage of the chemicals that would be used at the Project are detailed in Sections 7.5 and 7.6 of the NRC Technical Report (LCI, 2010).

4.17.2 Monitoring of Public and Occupational Health Impacts

4.17.2.1 Radiological Impacts

The radiological monitoring required by the NRC is detailed and extensive. LCI's radiological monitoring program is included in Section 5.0 of the NRC Technical Report (LCI, 2010). In addition to specifying monitoring locations, parameters, and frequency, there are requirements for personnel training, specifying the chain of command, equipment calibration, record keeping, and reporting to both the agencies and workers.

The required monitoring addresses both workers and the public. With respect to workers, monitoring of the workers, the work place, and the environment is required. For example, monitoring of the workers includes radiation badges and, for specific work circumstances, may also include breathing zone sampling. Examples of work place monitoring include gamma surveys of the ion exchange tanks and smear samples of work surfaces. Examples of environmental monitoring include routine soil sampling and air particulate sampling at specific locations relative to the Plant and Permit Area.

With respect to the public, the radiological monitoring required by NRC specifies monitoring procedures for contractors and visitors to the Project, in addition to establishment of exclusion zones where only specified, trained LCI personnel are allowed. At the Permit Area boundary, monitoring for radon, gamma, and air particulates is required.

4.17.2.2 Non-Radiological Impacts

The monitoring requirements for the non-radiological health impacts of the Project are those typical for industries, such as drilling, which are regulated by OSHA. In particular, reporting of all accidents, investigating the circumstances causing the accident, and implementing improved practices where necessary are essential to monitoring the effectiveness of the Project's health and safety practices. The regular inspections of work areas, as described in Section 2.9 of the WDEQ-LQD Permit to Mine (LCI, 2011b) and Section 5.0 of the NRC Technical Report (LCI, 2010), would also help ensure the Project's health and safety practices are effective.

4.17.3 Impact Significance Criteria

Radiological impacts were evaluated on the basis of potential exposures to workers and the public during the Project phases compared to naturally occurring and anthropogenic exposures. Both worker and public radiological exposures are addressed in NRC regulations in 10 CFR Part 20, which requires licensees to implement an NRC-approved radiation monitoring and protection program.

The non-radiological impacts were evaluated on the basis of relative hazards of the work processes (e.g., drilling) and materials (e.g., chemicals). Although the Project is a mining operation, the industrial safety aspects associated with the Project are regulated by the Wyoming Department of Employment (State OSHA Program) because most of the Project activities are more similar to other industries (e.g., drilling and manufacturing) than traditional mining.

4.17.4 Public and Occupational Health Impacts from the Proposed Action

The Project would use ISR technology to extract uranium from permeable, uranium-bearing sandstones. Once extracted, the uranium would be recovered by means of ion exchange, elution, and precipitation/filtration to ultimately produce yellowcake slurry. The operation plan for the Proposed Action is presented in **Section 2.0**.

There are no permanent residents within 15 miles of the Permit Area, significantly reducing the possibility of public impacts. Potential public health impacts, however, were evaluated to ensure the health of occasional near/on-site members of the public, such as hunters and ranchers. In addition, the workforce for the ISR operation would be relatively small, especially as compared to the work force needed for surface mining of uranium and conventional mill operation, reducing the possibility of occupational impacts.

4.17.4.1 Radiological Impacts

The purpose of this section is to evaluate the potential impacts for radiological exposures above the levels of naturally occurring exposures. Naturally occurring exposures are due to the presence of radioactive materials in the earth. (For example, radon-222 is a radioactive gas that escapes into ambient air from the decay of uranium found in most soils and rocks.) As a result, radioactive materials are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of radiation. There are also anthropogenic sources, such as medical diagnostic procedures using radioisotopes. The National Council for Radiation Protection (NCRP) estimates the annual average dose to the public from all natural background radiation sources (terrestrial and cosmic) is 310 millirems (mrem), and the annual average dose to the public from all sources (natural and anthropogenic) is 620 mrem (NCRP, 1987).

Construction

None of the activities during Construction involve worker exposure to uranium ore and associated radiological parameters, with the possible exceptions of short-term exposure drilling of the deep wells and potential movement of soil with elevated radionuclide concentrations. With respect to the deep wells, the locations were selected on the basis of minimizing interference with production of known uranium resources. Therefore, interception of uranium ore during drilling, and subsequent movement of the material to the surface via the drilling process, is unlikely. With respect to movement of soil with elevated uranium concentrations, the results of the site-wide gamma scan and soil sampling (**Section 3.15**) do not indicate the presence of radionuclides in excessive quantities in Construction areas at the surface due to the presence of ore (e.g., an outcrop) or prior exploration activities. Practices to prevent worker exposure to inhalation of fugitive dust, e.g., dust masks, and to minimize creation and transport of dust, e.g., application of magnesium chloride (**Section 4.11**), that are implemented for air quality concerns would reduce the potential for transport of radionuclides in soil if they were encountered.

Exclusion of the public from Construction zones, following standard health and safety regulations and practices, along with practices to minimize creation and transport of dust, would preclude radionuclide exposure to the public during Construction.

During Mine Unit Development, the drilling of wells in the pattern areas increases the potential for exposure to radionuclides as the water and drill cuttings from the ore zone are brought to the surface and circulated through the mud pit. However, the relative volume of the water and cuttings from the ore zone, which is on the order of a few feet thick, relative to the overall volume of drill cuttings from a given well, which is several hundred feet deep, is minimal.

Section 4.13.1.1 of NRC SEIS discusses that workers would most likely be exposed during well construction, disturbing surface soils, and fugitive dust, but that concentrations would be low, and any health impacts for employees and the general public would be low (NRC, 2011a).

Operation

During the Operation phase, radon would be released from the solutions at the mine units and vented from the Plant building to the atmosphere during routine operation or when vessels are opened for maintenance. Experience from other ISR projects shows that these releases would only be a small fraction of the natural background dose contribution and would not result in a significant off-site impact. Potential public exposures to radiation could occur from the same radon releases. The MILDOS-AREA computer code (ANL, 1998) was used to estimate potential exposures and doses to human receptors and populations surrounding the Permit Area, and the results are summarized below. Details on input parameters, exposure pathways, as well as the results of the MILDOS modeling are presented in the NRC Technical Report (LCI, 2010). The potential for exposures due to accidental releases during the Operation phase was also evaluated as part of the Technical Report, and the results are also summarized below.

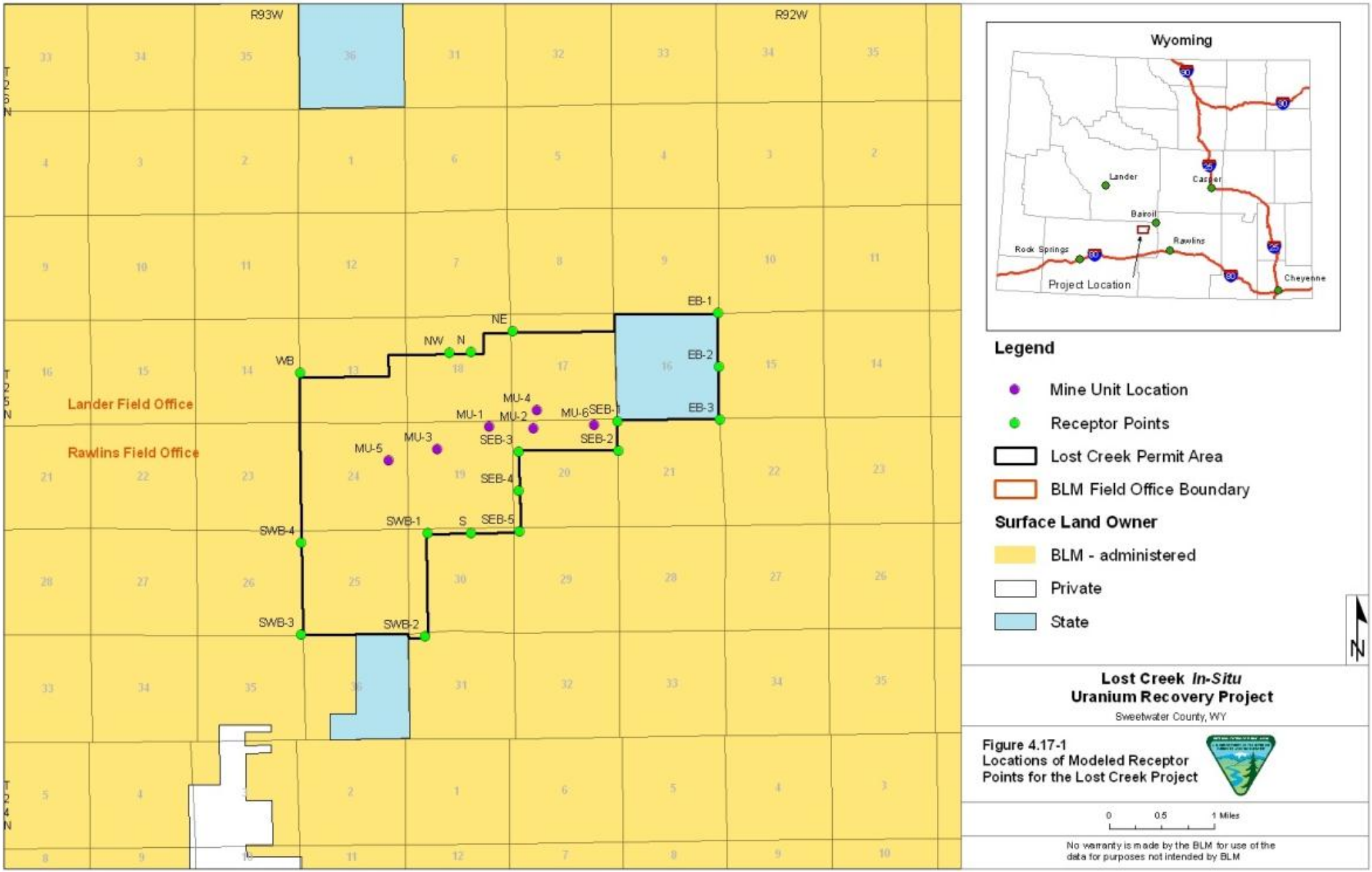
Section 4.13.1.2 of the NRC SEIS summarizes how employees and the public can become exposed during normal operations and accidents. The expected doses during normal operations are below the regulated limits, and any impacts from this exposure would not be expected. Additionally, the mitigation efforts to prevent accidents and the response plans if an accident does occur minimize the threat from spills and reduce the potential impact (NRC, 2011a).

Operational MILDOS Modeling Results

Since there are no permanent residents in the vicinity of the Permit Area, radon doses were modeled at 17 locations around the perimeter of the Permit Area boundary (**Figure 4.17-1**). The map shows modeled receptor locations, as well as centroids of each mine unit. MILDOS calculations and output use metric units; this discussion refers to English and metric length units for the sake of consistency.

MILDOS modeling indicates that releases from the site lead to a maximum calculated total effective dose equivalent (TEDE) to a potential resident at the SEB1 boundary location of 3.01 mrem, which is well below the 100-mrem-per-year limit of Title 10 CFR Part 20 (**Figure 4.17-2**). No other boundary location exceeds 2 mrem in a given year and most are below 1 mrem. The vast majority of the calculated doses at the SEB1 location are from venting during operation, which occurs at the centroid of the mine unit. Most mine units are upwind of the SEB1 location.

There are no towns of any size within 15 miles of the Permit Area. While there are no standards for population dose, it is interesting to compare population doses from the Project, calculated from MILDOS, to the natural background for the same region. The average US resident receives 360 mrem per year (NRCP, 1987). When applying this average US effective dose to the MILDOS population (8,985 residents), the natural background population dose (TEDE) would be approximately 3,200 person-rem per year, which is over 170,000 times higher than that of the calculated maximum 0.019 person-rem-per-year population dose within 50 miles of the Permit Area.

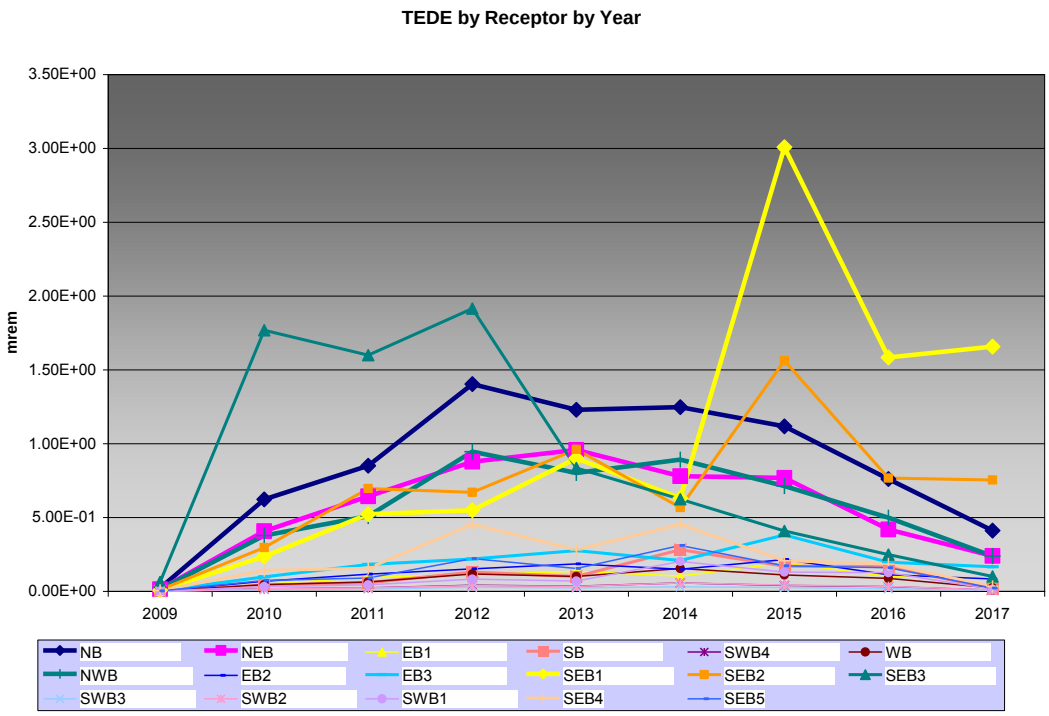


Lost Creek *In-Situ* Uranium Recovery Project

Sweetwater County, WY

Figure 4.17-1
Locations of Modeled Receptor Points for the Lost Creek Project

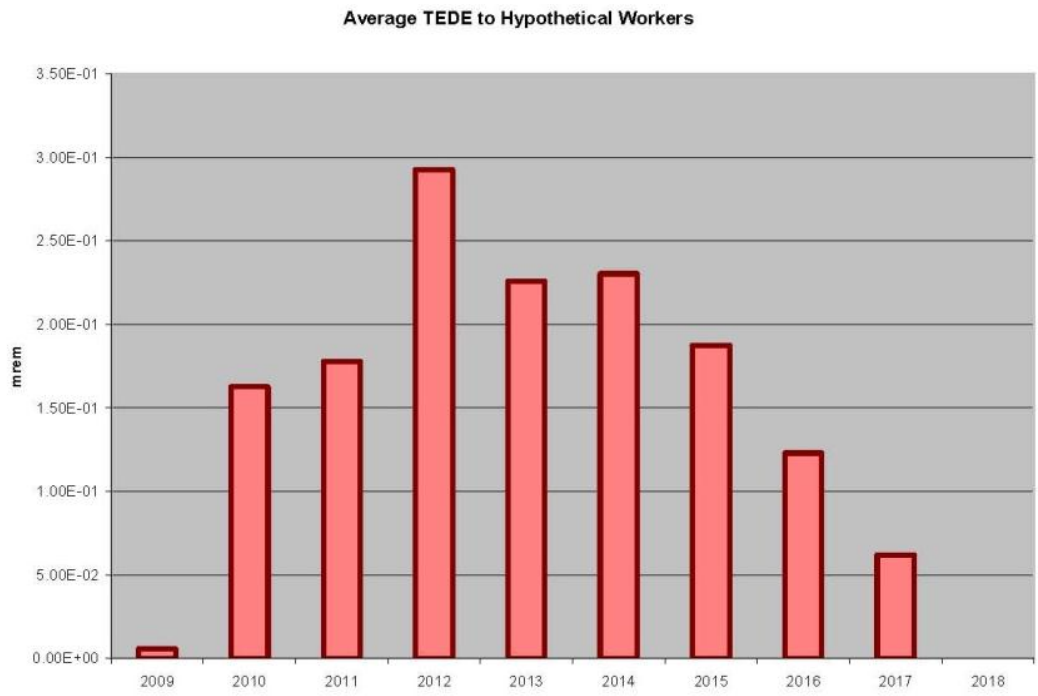
Figure 4.17-2 TEDE at Boundary Receptor Points



MILDOS is not commonly used to calculate occupational doses, because such doses are calculated using results of personnel monitoring during facility operation. However, a hypothetical worker location was used in MILDOS to calculate doses through the operation of the Plant. The worker location was modeled once for 328 feet (100 meters) to the north, east, south and west of the ion exchange facility. For each worker receptor location, a dose was calculated, multiplied by 0.22 to represent an occupational year (2,000 work hours in an 8,760-hour year), and averaged. The maximum worker dose would be 0.3 mrem in 2014, which is well below the occupational standard of five rem (**Figure 4.17-3**). This value is likely an overestimate for a worker at the specified locations, because MILDOS includes contributions from pathways, such as ingestion of vegetation, which would not apply to the Permit Area. During operation of the facility, workers at the site would be monitored and occupational doses calculated in accordance with the NRC License.

There are no current dosimetric standards for protection of biota. However, it has been assumed by the International Commission on Radiological Protection that if humans were protected, then biota in the same exposure environment would also be protected.

Figure 4.17-3 MILDOS-Calculated Doses to a Hypothetical Worker 328 feet (100 meters) from the Plant, Averaged over Direction



Accidental Releases

The precautions put into place for the Project are intended to reduce the risk of accidents and associated releases as much as possible. Even so, the consequences of various on-site accidents and transportation accidents were evaluated as part of the NRC Technical Report (LCI, 2010). Specifically, Sections 4.1.2, 7.4.1, and 7.4.2 include evaluations of the consequences of releases from areas in the Plant with the higher concentrations of radioactive material, such as the yellowcake slurry storage tanks. Similarly, Section 7.2.7 includes evaluations of the consequences of off-site transportation accidents.

Reclamation

Exposures to workers could occur during disassembly of equipment used to convey production fluids from the mine units and equipment used in the Plant. Decontamination of equipment could also result in exposures, and for equipment that cannot be decontaminated, packaging of the equipment for transport to a designated disposal facility could also result in exposure if not done in accordance with specified practices and procedures.

Sections 4.13.1.3 and 4.13.1.4 of the NRC SEIS discuss that while there is a potential for some exposure during the reclamation efforts, the mitigation efforts and the clean-up of the area reduces these, and the impact on public and worker health is expected to be minimal (NRC, 2011a).

4.17.4.2 Non-Radiological Impacts

Increased traffic from the Project would increase the amount of gaseous emissions and airborne particulates. Potential impacts from these emissions are discussed in **Section 4.11**.

Construction

During Construction, most of the potential non-radiological impacts are related to mechanical hazards, such as operation of heavy equipment and drilling, and to exposure of emissions from engines on vehicles and equipment. Potential impacts include injuries or irritation of the eyes, nose, or respiratory system.

Section 4.13.1.1 or the NRC SEIS discusses the potential exposure to emissions from diesel exhaust fumes, but explains that the short exposure time and the quick dispersal into the atmosphere lead to minimal impacts (NRC, 2011a).

Operation

During the Operation phase, there are potential chemical exposures. Chemicals used in bulk quantities at the Permit Area would include sodium chloride, sulfuric acid, oxygen, hydrogen peroxide, CO_2, sodium carbonate, hydrochloric acid, as wells as fuels (diesel and gasoline), and smaller quantities of chemicals may be needed for laboratory procedures. As with radioactive materials, the precautions put into place for the Project are intended to reduce the risk of accidents and associated releases as much as possible. Even so, the consequences of various on-site accidents and transportation accidents were evaluated as part of the NRC Technical Report (LCI, 2010). Specifically, Sections 7.5 and 7.6 include evaluations of the consequences of releases from areas in the Plant in which chemicals would be stored and used, such as the hydrochloric acid storage tanks. Similarly, Section 7.4.7 includes evaluations of the consequences of off-site transportation accidents.

Section 4.13.1.2.3 of the NRC SEIS discusses the potential impacts from working with the chemicals present on-site. Any spills would have a minimal impact on the public off-site, but a potentially higher impact on workers if proper clean-up is not accomplished shortly after the spill. However, with the spill prevention and mitigation measures the impact from these spills is reduced since if one occurs, it would be properly addressed (NRC, 2011a).

Reclamation

The primary concerns during Reclamation would be similar to those during Construction, including operation of heavy equipment and exposure to engine emissions.

Section 4.13.1.4 of the NRC SEIS discusses the potential health impacts that could occur during Reclamation. The NRC suggests that as cleaning efforts progress in the Permit area, the likelihood for health impacts decreases, and that overall, the impact would be minimal (NRC, 2011a).

4.17.5 Public and Occupational Health Impacts from Other Alternatives

4.17.5.1 No Action Alternative

The No Action Alternative would generate no impact on public and occupational health.

4.17.5.2 Other Action Alternatives

The alternative of Not Fencing the Pattern Areas increases the potential for access to the pattern areas. The primary concern is that cattle or wild horses would damage the well heads, resulting in a release of production fluid, i.e., a radiological exposure. Procedures that are in place for detecting releases, repairing equipment, and implementing appropriate remediation measures would reduce the potential for exposure to radiological materials. With respect to non-radiological hazards, fencing the pattern areas reduces the potential access for someone unfamiliar with the pattern area hazards (e.g., trip and fall hazards in the header houses).

The alternative for Drying Yellowcake On-Site increases the potential radiation exposure to workers in the Plant. The potential exposure is not during operation of the dryer, because the vacuum system is designed to prevent release of radiological particulates. The potential exposure could occur during maintenance and reclamation of the dryer or during an accidental release, and this exposure would be similar to that of the Proposed Action. In addition, before a dryer could be installed, an NRC license amendment would be required, which would include further detail on dryer operation, monitoring, and decommissioning. The vacuum dryer and associated equipment would not be significantly more complex than the other processing equipment in the Plant; therefore, the potential increase in non-radiological impacts would be minimal. Because the dryer would be located within a restricted area of the Plant, there would be no potential for public exposure during routine operations.

4.18 Waste Management

During the Project, gaseous/airborne, liquid, and solid effluents would be generated from the processes associated with ISR operations. All of the effluents are typical for ISR projects currently operating in Wyoming, and existing technologies are amenable to all aspects of effluent control in the Permit Area. Waste streams from different phases of the Project and waste management practices for the Project are described in **Section 2.1**. The waste management control practices are also described in Section OP 5.0 of the WDEQ-LQD Permit to Mine (LCI, 2011b) and Section 4.0 of the NRC Technical Report (LCI, 2010).

4.18.1 Agency-Required Measures

The required environmental protection measures are summarized below from Sections OP 5.2, 5.3 and RP 4.2 of the WDEQ-LQD Permit to Mine (LCI, 2011b), Sections 2.1.1.1.6.2 and 2.1.1.1.6.3 of the NRC SEIS (NRC, 2011a), and Conditions 9.6, 9.9, 11.1(D), and 12.6 of the NRC License (NRC, 2011b).

The monitoring programs for non-radioactive emissions and particulates and for radon are described in **Sections 4.11** and **4.17**, respectively.

Liquid and solid wastes would be reduced by reusing/recycling materials whenever possible. The primary measures that would be employed to mitigate waste management impacts would be reduction of wastes and proper storage, handling, and disposal of wastes. Similarly, instrumentation and inspection of process facilities for timely identification and remediation of leaks and spills would reduce the potential for generating large volumes of wastes that would need to be disposed of at a licensed facility. In addition, by disposing of solid non-hazardous wastes at licensed facilities off-site, solid wastes would not be present in the Permit Area after the Project is completed. (For example, at conventional open pit mines, building rubble is often disposed of on-site.) The exception is that well casings may remain in place; however, the casing must be cut off below grade and a deed notice completed to document the well locations (WDEQ-LQD NonCoal Rules, Chapter 11, Section 8(h)(i) [WDEQ, 2005b]).

4.18.2 Monitoring of Waste Disposal Impacts

Gaseous Emissions and Airborne Particulates

The monitoring programs for non-radioactive emissions and particulates and for radon are described in **Sections 4.11** and **4.17**, respectively.

Liquid and Solid Wastes

The Storage Ponds and UIC Class I wells would be routinely inspected, maintained and tested to ensure that any impact-generating potential is kept to minimum. The septic system would be maintained in accordance with the Sweetwater County permit. The UIC Class I wells would be monitored in accordance with the requirements of the UIC permit. An evaluation of the well performance would be included in the Annual Report submitted to NRC and WDEQ.

Monitoring of solid wastes would include inspection to ensure proper storage, selection of licensed disposal contractors, and periodic audits of labels, manifests, and disposal practices.

4.18.3 Impact Significance Criteria

The criteria used to evaluate the impacts of waste management activities are the availability of appropriate treatment options and disposal facilities, the capacity of those disposal facilities (e.g., whether the volume of Project wastes would overtax the facilities), and efficiency of the disposal option (e.g., disposal versus reuse). The impacts of the waste management facilities on specific resources are evaluated in the respective resource sections (e.g., the impacts of the Storage Ponds on wildlife are discussed in the **Section 4.9**).

Section 4.14 of the NRC SEIS addresses waste management impacts. Wastes identified include liquid waste, both radiological and non-radiological, and solid wastes. However, due to the contents, quantity, and management measures, the impact from waste is expected to be small (NRC, 2011a).

4.18.4 Waste Disposal Impacts from the Proposed Action

The following discussion is separated on the basis of the type of effluent, i.e., gaseous/airborne, liquid, or solid effluent, and then on the basis of the phase of the Project, i.e., Construction, Operation, and Reclamation.

4.18.4.1 Gaseous Emissions and Airborne Particulates

As described in **Section 2.1**, non-radioactive and radioactive airborne effluents are anticipated during the Project; however, the relative quantities vary among the Construction, Operation, and Reclamation phases of the Project.

Non-Radioactive Emissions and Particulates

Most non-radioactive emissions and particulates would be generated during Construction, when the most earth moving would occur and heavy machinery

would be used for building the Plant. The impacts are, however, short-term. Compared with the Construction phase, fewer amounts of non-radioactive effluents are expected during the Operation phase and, thus, less impact is anticipated. Impacts during the Reclamation phase are short-term; and the amount of emission and particulates generated would be less than those from Mine Unit Development but more than those from Operation. Detailed discussions of non-radioactive emissions and particulates generated during the Project, as well as their potential impacts, are presented in **Section 4.11**.

Radioactive Emissions

Almost all of the expected radioactive emissions would occur during the Operation phase. There would be minimal radioactive emission, if any, during Construction, and limited amount during Reclamation. Radon would be the radioactive gaseous emission from ISR production and processing, as it is naturally present in the orebody and concentrated in the lixiviant solution. Radon would be released occasionally from the mine unit wells as gas is vented from the injection and production wells. Radon would also be released during ion exchange resin transfers and subsequent processing steps, as described in more detail below. Detailed discussions of radioactive emissions generated during the Project, as well as their potential impacts, are presented in **Section 4.17**.

4.18.4.2 Liquid Wastes

Most of the liquid wastes (in terms of both type and amount [**Table 2.1-1**]) would be generated during Operation. **Table 4.18-1** summarizes the types of liquid wastes generated during the Project phases.

Table 4.18-1 Summary of Liquid Wastes Generated during Different Phases of the Project

Liquid Waste	Construction	Operation	Reclamation
Native Groundwater	Yes	Yes	No
Storm Water Runoff	Yes	Yes	Yes
Waste Petroleum Products and Chemicals	Yes	Yes	Yes
Domestic Sewage	Yes	Yes	Yes
11(e)(2) Byproduct Materials	No	Yes	Yes

"Native" Groundwater Recovered during Well Development, Sample Collection, and Pump Testing

In Construction, groundwater is recovered during well installation, sample collection, and pump testing conducted prior to Operation or from portions of the Permit Area not affected by ISR operations. This "native" groundwater has not been exposed to any ISR process or chemicals. During well development, sample

collection, and pump testing, this water would be discharged to the surface under the provisions of a general WYPDES permit, in a manner that mitigates erosion, or reused in the drilling process. Because of the relatively small quantities of water discharged at any given time, no impacts are anticipated.

Storm Water Runoff

Throughout the Project, the storm water discharge permits applicable per the WYPDES would be maintained. The associated SWPPP would be implemented as part of LCI's compliance with applicable WDEQ-WQD rules. A copy of the SWPPP is included as Attachment ADJ-3 of the WDEQ-LQD Permit to Mine (LCI, 2011b), and a copy would be in an accessible area at the site. /Because of the limited precipitation at the Permit Area, no impacts are anticipated.

Waste Petroleum Products and Chemicals

LCI would generate about 40 to 80 gallons of waste petroleum products per month, which would be periodically collected by a commercial business for recycling or energy recovery purposes. With respect to hazardous wastes, LCI would be a Conditionally Exempt Small Quantity Generator (CESQG), per EPA definition. About five to ten gallons of waste chemicals not immediately associated with laboratory operations would be generated per year. These waste chemicals would be periodically collected by a commercial business for recycling or disposal in a licensed disposal facility. As a CESQG, LCI could send the hazardous waste to the Sweetwater County District #1 Landfill in Rock Springs (**Section 4.18.4.3**). However, if recycling or reuse alternatives are available, those alternatives would be used to reduce the potential waste disposal impact.

Waste chemicals typically associated with the laboratory operations would be captured in the drains and/or sumps within the laboratory and would go straight to Plant waste tanks for eventual deep well disposal. An estimated five to ten gallons of these waste chemicals would be disposed of per year. The impacts of the UIC Class I wells are discussed in **Section 4.7**.

Domestic Sewage

Domestic liquid waste would be disposed of in an approved septic system that meets the requirements of the WDEQ-WQD. A permit would be obtained for the septic system prior to construction of the system. The septic system would receive waste from the restrooms, shower facilities, and miscellaneous sinks located within the office. The septic system, which is also permitted by Sweetwater County, would be maintained by a licensed contractor. Given the lack of shallow groundwater at the site, the remote location, and the relatively small work force, impacts to the Permit Area would be limited.

In addition, chemical toilets may be temporarily placed at mine units and other drilling areas. The chemical toilets would be maintained by a licensed contractor, and no impacts are anticipated in the Permit Area.

Liquid 11(e)(2) Byproduct Materials

The three 11(e)(2) byproduct materials (liquid process wastes, 'affected' groundwater generated during well development, and groundwater generated during aquifer restoration) would be treated and disposed of on-site through the Storage Ponds and UIC Class I wells. Because of the controlled on-site disposal procedures, no impacts from the liquid process wastes, other than those associated with the UIC Class I wells, are anticipated in the Permit Area. The Storage Pond impacts and the UIC Class I well impacts are discussed in **Section 4.7**.

The WDEQ has issued a permit to the applicant to drill, operate, and complete the UIC Class I wells in specific geologic formations. The permit specifies well construction, testing and operating conditions the applicant must follow to ensure adequate protection of the public and environmental health and safety. The permitted disposal rate is 250 gpm, based on a 50 gpm rate for each well. The maximum anticipated disposal rate based on the water balance for the Project is 115 gpm. Therefore, even allowing for redundancy, there is sufficient disposal capacity for the Project.

4.18.4.3 Solid Wastes

Table 4.18-2 summarizes the solid wastes generated during the Project phases. Most solid wastes generated during Construction would be non-hazardous (**Table 2.1-1**); no 11(e)(2) byproduct materials would be produced during Construction.

Table 4.18-2 Summary of Solid Wastes Generated during Different Phases of the Project

Solid Waste	Construction	Operation	Reclamation
Non-Hazardous Wastes	Yes	Yes	Yes
Hazardous Wastes	Yes	Yes	Yes
11(e)(2) Byproduct Materials	No	Yes	Yes

Non-Hazardous Solid Wastes

During Construction, most solid wastes would be typical construction debris, including scrap metal, paper, wood, and plastic. Based on empirical assessments of non-residential construction debris (Franklin Associates, 1998), an estimated average weight to volume conversion rate of 100 for such debris (California Department of Resources Recycling and Recovery, 2001), and a construction area of 100,000 square feet, about 150 cubic yards of construction debris would be generated. (The Plant covers about 41,600 square feet, but because of the variety

of facilities, such as the Storage Ponds, a larger square footage was assumed.) During Operation, about 55 cubic yards of non-hazardous solid wastes would be generated each year (LCI, 2011b). During Reclamation, an estimated 1,400 cubic yards of non-hazardous materials would be generated (NRC, 2011a).

The non-hazardous materials would be recycled when possible or temporarily stored in commercial bins prior to disposal by a contracted waste disposal operator at a licensed waste disposal facility. As noted in the NRC SEIS, "The closest location for disposal of non-hazardous solid wastes is the Carbon County landfill north of Rawlins, Wyoming"…"The municipal waste and the construction and demolition waste cells at the Carbon County landfill are not at or near capacity" (NRC, 2011a). The Rawlins Landfill has an anticipated life expectancy of 50 years, based on its current rates of waste disposal. The landfill does not accept liquid, industrial, or hazardous wastes. All wastes received at the landfill are disposed there, and no wastes are transferred to other facilities.

Hazardous Solid Wastes

Hazardous wastes, such as solvents, paints, used oil, batteries, and fluorescent bulbs, would be a significantly smaller percentage of the solid wastes generated during the Project than non-hazardous wastes. The closest location for disposal of hazardous solid wastes is the Rock Springs Landfill. As noted in the NRC SEIS, the facility has the capacity and is also in the process of permitting additional capacity that would expand the life of the landfill about 30 years (NRC, 2011a).

Solid 11(e)(2) Byproduct Materials

Solid 11(e)(2) byproduct materials would include process wastes, such as spent ion exchange resin, filter media, and tank sludge, generated during ISR and ore processing, and would include equipment that becomes contaminated during ISR and ore processing. These items include tanks, vessels, PPE, and process pipe and equipment. Such wastes could also include soils contaminated from spills.

No solid 11(e)(2) byproduct materials would be generated during Construction. Approximately 80 to 100 cubic yards of solid 11(e)(2) by-product materials would be generated each year during Operation (LCI, 2011b), including maintenance and housekeeping items, such as cleaning equipment, replacement components, filters, protective clothing, solids removed from process pumps and vessels, and any soils or other materials that cannot be decontaminated. The annual amounts would be somewhat higher during reclamation of the mine units as the equipment from the mine units is taken out of service. The total estimated amount of 11(e)(2) byproduct material from the Project, including Reclamation, is estimated to be 4,000 cubic yards (NRC, 2011a).

Where possible, equipment would be decontaminated for disposal as non-11(e)(2) byproduct material or for reuse. Equipment that cannot be decontaminated and

process wastes would be placed in clearly labeled, covered containers and temporarily stored in restricted areas with clearly visible radioactive warning signs. The materials would be temporarily stored on-site in containers called 'super-sacs'. Sacs that are full would be sealed and stored in secure areas in the Plant or outdoors in strong, tight, covered roll-off containers approved by the US DOT for transport of Low Specific Activity material until sufficient volume is generated for shipment to a facility that is licensed for treatment and/or disposal. Safe handling, storage, and disposal of decommissioning wastes are addressed in Sections 4.0 through 6.0 of the NRC Technical Report (LCI, 2010), and these procedures would be reviewed and updated, if necessary, in the decommissioning plan which must be submitted to NRC for review and approval prior to initiation of decommissioning activities. Because of the controlled off-site disposal procedures, no impacts from the non-hazardous solid waste disposal are anticipated in the Permit Area.

The solid 11(e)(2) byproduct materials would be disposed off-site, at a facility licensed by the NRC to accept such wastes, by personnel qualified to dispose of such wastes. At present, LCI does not have an agreement with such a facility; however, prior to the start of operations, LCI would enter into a written agreement with a disposal site as required by the NRC. A licensed facility may be a uranium mill tailings impoundment, and the closest would be the Pathfinder Shirley Basin Facility in Wyoming. Other NRC-licensed facilities that can accept byproduct material for disposal include: the Rio Algom Ambrosia Lake facility near Grants, New Mexico; the Energy Solutions site in Clive, Utah; the White Mesa facility in Blanding, Utah; and the Waste Controls Specialists site in Andrews, Texas.

4.18.5 Waste Disposal Impacts from Other Alternatives

The No Action Alternative would not generate any of the ISR wastes and thus no impacts would be created. With respect to waste management, there are no significant differences in the anticipated impacts, or in the monitoring and mitigation, between the Proposed Action and the Other Action Alternatives described in **Section 2.0**. Slightly less solid waste, specifically fencing materials, would be generated if the pattern areas were not fenced. However, the difference in volume of solid waste, if the fencing material was disposed of rather than reused, is minimal compared to the overall Project.

Processing wet yellowcake into a dry powder is not expected to change the nature or magnitude of waste disposal impacts as a vacuum dryer would be used. In a vacuum dryer, the heating system is isolated from the yellowcake so no radioactive materials are entrained in the heating system or its exhaust. The drying train would operate under a negative pressure to avoid atmospheric emissions, and drying would take place at relatively low temperatures. Emissions from the drying chamber would be normally treated through a bag filter to remove yellowcake particulates, and air from the bag filter dust collection system would typically be routed to the dryer offgas line and scrubber. A small volume of

liquid effluent from the vacuum dryer would be cooled and condensed for disposal as 11(e)(2) byproduct material in the UIC Class I wells; however, the volume would be minimal compared to the total volume of material from the Project. During loading of the dried yellowcake into a drum, the typical shipping container, the drum would also be kept under negative pressure via a drum hood with a suction line. The packaging area also has a bag filter dust collection system to protect personnel and to minimize yellowcake release. The vacuum drying equipment would need to be decommissioned in accordance with NRC requirements. Filters and dryer equipment that could not be decommissioned would be disposed of as solid 11(e)(2) byproduct material; however, the volume would be minimal compared to the total volume of material from the Project.

4.19 Mitigation Measures

Mitigation includes specific means, measures, or practices that would reduce or eliminate effects of the Proposed Action or alternatives. The agency-required measures, LCI's commitments and initiatives, and monitoring presented in the previous subsections of **Section 4.0** would provide adequate protection of resources and mitigation of impacts from the Proposed Action and alternatives. No additional mitigation measures are identified.

4.20 Residual Impacts

Residual impacts are adverse effects that remain after mitigation measures have been applied. Since the agency-required measures, LCI's commitments and initiatives, and monitoring presented in the previous subsections of **Section 4.0** would provide adequate protection of resources and mitigation of impacts from the Proposed Action and alternatives, no additional mitigation measures were proposed in **Section 4.19** (Mitigation Measures). Since no additional mitigation measures have been proposed, no residual impacts discussion is required. All impacts would remain as previously described in the subsections of **Section 4.0**.

4.21 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are actions that disturb or remove a resource to the point that it can only be renewed over a long period of time (centuries). A resource is irreversibly committed when it cannot be restored or returned to its original or pre-disturbance condition and when it, its productivity or its utility would be consumed, committed, or lost forever.

An irretrievable commitment of a resource directly removes the resource from availability or renders its productivity or utility lost for a period of time (e.g., closure of an area to resource extraction). An irretrievable commitment is the loss of opportunities for production or use of a renewable resource for a short to medium period of time (years). A resource is irretrievably committed when a decision results in the loss of production or future use of the resource.

The removal of uranium from the subsurface would be an irreversible and irretrievable commitment of resources. While the uranium is irreversibly removed from the ground, it is also irretrievably committed to present-day uses rather than potential uses at some undetermined future time. Other irretrievably committed resources of the Proposed Action and alternatives include building materials, electricity, fuels, office supplies, and other products consumed during the Project.

While surface disturbing and disruptive activities of the Proposed Action and alternatives are considered an irretrievable commitment of resources during the Project life, the environmental protection measures required for the Proposed Action and alternatives would reduce or eliminate the magnitude of this irretrievable commitment of resources. In the long-term, however, the resource commitment of surface disturbing and disruptive activities would be retrievable.

4.22 Relationship between Short-Term Uses and Long-Term Productivity

The Proposed Action and alternatives would result in the potential for loss in long-term productivity; however, the required environmental protection measures for the Proposed Action and alternatives would minimize the effect of short-term uses on long-term productivity.

The extracted uranium would support present-day objectives and not contribute to the national long-term productivity or production and use of uranium. Currently, the national nuclear energy industry (including domestic uranium production) is expanding to meet increasing energy demands, increased interest in energy security, and increased demand for alternative energy sources. At present, the US is importing most of the uranium used to fuel existing nuclear reactors in the country. Recent national programs, statutes, and initiatives include:

- the Nuclear Power 2010 program of the US Department of Energy;
- the Energy Policy Act of 2005;
- the American Recovery and Reinvestment Act of 2009;
- the Nuclear Energy Research Initiative;
- Nuclear Energy University Programs; and
- Generation IV Nuclear Energy Systems.

The State of Wyoming is historically, culturally, and economically tied to the mining industry. With its long-standing mining background and the largest uranium reserves in the US, Wyoming is well-equipped to play a leading role in the nation's uranium production. Uranium mining in Wyoming would not only help to diversify the nation's energy sources, it would offset the boom and bust cycles of other Wyoming natural resource development industries through diversification.

The short-term extraction of uranium would limit the long-term productivity of mineral resource extraction in the Permit Area at some point in the future. The uranium mineral resource remaining after the Proposed Action would be minimal since the Proposed Action anticipates at least an 80-percent recovery rate of the resource. However, other mineral resources could be discovered in economic quantities and recovered within the Permit Area in the future.

Present-day removal of uranium may indirectly improve long-term productivity by reducing the radioactivity of material associated with extracted uranium, thereby benefitting the health of humans and the environment by minimizing potential exposure.