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NUREG-1910
Supplement 2

Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming

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

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and
Environmental Management Programs

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U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1910, Supplement 2, draft, in your comments, and send them by February 1, 2010 to the following address:

Chief, Rulemaking and Directives Branch
U.S. Nuclear Regulatory Commission
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Electronic comments may be submitted to the NRC by e-mail at NicholsRanchISRSEIS@nrc.gov.

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ABSTRACT

The U.S Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source material provided that proposed facilities meet NRC regulatory requirements and would be operated in a manner that is protective of public health and safety and the environment. Under NRC's environmental protection regulations in the *Code of Federal Regulations* (CFR), Title 10, Part 51, which implement the *National Environmental Policy Act of 1969* (NEPA), issuance of a license to possess and use source material for uranium milling requires an environmental impact statement (EIS) or a supplement to an environmental impact statement.

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

By letter dated November 30, 2007, Uranerz Energy Corporation (Uranerz) submitted a license application to NRC for a new source material license for the Nichols Ranch ISR Project. The proposed Nichols Ranch ISR Project would be located in Campbell and Johnson Counties, Wyoming, which is in the Wyoming East Uranium Milling Region identified in the GEIS. The NRC staff prepared this SEIS to evaluate the potential environmental impacts from Uranerz's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR uranium milling facility at the Nichols Ranch ISR Project. This SEIS also describes the environment potentially affected by Uranerz's proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes Uranerz's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings and conclusions in the GEIS that could be incorporated by reference, and areas that needed additional analysis. Based on its environmental review, the NRC staff recommends that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Nichols Ranch ISR Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

Paperwork Reduction Act Statement

This SEIS covers information about only one site, does not contain information collection requirements and, therefore, is not subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

Public Protection Notification

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BACKGROUND

By letter dated November 30, 2007, Uranerz Energy Corporation (Uranerz) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Nichols Ranch In-Situ Uranium Recovery (ISR) Project, located in the Powder River Basin in Campbell and Johnson Counties, Wyoming. Uranerz is proposing to recover uranium using the in-situ leach (also known as the in-situ recovery (ISR)) process. The proposed Nichols Ranch ISR Project is divided into two units, the Nichols Ranch Unit and the Hank Unit. Proposed facilities for the Nichols Ranch ISR Project include a central processing plant at the Nichols Ranch Unit, a satellite facility at the Hank Unit, well fields, and deep disposal wells for the liquid effluent wastes.

The *Atomic Energy Act of 1954* (AEA) as amended by the *Uranium Mill Tailings Radiation Control Act of 1978* authorize the NRC to issue licenses for the possession and use of source material and byproduct material. These statutes require NRC to license facilities, including ISR operations that meet NRC regulatory requirements that were developed to protect public health and safety from radiological hazards. Under the NRC's environmental protection regulations in the *Code of Federal Regulations*, Title 10, Part 51 (10 CFR 51), which implement the *National Environmental Policy Act of 1969* (NEPA), preparation of an environmental impact statement (EIS) or supplement to an EIS is required for issuance of a license to possess and use source material for uranium milling (see 10 CFR 51.20(b)(8)).

In June 2009, NRC staff issued NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (hereafter referred to as the "GEIS"). In the GEIS, NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specified geographic regions of the western United States. The proposed Nichols Ranch ISR Project site lies within the Wyoming East Uranium Milling Region identified in the GEIS. The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This draft Supplemental Environmental Impact Statement (SEIS) incorporates by reference from the GEIS and uses information from the applicant's license application and other independent sources to fulfill the requirements set in 10 CFR 51.20(b)(8).

PURPOSE AND NEED OF THE PROPOSED ACTION

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." Uranerz is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Nichols Ranch and Hank sites. The purpose and need for the proposed action is to provide an option that allows the applicant to use ISR technology to recover uranium and produce yellowcake at the Nichols Ranch ISR Project. Yellowcake is the uranium oxide product of the ISR milling process that is used to produce fuel for commercially-operated nuclear power reactors. Based on the application, the NRC's federal action is the decision whether to issue the license to Uranerz.

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

THE PROJECT AREA

The proposed Nichols Ranch ISR Project is located in the Pumpkin Buttes Uranium Mining District of the Powder River Basin in Campbell and Johnson Counties, Wyoming. The proposed site is located approximately 74 kilometers (km) (46 miles [mi]) south-southwest of the city of Gillette and approximately 98 km (61 mi) north-northeast of the city of Casper. The total land surface ownership of the proposed Nichols Ranch ISR Project is approximately 1,365 hectares (ha) (3,371 acres [ac]). Sections within the proposed project area are considered split estate, where surface and subsurface mineral right ownership is divided between two or more owners. The total land surface ownership includes approximately 1,251 ha (3,091 ac) of private ownership, mainly by the T-Chair Livestock Company, and approximately 110 ha (280 ac) of U.S. Government ownership administrated by the Bureau of Land Management (BLM). The subsurface mineral ownership is divided between various private entities, including oil and gas, mineral extraction companies, and the U.S. Government.

Of the total land surface ownership, Uranerz estimates that the land surface area that would be affected by the proposed ISR operations would be approximately 120 ha (300 ac). The facilities (buildings and structures) proposed to be constructed as part of the Nichols Ranch ISR Project includes the buildings associated with a central processing plant and a satellite facility, storage and maintenance, wells and their associated features, and access roads. The proposed Nichols Ranch ISR Project would be divided into two noncontiguous units, the Nichols Ranch Unit and the Hank Unit, located west and southwest of the North Middle Butte respectively.

IN-SITU RECOVERY PROCESS

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

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

ALTERNATIVES

The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action before acting on a proposal. The NRC staff considered a range of alternatives that would fulfill the underlying purpose and need for the proposed action. From this analysis, a set of reasonable alternatives was developed, and the impacts of the proposed action were compared with the impacts that would result if a given alternative were implemented. This draft SEIS evaluates the potential environmental impacts of two alternatives to the proposed action, including the No-Action alternative. Under the No-Action alternative, Uranerz would not construct and operate ISR facilities at the proposed site. The other alternative considered is a modification of the proposed action whereby Uranerz would construct and operate facilities for ISR uranium recovery and processing at only the Nichols Ranch Unit and not the Hank Unit and to conduct the consequent aquifer restoration and site decommissioning and reclamation activities. Alternatives considered but eliminated from detailed analysis include conventional mining and milling at the proposed Nichols Ranch ISR Project site, conventional mining and heap leach processing at the proposed Nichols Ranch ISR Project site, alternate lixiviants, and alternate waste disposal methods.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts resulting from the construction, operation, aquifer restoration, and decommissioning of ISR operations at the proposed Nichols Ranch ISR Project site and two alternatives. The draft SEIS also provides mitigation measures for the reduction or avoidance of potential adverse impacts. The draft SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

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

> **SMALL**: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> **MODERATE**: The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource.
>
> **LARGE**: The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

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

Impacts by ISR Facility Phase and Significance Level

Construction

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Socioeconomics (Demography, Income, Housing, Employment

	Rate, Local Finance, Education, Health and Human Services); Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	Historic, Cultural, and Archaeological Resources; Visual and Scenic Resources
LARGE impacts:	NONE

Operation

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historic, Cultural, and Archaeological Resources; Visual and Scenic Resources; Socioeconomics (Income, Employment Rate, Education, Health and Human Services); Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	Socioeconomics (Demography, Housing, Local Finance)
LARGE impacts:	NONE

Aquifer Restoration

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historic, Cultural, and Archaeological Resources; Visual and Scenic Resources; Socioeconomics (Demography, Income, Housing, Employment, Local Finance, Education, Health and Human Services); Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	NONE
LARGE impacts:	NONE

Decommissioning

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historic, Cultural, and Archaeological Resources; Visual and Scenic Resources; Socioeconomics (Demography, Income, Housing, Employment, Local Finance, Education, Health and Human Services); Public and Occupational Health and Safety; Waste Management
MODERATE impacts:	NONE
LARGE impacts:	NONE

Impacts by Resource Area and ISR Facility Phase

Land Use

Construction: Impacts would be SMALL. Approximately 120 ha (300 ac) would be disturbed for construction, which is small in comparison to the total project area (1,364 ha [3,371 ac]). Topsoil would be stripped and stockpiled, and land would be graded for construction of access roads and processing facilities. Approximately 24 to 32 ha (60 to 80 ac) would be fenced off to grazing activities. Many construction impacts would be temporary.

Operation: Impacts would be SMALL. Impacts would be similar to, or less than, those during the construction phase. Areas would still be fenced off from grazing activities. Development or sequencing of well fields from one area of the site to another, as well as moving active operations from one well field to another, would shift potential impacts during this phase.

Aquifer Restoration: Impacts would be SMALL. Land use impacts would be similar to, or less than, those during the operational phase. Land use impacts would decrease as fewer wells and pump houses were used and overall equipment traffic and use diminish.

Decommissioning: Impacts would be SMALL. Land use impacts would be similar to those during the construction phase. Upon completion of well abandonment, seeded soil would be returned to the areas where it was stripped such as near removed header houses, roads, and facilities. As decommissioning and reclamation proceeds, the amount of disturbed land would decrease.

Transportation

Construction: Impacts would be SMALL. Low levels of traffic generated by construction activities would not significantly increase traffic or accidents on roads in the region. Existing ranch roads have been constructed to accommodate tractor trailer traffic related to coal bed methane (CBM) activities. Projected traffic volumes should not be conspicuous on roads near the proposed project area or on the regional road network.

Operation: Impacts would be SMALL. Transportation impacts would be similar to those during the construction phase. Additionally, transport of hazardous materials and uranium-loaded resins would add risk of spills or leakage during potential accidents; however this risk was determined to be minimal and further minimized by compliance with existing NRC transportation regulations and the implementation of best management practices (BMPs). Ranch road maintenance would be carried out by Uranerz in conjunction with landowners.

Aquifer Restoration: Impacts would be SMALL. Transportation impacts would be less than those during the construction and operation phases. Need for transport of hazardous materials and uranium-loaded resins would decrease as aquifer restoration proceeds, which would decrease the risk of spills or leakage associated with accidents. Also, fewer employees would be working at the proposed site further reducing transportation impacts during this phase.

Decommissioning: Impacts would be SMALL. Transportation impacts would be less than those during the construction and operation phases. Transport of hazardous materials would cease during decommissioning, and access roads would be dismantled. Also, fewer employees would be working at the proposed site further reducing transportation impacts during this phase.

Geology and Soils

Construction: Impacts would be SMALL. Earth-moving activities associated with construction of surface facilities, access roads, well fields, and pipelines would include clearing of topsoil and land grading. Drilling and installation of piping would occur. Implementation of BMPs would mitigate these impacts.

Operation: Impacts would be SMALL. Removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations; however, the rock matrix and structure would remain, which would not cause any significant matrix compression or ground subsidence. Spills from moving uranium-bearing lixiviant to and from the Nichols Ranch Unit central processing plant would be mitigated by onsite standard procedures and applicable NRC and State regulations.

Aquifer Restoration: Impacts would be SMALL. During aquifer restoration, groundwater sweep would not result in the removal of rock matrix or structure. Spill recovery and leak detection programs used during the operational phase would still be used during this phase.

Decommissioning: Impacts would be SMALL. Some disruption and/or displacement of soils would occur during dismantling of the facilities and reclamation of the land. Topsoil would be returned to the proposed project area and re-grading would return the land contours to their original condition.

Surface Waters and Wetlands

Construction: Impacts would be SMALL. Construction of roads, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment could all impact surface waters. Surface water features on the proposed Nichols Ranch ISR Project include ephemeral channels and washes. Uranerz would implement an emergency response plan (ERP) and observe applicable NRC and State regulations regarding spills to minimize the risk of chemicals being introduced to waterways. Well construction would avoid channels when possible. Temporary disturbances to the soil from vehicular passes during construction may cause some sediment transport during periods of surface flow; however, mitigation to minimize erosion and sedimentation would limit this impact. Wetland areas would be avoided by the proposed project.

Operation: Impacts would be SMALL. Spills and leaks could impact surface waters, but would be properly managed as in the construction phase. Uranerz would develop a storm water management plan in accordance with State regulations. Routine maintenance of wells would require vehicular crossings of some ephemeral channels, which would cause temporary disturbances.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to those during the operation phase due to use of same infrastructure and the fact that similar activities would be conducted. Restoration of groundwater aquifers would create wastewater, though this water would be contained in a wastewater disposal system for eventual deep well disposal.

Decommissioning: Impacts would be SMALL. Impacts would be similar to those during the construction phase. Re-contouring of the land would restore areas to their pre-construction state, which would minimize the long-term impact to any ephemeral streams that were crossed during the maintenance of wells. Work would be performed during the dry season to minimize sedimentation in surface waters.

Groundwater

Construction: Impacts would be SMALL. Groundwater use during construction is expected to be limited to routine activities such as dust suppression, mixing cements, and drilling support. The amount of groundwater used in these activities is small relative to available water. Groundwater quality of near-surface aquifers would be protected by BMPs such as implementation of a spill prevention and cleanup plan to minimize soil contamination.

Operation: Impacts would be SMALL. Releases at or near the ground surface on shallow (near-surface) groundwater at the Nichols Ranch and Hank Units would result in SMALL impacts with the implementation of mitigation measures such as a leak detection program, a spill cleanup program, and well mechanical integrity testing. Given the in-place mitigation measures in the event of impact to free flowing wells and absence of the evidence of indicating leakage from overlying and underlying aquifers, the impacts due to consumptive use are considered SMALL. Based on the generally poor pre-existing water quality in the proposed project area and the expected restoration of the production zones, the impacts to water quality of the uranium-bearing production zone aquifer as a result of ISR operations would be SMALL. Based on the low water quality in and the reduced water yields from the nonkarstic Paleozoic Aquifers in which the deep disposal wells may be drilled into, the presence of thick and regionally continuous aquitards confining them from above, and the approval needed by Wyoming Department of Environmental Quality (WDEQ) and NRC, the impacts to deep aquifers below the production aquifers of deep well injection of waste would be SMALL.

Aquifer Restoration: Impacts would be SMALL. Given that groundwater levels will tend to recover with time after production and restoration are complete and groundwater withdrawals are terminated, the potential long-term environmental impact from consumptive use would be SMALL. Due to the unconfined nature of the Hank Unit, the predicted drawdowns during production are expected to be limited and localized and therefore would have SMALL impacts as a result of consumptive use of groundwater. Groundwater quality of near-surface aquifers would be protected by BMPs such as implementation of a leak detection program, spill cleanup program, and well mechanical integrity testing and therefore, would result in SMALL impacts to shallow aquifers at the proposed site. The disposal of waste fluids via deep injection wells would be the same as during the operational phase and thus the impacts to deep aquifers below the production aquifers of deep well injection of waste would be SMALL.

Decommissioning: Overall impacts would be SMALL. All monitoring, injection, and production wells would be plugged and abandoned in accordance with Wyoming underground injection control (UIC) program requirements. Therefore, the abandoned wells would be properly isolated from the flow domain and thus the impacts would be SMALL. Prior to NRC's termination of an ISR source material license, the licensee must demonstrate that there would be no long-term impacts to underground sources of drinking water.

Ecological Resources

Construction: Impacts would be SMALL. Approximately 120 ha (300 ac) of land would be disturbed during construction, which would require vegetative removal. Some habitat loss or alteration, displacement of wildlife, and mortality due to encounters with vehicles or heavy equipment would occur, though wildlife species would generally be expected to disperse from the area once construction activities begin. Mitigation would ensure that greater sage-grouse breeding is not disrupted. Any trees with raptor nests would not be removed, and Wyoming Game and Fish Department (WGFD) guidelines regarding noise, vehicular traffic, and human proximity would be observed. No Federally threatened or endangered species are known to occur in the proposed project area. Impacts to State-protected species are not expected to noticeably affect species' populations within the vicinity of the proposed project site.

Operation: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during construction. Disturbed areas would be reseeded with WDEQ- or BLM-approved seed mixtures as soon as conditions allow. Access to crucial wintering habitat and water could be limited by fencing; however, WGFD-recommended fencing techniques would be used to minimize impediments to game movement.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to those experienced during the operation phase with no major differences in type or degree of impact. The existing infrastructure would be used during this phase and mitigation measures would continue to apply from the construction and operation phases.

Decommissioning: Impacts would be SMALL. Temporary disturbances to land and soils may displace vegetation and wildlife species that have re-colonized the proposed project area since the construction phase. Re-vegetation and re-contouring would restore habitat previously altered during construction and operations.

Air Quality

Construction: Impacts would be SMALL. Fugitive dust and combustion from vehicles and diesel equipment during construction would create emissions but emissions would be below the National Ambient Air Quality Standards (NAAQS). Uranerz would implement BMPs to mitigate these emissions. Mitigation would include wetting and stabilizing unpaved roads, reclaiming disturbed soil and using vegetative covers on soil piles, and utilizing stationary equipment to lessen traffic volume on the roads.

Operation: Impacts would be SMALL. Impacts would similar, but less than, those experienced during construction. Operating ISR facilities are not expected to be major point source emitters and are not expected to be classified as major source under the operation (Title V) Clean Air Act (CAA) permitting program.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar in type and degree as those experienced during the operational phase. The use of existing infrastructure and reduced volume of traffic would lessen fugitive dust and emissions.

Decommissioning: Impacts would be SMALL. Impacts would similar those experienced during construction. Emissions would decrease as decommissioning proceeds. The mitigation measures used during the construction phase would also be implemented in this phase.

Noise

Construction: Impacts would be SMALL. Increased traffic as well as use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the well fields, drill the wells, develop the necessary access roads, and build the production facilities would generate noise that would be audible above the undisturbed background levels. Administrative and engineering controls would be expected to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. Limited impacts to the nearest residential receptor (based on distance) and nearby traffic (based on existing traffic volumes) are expected as a result of the proposed project on the residential receptors.

Operation: Impacts would be SMALL. Traffic noise would be the primary noise impact as all noise-generating activities in the central processing plant would be indoors and well field equipment would be contained within structures. OSHA regulatory limits would be maintained.

Aquifer Restoration: Impacts would be SMALL. Noise impacts would be similar to, or less than, those experienced during the operational phase. OSHA regulatory limits would be maintained. Vehicular traffic would be limited to the delivery of supplies and staff accessing the site therefore reducing the traffic noise.

Decommissioning: Impacts would be SMALL. Noise impacts would be similar to, or less than, those experienced during the construction phase. Noise levels during this phase would be temporary and once decommissioning and reclamation activities were complete, noise levels would return to baseline, with occasional vehicle traffic for any longer term monitoring activities. OSHA regulatory limits would be maintained.

Historical, Cultural, and Paleontological Resources

Construction: Impacts would be MODERATE. Potential disturbance of archaeological sites during construction may occur. Four sites eligible for the National Register of Historic Places (NRHP) are located within proposed well fields or other construction areas. Mitigation for the Pumpkin Buttes Traditional Cultural Property (TCP) would be required in the Hank Unit according to a Programmatic Agreement (PA) between BLM and the State. Construction would impact surficial Quaternary deposits and near surface Wasatch Formation deposits. If paleontological specimens were discovered, work would stop and contact would be made to the appropriate state and federal agencies. Implementation of a mitigation plan or Memorandum of Agreement (MOA) would reduce impacts to cultural resources.

Operation: Impacts would be SMALL. Minimal impacts would result during the operational phase because impacts to cultural resources would be mitigated prior to facility construction and identified resources would be avoided. There are no cultural resources known in the project area that would be affected by facility operation or maintenance. Should resources be encountered during routine maintenance activities, per site procedures, work would stop and proper notifications would be undertaken.

Aquifer Restoration: Impacts would be SMALL. Minimal impacts would result during this phase because impacts to cultural resources would be mitigated prior to facility construction. If paleontological specimens were discovered during aquifer restoration, work would stop and contact would be made to the appropriate state and federal agencies.

Decommissioning: Impacts would be SMALL. Minimal impacts would result during the decommissioning phase because impacts to cultural resources would be mitigated prior to facility construction. If decommissioning includes ground-disturbing activities to depths in excess of a few feet, then a monitor should be in place during these actions. If paleontological specimens were discovered during decommissioning, work would stop and contact would be made to the appropriate state and federal agencies.

Visual/Scenic Resources

Construction: Impacts would be MODERATE. Visual impacts would result from construction equipment, dust and diesel emission, and project facilities. BMPs would reduce overall visual and scenic impacts of project construction. Visual impacts to the Pumpkin Buttes TCP would occur based on the proximity of the Hank Unit and the presence of construction machinery in plain view. Mitigation measures similar to those specified in the PA for the Pumpkin Buttes TCP may apply to construction activities in the Hank Unit because it lies within the 3.2-km (2-mi) radius of the TCP. These measures would include avoiding dense vegetation stands and painting buildings and structures to blend into the landscape.

Operation: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during construction. Less heavy machinery would be used and less fugitive dust would result during the operational phase.

Aquifer Restoration: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during the operation phase. Less vehicular traffic would occur during this phase as compared to the construction phase, which would reduce visual impacts.

Decommissioning: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during construction. During decommissioning, land would be returned to its original state, which would remove almost all visual impacts by the end of the decommissioning phase.

Socioeconomics

Construction: Overall impacts would be SMALL. Temporary relocation of workers in nearby towns would have a SMALL impact of demographics. Workers would be paid the regional rates typical of the area; therefore impacts to income would be SMALL. Housing demand is anticipated to increase but housing demand will likely be met due to the availability of temporary housing; therefore impacts to housing would be SMALL. Local employees and contractors would be employed whenever possible, which would have a slightly positive, but SMALL impact on employment rates. The local economy would experience a positive, but SMALL impact from the purchasing of local goods and services and taxes derived from construction equipment and other construction-related activities. An increased demand for local infrastructure, schools, and public services would have a SMALL impact on education and health and social services.

Operation: Overall impacts would be MODERATE. Relocation of workers and their families in nearby towns for an extended period of time (approximately 9 years) would have a MODERATE impact of demographics. Workers would be paid similar rates to the average income in Wyoming; therefore impacts to income would be SMALL. Housing demand would increase in areas that already have very low vacancy rates, which would result in a MODERATE impact to housing. Operation of the proposed Nichols Ranch ISR Project would create new jobs in an area with an increasing unemployment rate over the past year, which would have a SMALL impact on employment. The local economy would experience a positive and MODERATE impact from the purchasing of local goods and services and taxes derived from the value of all equipment used by the proposed project. The small increase in the number of students would have a SMALL impact on the county school systems. Increased demand for health and social services would be similar to demand during the construction phase and would have a SMALL impact.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to, but less than, those during the operational phase. Fewer workers would be required, which would reduce pressure on housing, education, and heath and social services.

Decommissioning: Impacts would be SMALL. Impacts would be similar to those during the construction phase. By this stage of the proposed project, local governments would have adapted to the changes brought on by the project years earlier, and thus, housing, education, and health and social services demand would be more likely to be met.

Environmental Justice

All Phases: No disproportionately high and adverse impacts would occur because no significant concentrations of minority or low income populations live within the project's region of influence (ROI), which consists of Campbell, Johnson, and Natrona Counties.

Public and Occupational Health and Safety

Construction: Impacts would be SMALL. Construction activities, including the use of construction equipment and vehicles could disturb the topsoil and create fugitive dust. The impacts from inhalation of fugitive dust would be SMALL because radionuclide concentrations in the soil are low.

Operation: Impacts would be SMALL. Public and occupational exposure rates at ISR facilities during normal operations are historically well below regulatory limits. The remote location of the proposed Nichols Ranch ISR Project site in addition to the proposed ISR technology to be used and procedures to be implemented indicate that public and occupational health and safety impacts from facility operation would be consistent with the historical information. The radiological impacts from accidents would be SMALL for workers if procedures to deal with accident scenarios are followed and SMALL for the public due to the remote location. The non-radiological public and occupational health and safety impacts from normal operations due primarily to risk of chemical exposure would be SMALL if handling and storage procedures are followed. As with radiological impacts, the non-radiological public and occupational health impacts from accidents would be SMALL if procedures are followed.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to, but less than, those during the operation phase. The reduction or elimination of some operational activities further limits the relative magnitude of potential worker and public health and safety hazards.

Decommissioning: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during construction. Soil and facility structures are decontaminated and lands are restored to pre-operational conditions. The decommissioning, and any subsequent NRC approval for release of the site for unrestricted access, would conform to NRC's radiation protection standards as developed.

Waste Management

Construction: Impacts would be SMALL. Small-scale and incremental well field development would generate low volumes of construction waste. Waste would primarily consist of building materials, piping, and other solid wastes. The nearby landfill and associated construction and demolition pit are not at capacity.

Operation: Impacts would be SMALL. Liquid waste, including process bleed, restoration water, resin transfer wash, filter washing, brine, and plant washdown, would be disposed of according to applicable NRC, federal, and state permits, which would mitigate impacts from liquid waste management. Two Class I deep disposal wells would be constructed onsite for disposal of liquid effluent wastes. Uranerz would have to obtain approval from the NRC and a UIC permit from the WDEQ that would ensure that there was no path of environmental contamination from the deep disposal wells. Solids classified as 11e.(2) byproduct wastes would be sent to a licensed facility for disposal. Contaminated materials would be decontaminated and disposed of in accordance with applicable NRC regulations.

Aquifer Restoration: Impacts would be SMALL. Waste decontamination and/or disposal procedures would be the same as those during the operational phase, resulting in similar impacts. Wastewater generated may increase but would be offset by the reduction in production capacity from the removal of well fields.

Decommissioning: Impacts would be SMALL. At the time of decommissioning, a large fraction of the process equipment and materials would be reusable and would be reused. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required decommissioning plan for NRC review prior to starting decommissioning activities. A pre-operational agreement with a licensed disposal facility to accept radioactive wastes would ensure that sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities.

CUMULATIVE IMPACTS

Cumulative impacts of past, present, and reasonably foreseeable future actions were also considered, regardless of what agency (federal or non-federal) or person undertakes such actions, as part of this draft SEIS. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Nichols Ranch ISR Project are not expected to contribute perceptible increases to the SMALL to LARGE cumulative impacts, due primarily to the CBM activities concurrently going on at the site and the substantial mining activities throughout the Powder River Basin.

SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the proposed action would generate primarily regional and local costs and benefits. The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed Nichols Ranch ISR Project are, for the most part, limited to the area surrounding the site. The cost-benefit balance of the proposed project as identified by the staff, are needed by the service area in the time frame projected, and would have accrued benefits that outweigh the economic, environmental, and social costs.

COMPARISON OF ALTERNATIVES

NRC's analysis indicates that the adverse impacts of the reasonable alternatives that were evaluated would differ from those of the proposed action.

For the No-Action alternative, Uranerz would not construct and operate ISR facilities at the proposed site. As a result, no uranium ore would be recovered from this proposed site. This alternative would result in neither positive nor negative impacts to any resource area.

Another alternative NRC considered is for Uranerz to construct and operate an ISR uranium milling processing facility as proposed by Uranerz, but only for the Nichols Ranch Unit and not the Hank Unit. The potential environmental impacts for this alternative on each of the resource areas are similar to, or smaller than, the impacts from the proposed action. A smaller area of land would be disturbed, which would remove any impact to geology and soils or ecological resources at the Hank Unit. Generally, less equipment and workers would be needed, which would reduce impacts to transportation, air quality, noise, visual/scenic resources, and socioeconomics. Three identified archaeological sites (48CA6146/6147, 48CA6148, and 48CA6927), which are located on top or between the ore body and within areas for proposed monitoring wells, would not be affected if the Hank Unit was not licensed. Impacts to the Pumpkin Buttes TCP, though they would be mitigated with measures such as those described in the Pumpkin Buttes PA for the proposed action, would be virtually removed in this alternative. In addition, the unconfined nature of the ore zone aquifer at the Hank Unit would not contribute to potential impacts to groundwater.

PRELIMINARY RECOMMENDATION

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.71(f), sets forth its preliminary NEPA recommendation regarding the proposed action. The NRC staff recommends that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Nichols Ranch ISR Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

The NRC staff has concluded that the overall benefits of the proposed action outweigh the environmental disadvantages and costs based on consideration of the following:

- Potential impacts to all environmental resource areas are expected to be SMALL, with the exception of

  1) historical and archaeological resources during construction,

2) visual and scenic resources during construction, and

3) socioeconomics (specifically, demographics, housing, and local finance) during operation,

where such impacts would be MODERATE.

- Regarding the Pumpkin Buttes TCP, a PA has been developed by the BLM and Wyoming State Historic Preservation Officer (SHPO), which includes mitigation measures for construction activities within the 3.2-km (2-mi) radius of the Pumpkin Buttes. If signed by Uranerz, the implementation of the requirements of the PA for the Pumpkin Buttes TCP would limit potential cultural and visual impacts. If not signed by Uranerz, a separate MOA with agreed upon mitigation measures would have to be developed with BLM.
- Regarding groundwater, ISR operations would take place in ore zone aquifers previously exempted by the U.S. Environmental Protection Agency as potential drinking water sources. Additionally, Uranerz would be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Uranerz would also be required to restore groundwater parameters affected by ISR operations to levels that are protective of public health and safety.
- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site.
- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

ABBREVIATIONS/ACRONYMS

AADT	annual average daily traffic count
ADAMS	Agency Wide Documents Access and Management System
ACL	Alternate Concentration Limit
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
AMSL	above mean sea level
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	best management practice
B.P.	before present
CAA	Clean Air Act
CBM	coal bed methane
CBNG	coal bed natural gas
CCESC	Campbell County Educational Services Center
CCPW	Campbell County Public Works
CCS	Center for Climate Strategies
CDNR	Colorado Department of Natural Resources
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CWA	Clean Water Act
dBA	decibels
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ERP	emergency response plan
ESA	*Endangered Species Act of 1973*
FCR	fire-cracked rock
FR	Federal Register
FSME	Office of Federal and State Materials and Environmental Management Programs
FWS	U.S. Fish and Wildlife Service

GEIS	Generic Environmental Impact Statement
gpm	gallons per minute
HDPE	high-density polyethylene
HFC	hydrofluorocarbon
HKM	HKM Engineering, Inc.
I	Interstate
ISR	in-situ recovery
JCSD	Johnson County School District
kph	kilometers per hour
LQD	Land Quality Division
Lpm	liters per minute
MCL	Maximum Contaminant Level
MIT	mechanical integrity test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	miles per hour
MSDS	material safety data sheets
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NCRP	National Council for Radiation Protection
NCTHPO	Northern Cheyenne Tribal Historic Preservation Office
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966, as amended
NMSS	Nuclear Materials Safety and Safeguards
NOAA	National Oceanographic and Atmospheric Association
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWS	National Weather Service
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PFC	perfluorocarbon
PM	particulate matter
PRI	Power Resources Inc.
PRRCT	Powder River Regional Coal Team
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PSM	Process Safety Management
PVC	plastic polyvinyl chloride

RCRA	Resource Conservation and Recovery Act
RFFA	reasonably feasible future action
ROI	region of influence
RQ	Reportable Quantity
RTV	Restoration Target Value
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SR	State Route
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TEDE	Total Effective Dose Equivalent
TDS	total dissolved solids
THPO	Tribal Historic Preservation Office
TPQ	Threshold Planning Quantity
TQ	Threshold Quantity
TR	Technical Report
TSCA	Toxic Substances Control Act
UCL	upper control limits
UIC	underground injection control
UMTRCA	Uranium Mill Tailings Radiation Control Act
U.S.	United States (or) United States Highway
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
VOC	volatile organic compound
VRM	Visual Resource Management
WBC	Wyoming Business Council
WDE	Wyoming Department of Education
WDEQ	Wyoming Department of Environmental Quality
WDOE	Wyoming Department of Employment, Research, and Planning
WDOR	Wyoming Department of Revenue
WGFD	Wyoming Game and Fish Department
WLS	Western Land Services
WQD	Water Quality Division
W.S.	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
cm	centimeters	0.39	inches	In
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
m^3	cubic meters	0.0008107	acre-feet	acre-feet
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lbs)	T
Temperature (Exact Degrees)				
°C	Celsius	1.8C + 35	Fahrenheit	°F
*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM E380 (ASTM International. "Standard for Metric Practice Guide." West Conshohocken, Pennsylvania: ASTM International. Revised 2003.).				

1 INTRODUCTION

1.1 Background

The U.S. Nuclear Regulatory Commission (NRC) prepared this Supplemental Environmental Impact Statement (SEIS) in response to an application submitted by Uranerz Energy Corporation (Uranerz) on November 30, 2007, to develop and operate the Nichols Ranch In-Situ Uranium Recovery (ISR) Project (herein referred to as "Nichols Ranch ISR Project"), located in Campbell and Johnson Counties, Wyoming (Uranerz, 2007). Figure 1-1 shows the geographic location of the proposed project. This SEIS supplements the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (referred to herein as the "GEIS") in accordance with the process described in Section 1.8 of the GEIS (NRC, 2009b) and as detailed in Section 1.4.1 of this chapter. The NRC's Office of Federal and State Materials and Environmental Management (FSME) Programs prepared this SEIS as required by Title 10, *Energy*, of the *U.S. Code of Federal Regulations* (10 CFR), Part 51. These regulations implement the requirements of the *National Environmental Policy Act of 1969 (*NEPA*)*, as amended (Public Law 91-190) which requires the Federal Government to assess the potential environmental impacts of major federal actions that may significantly affect the human environment. For the purposes of this SEIS, "in-situ recovery" or ISR is synonymous with "in-situ leach" or ISL.

1.2 Proposed Action

On November 30, 2007, Uranerz initiated the proposed federal action by submitting an application for an NRC source material license to construct and operate an ISR facility at the Nichols Ranch ISR Project site and to conduct the consequent aquifer restoration and site decommissioning and reclamation activities. Based on the application, the NRC's federal action is the decision whether to issue the license to Uranerz. Uranerz's proposal is discussed in detail in Section 2.1.1 of the SEIS.

1.3 Purpose of and Need for the Proposed Action

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

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

1.4 Scope of the Supplemental Environmental Analysis

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

1.4.1 Relationship to the GEIS

As discussed previously, this SEIS supplements the GEIS, published as a final report in June 2009 (NRC, 2009b). The final GEIS assessed the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four specific geographic regions of the western United States. The proposed Nichols Ranch ISR Project is located in one such region, the Wyoming East Uranium Milling Region. Table 1-1 summarizes the expected environment impacts by resource area in the Wyoming East Uranium Milling Region based on the GEIS analyses.

In defining the scope of this SEIS, the NRC staff considers the scope of the GEIS to be sufficient for this purpose. NRC accepted public comments on the scope of the GEIS from July 24 to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming, to aid in this effort. Additionally, NRC held eight public meetings to receive comments on the draft GEIS, published in July 2008. Three of these meetings were held in the State of Wyoming. Comments on the draft GEIS were accepted between July 28 and November 8, 2008. Comments received during scoping and on the draft GEIS are available through NRC's Agencywide Documents Access and Management System (ADAMS) database on the NRC's website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of the scoping meeting and draft GEIS comment meetings in Wyoming are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report is provided as Appendix A to the GEIS (NRC, 2009b).

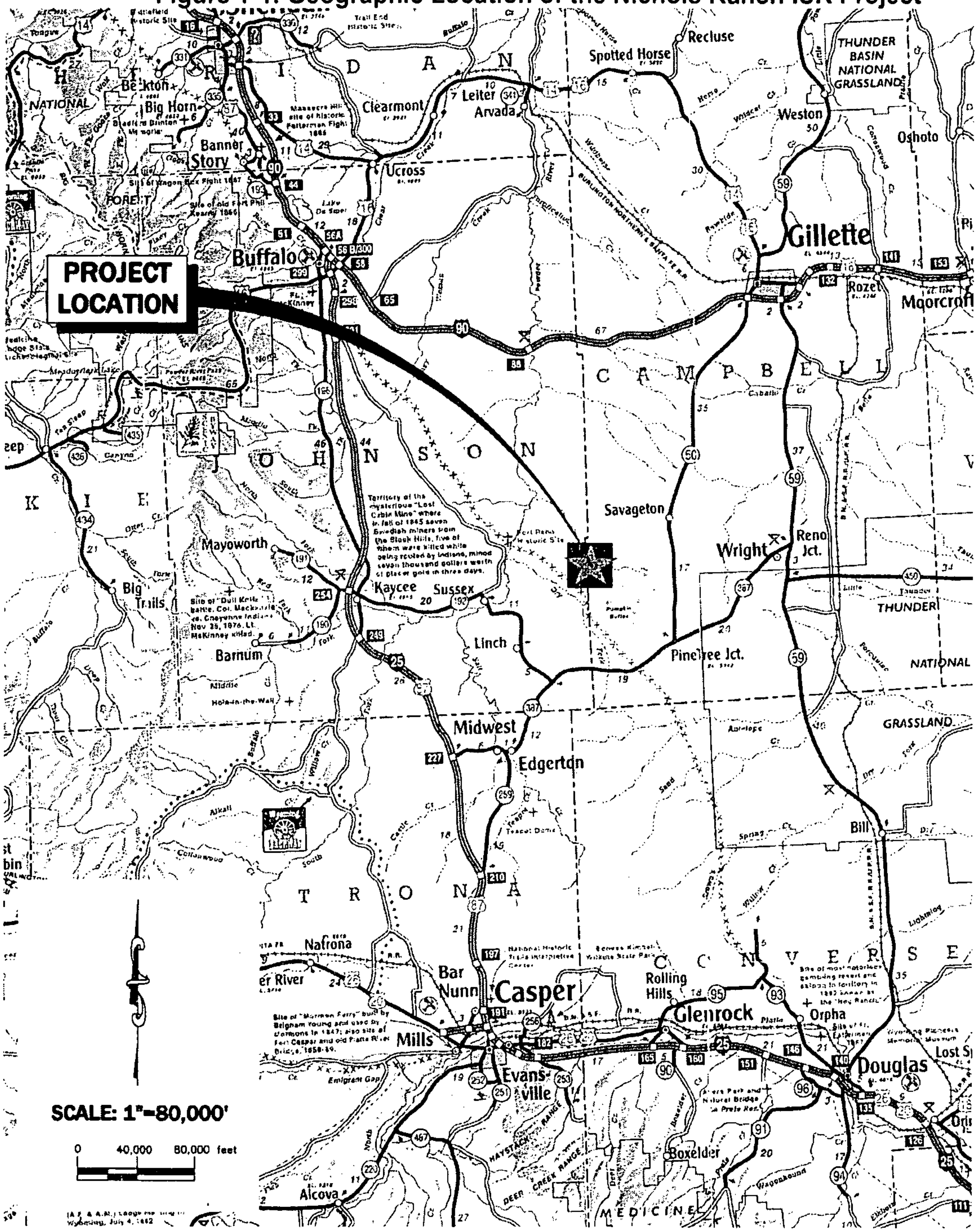
The SEIS was prepared to fulfill the requirement listed under 10 CFR 51.20(b)(8) to prepare either an Environmental Impact Statement (EIS) or supplement to an EIS for the issuance of a source material license for an ISR uranium recovery facility (NRC, 2009b). The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This SEIS tiers from the GEIS by incorporating by reference relevant information, findings, and conclusions concerning potential environmental impacts. The extent to which NRC incorporates GEIS impact conclusions depends on the consistency between Uranerz's proposed facilities and activities and conditions at the proposed Nichols Ranch ISR Project and the reference facility description and activities and information or conclusions in the GEIS. NRC's determinations regarding potential environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are discussed in Chapter 4 of this SEIS. Section 1.8.3 of the GEIS describes in more detail the relationship between the GEIS and the conduct of site-specific reviews as documented in this SEIS.

1.4.2 Public Participation Activities

As part of the preparation of this SEIS, NRC staff met with federal, state, and local agencies and authorities during the course of an expanded visit to the proposed Nichols Ranch ISR Project site and vicinity in January 2009 (NRC, 2009a). The purpose of this visit and these meetings was to gather additional site-specific information to assist in the NRC staff's environmental review and to aid the staff in its determination of the consistency between site and local information and similar information in the GEIS. As part of this effort to gather additional site-specific information, the NRC staff also contacted potentially interested Native American tribes and local authorities, entities, and public interest groups in person and via e-mail and telephone.

NRC published a Notice of Opportunity for Hearing in the *Federal Register* (FR) on June 16, 2008 related to the Nichols Ranch ISR Project license application (73 FR 34052). NRC also published a Notice of Intent (NOI) to prepare this SEIS on August 5, 2009 (74 FR 39116).

Figure 1-1. Geographic Location of the Nichols Ranch ISR Project



Source: modified from Uranerz, 2007

Table 1-1. Impacts Summary for the Wyoming East Uranium Milling Region

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

S: SMALL impact M: MODERATE impact L: LARGE impact
Source: NRC, 2009b

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Nichols Ranch ISR Project license application, the NRC staff has conducted an independent, detailed, comprehensive evaluation of the potential environmental impacts from construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Nichols Ranch ISR Project site. As discussed in Section 1.8.3 of the GEIS, the GEIS (1) provided an evaluation of the types of environmental impacts that may occur from ISR uranium milling facilities, (2) identified and assessed impacts that are expected to be generic (the same or similar) at all ISR facilities (or those with specified facility or site characteristics), and (3) identified the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS will be addressed in site-specific reviews, certain resource areas would require a more detailed analysis, because the GEIS analysis found that a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result given site-specific conditions (see Table 1-1).

In this SEIS, the following resource areas received a more detailed analysis:

- Land use;
- Historic and cultural resources;
- Transportation;
- Surface water;
- Groundwater;
- Terrestrial ecology;
- Threatened and endangered species;
- Noise;
- Socioeconomics; and
- Public health and safety.

Furthermore, certain site-specific analyses not conducted in the GEIS (e.g., assessment of cumulative impacts, analysis of environmental justice concerns) will also be considered in this SEIS.

1.4.4 Issues Outside the Scope of the SEIS

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

1.4.5 Related NEPA Reviews and Other Related Documents

The following NEPA documents were reviewed as part of the development of this SEIS to obtain information relevant to the issues raised:

- **NUREG-1910, Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Final Report (NRC, 2009b).** As discussed previously, this GEIS was prepared to assess the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in four different geographic regions of the western United States, including the Wyoming East Uranium Milling Region where the proposed Nichols Ranch ISR Project is located. The environmental analysis in this SEIS tiers from the GEIS.

- **Draft Environmental Impact Statement for the Wright Area Coal Lease Applications (BLM, 2009a).** The U.S. Bureau of Land Management (BLM) has prepared this draft EIS to evaluate the environmental impacts of leasing six tracts of federal coal reserves in the southern portion of the Powder River Basin, located approximately 56 km (35 mi) north of the town of Wright and 72 km (45 mi) north of the proposed Nichols Ranch ISR Project. All six tracts are operating surface coal mines and would be run by the operators of three adjacent mines (Black Thunder, Jacobs Ranch, and North Antelope Rochelle).
- **Final Environmental Impact Statement for the South Gillette Area Coal Lease Applications WYW172585, WYW173360, WYW172657, WYW161248 (BLM, 2009b).** The BLM prepared this EIS to evaluate the environmental impacts of leasing four tracts of federal coal reserves adjacent in the east-central portion of the Powder River Basin, located approximately 80 km (50 mi) northeast of the proposed Nichols Ranch ISR Project. All four tracts are operating surface coal mines and are adjacent to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines.
- **Final Environmental Impact Statement for the West Antelope II Coal Lease Application WYW163340 (BLM, 2008b).** The BLM has prepared this EIS to evaluate the environmental impacts of leasing and mining coal on approximately 1,663 ha (4,109 ac) located 32 km (20 mi) southeast of the town of Wright and 160 km (100 mi) southeast of the proposed Nichols Ranch ISR Project. The BLM estimates an average annual production of 36 to 42 million tons of coal per year over the proposed 9- to 11-year extended life of the mine.
- **Fortification Creek Area Draft Resource Management Plan Amendment/Environmental Assessment (BLM, 2008c).** The BLM prepared this Environmental Assessment (EA) and Resource Management Plan Amendment to evaluate the impacts of allowing coal bed natural gas development within the Fortification Creek Planning Area, which encompasses 40,734 ha (100,655 ac) of land within Campbell, Johnson, and Sheridan Counties. About 26,300 ha (65,000 ac) of this land is federally owned, and 37,700 ha (93,159 ac) are BLM-managed mineral resources.
- **Environmental Assessments for Anadarko Petroleum Corporation, Dry Willow Phase I and Dry Willow Phase II (BLM, 2007).** The BLM has prepared two Environmental Assessments (EAs) to evaluate the environmental impacts of authorizing the development of 33 coal bed natural gas wells and associated infrastructure in the Big George coal zone in Campbell County, located approximately in the Pumpkin Buttes between North and North Middle Buttes and approximately 8 km (5 mi) west of the proposed Nichols Ranch ISR Project. These EAs tier from the Powder River Basin Oil and Gas Project EIS and Resource Management Plan Amendment WY-070-02-065 (BLM, 2003).
- **Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project WY-070-02-065 (BLM, 2003).** The BLM has prepared this EIS and Proposed Resource Management Plan Amendment to evaluate the environmental impacts of continuation and expansion of coal bed methane (CBM) development within the Powder River Basin by a group of oil and gas companies collectively referred to as the Powder River Basin Companies. The document assesses the drilling, operation, and reclamation of approximately 39,400 new natural gas wells and associated infrastructure in Campbell, Converse, Johnson, and Sheridan Counties.

The NRC reviews were also reviewed as part of the development of this SEIS:

- **NRC's Safety Evaluation Report (SER) for the Nichols Ranch ISR Project.** The NRC staff is conducting a safety review, which will be documented in a SER. The SER evaluates Uranerz's proposed facility design, operational procedures, and radiation protection program to ensure that Uranerz's proposed action can be accomplished in accordance with the applicable provisions in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40 Appendix A. The SER also provides the staff's analysis of the initial estimate from Uranerz of the funding needed to complete site decommissioning and reclamation.

- **NRC's Environmental Review for the Moore Ranch ISR Project.** The NRC is reviewing an application from Energy Metals Corporation (now Uranium One) for a source material license for the proposed Moore Ranch ISR Project, which is located in Campbell County about 32 km (20 mi) from the proposed Nichols Ranch ISR Project site. The proposed Moore Ranch ISR Project would encompass 877 ha (7,110 ac) of privately-owned and State of Wyoming lands, but only 61 ha (150 ac) would be disturbed as a result of the project.
- **NRC's Environmental Review for the Irigaray/Christensen Ranch ISR Projects License Renewal.** The NRC is reviewing an application from COGEMA Mining, Inc. (Cogema) for the renewal of Source Material License SUA-1341, which is located in Campbell and Johnson Counties about 8 km (5 mi) north of the Nichols Ranch Unit. The Irigaray project was licensed for commercial ISR operations in August 1978. In June 1987, the license was amended to include the Christensen Ranch satellite facility and associated production areas. Production ended in June 2000 and the site has since been undergoing well field restoration and site decommissioning.

1.5 Applicable Regulatory Requirements

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

1.6 Licensing and Permitting

NRC has statutory authority through the *Atomic Energy Act* (AEA) as amended by *Uranium Mill Tailings Radiation Control Act* (UMTRCA) to regulate uranium ISR facilities. In addition to obtaining an NRC license, uranium ISR facilities must also obtain the necessary permits from the appropriate federal, state, local and tribal governmental agencies. The NRC licensing process for ISR facilities was described in Section 1.7.1 of the GEIS. Sections 1.7.2 through 1.7.5 of the GEIS describe the role of the other federal, tribal, and state agencies in the ISR permitting process.

This section of the SEIS summarizes the status of the NRC licensing process at the proposed Nichols Ranch ISR Project site and the status of Uranerz's permitting with respect to other applicable federal, tribal, and state requirements.

1.6.1 NRC Licensing Process

By letter dated November 30, 2007, Uranerz submitted a final license application to NRC for the Nichols Ranch ISR Project (Uranerz, 2007). As discussed in Section 1.7.1 of the GEIS, NRC initially conducts an acceptance review of a license application to determine whether the application is complete enough to support a detailed technical review. The NRC staff accepted the Nichols Ranch ISR Project license application for detailed technical review by letter dated April 14, 2008 (NRC, 2008d).

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

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with proposed licensing actions. No request for a hearing was received on the Nichols Ranch ISR Project license application.

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

In addition to obtaining a source material license from NRC prior to conducting ISR operations at the proposed Nichols Ranch ISR Project site, Uranerz is also required to obtain necessary permits and approvals from other federal, tribal, and state agencies. These permits and approvals would address issues such as (1) the underground injection of solutions and wastewater associated with the ISR process; (2) the exemption of all or a portion of the ore zone aquifer from regulation under the *Safe Drinking Water Act* (SDWA); and (3) the discharge of stormwater during construction and operation of the ISR facility.

Table 1-2 provides the status of Uranerz's efforts to obtain these necessary permits and approvals.

Table 1-2. Environmental Approvals for the Nichols Ranch ISR Project

Issuing Agency	Description	Status
U.S. Nuclear Regulatory Commission (NRC) Washington, DC 20555	Source Material License (10 CFR Part 40)	Application submitted
Wyoming Department of Environmental Quality (WDEQ) 122 West 25th St Herschler Building Cheyenne, Wyoming 82001	Permit to Mine	Application submitted
	WDEQ Drilling Permit (for exploration)	Permit No. 336DN-TFN 4 5/276
	Well Field Authorization Permit	Application under preparation
	Deep Disposal Well Permits	Application under preparation
	Wyoming Pollutant Discharge Elimination System (WYPDES) Permit	Application under preparation
U.S. Environmental Protection Agency (EPA) 1200 Pennsylvania Ave, NW, Washington, DC 20460	Aquifer Exemption (40 CFR Part 144 and 40 Part 146)	Aquifer exemption application will be forwarded to EPA following WDEQ action

Issuing Agency	Description	Status
State Engineer's Office (WSEO) 122 West 25th Street 4th Floor East Cheyenne, Wyoming 82002	Permit to Appropriate Groundwater	Existing wells are approved; new well permits would be obtained prior to drilling
Bureau of Land Management Casper Field Office 2987 Prospector Drive Casper, Wyoming 82604	BLM Drilling Permit (for exploration)	Permit No. W-169662
Campbell County Building and Zoning Division 500 S. Gillette Ave. Suite 1400 Gillette, Wyoming 82716	Permit to Construct Septic Leach Field	Application under preparation
N/A	11e.(2) Byproduct/Waste Disposal Agreement	Application under preparation
Source: Uranerz, 2007		

1.7 Consultations

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

1.7.1 Endangered Species Act of 1973 Consultation

The ESA was enacted to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) to ensure that actions they authorize, permit or otherwise carry out will not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

By letter dated July 3, 2008, NRC staff initiated consultation with the FWS, requesting information on threatened and endangered (T&E) species or critical habitat in the proposed Nichols Ranch ISR Project area (NRC, 2008a). NRC received a response from the FWS Ecological Services Field Office in Cheyenne, Wyoming dated August 15, 2008, that: 1) provided a list of the T&E species that may occur in the proposed project area, 2) discussed obligations to protect migratory birds, 3) noted the negative impacts that can result from the land application of ISR wastewater, and 4) recommended avoidance of wetland and riparian areas and protection of sensitive species (FWS, 2008a). Four emergent wetlands are located on the southeastern portion of the Nichols Ranch Unit and are addressed in detail in Section 3.5.1.

NRC staff also met with the FWS Buffalo Field Office on January 14, 2009 to discuss site-specific issues (NRC, 2009a). The main concern expressed by the Buffalo Field Office was potential impacts to greater sage-grouse (*Centrocercus urophasianus*) and typical mitigation measures were discussed (see Section 4.6.1).

No Federally-listed species are known to occur in the vicinity of the site; however, black-tailed prairie dog (*Cynomys ludovicianus*) colonies, which are potential habitat for black-footed ferrets (*Mustela nigripes*), are located on and in the vicinity of the proposed Nichols Ranch ISR Project site. Because of this, the NRC is in the process of consultation with the FWS to ensure that the provisions of the ESA are upheld for the black-footed ferret. Consultation will also ensure that impacts to the black-tailed prairie dog are minimized. T&E species are addressed in detail in Sections 3.6.3 and 4.6.

1.7.2 National Historic Preservation Act of 1966 Consultation

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

NRC initiated consultation with the Wyoming SHPO via a letter dated July 1, 2008, requesting information from the SHPO to facilitate the identification of historical and cultural resources that could be affected by the proposed project (NRC, 2008c). A response from the SHPO's office, dated July 25, 2008, indicated that a cultural resource survey had not been conducted for the entire "area of potential effect" (APE). The response also provided guidance and recommendations for identifying historical properties (WY SHPO, 2008).

NRC staff also met with a member of the SHPO's office on January 12, 2009 to discuss site-specific issues, including Wyoming SHPO's review process, cumulative impacts to historical sites, and best management practices (BMPs) (NRC, 2009a). NRC staff is continuing to consult with the Wyoming SHPO throughout the environmental review process regarding a determination of effects on cultural and historical resources, as discussed in more detail in Chapters 3 and 4.

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

The NRC staff interacted with multiple federal, tribal, state, and local agencies and/or entities during preparation of this SEIS to gather information on potential issues, concerns, and environmental impacts related to the proposed ISR facility at the proposed Nichols Ranch ISR Project site. The consultation and coordination process included, but was not limited to, discussions with the BLM, the Bureau of Indian Affairs (BIA), tribal governments, WDEQ, WSEO, and local organizations (NRC, 2009a).

1.7.3.1 *Coordination with Bureau of Land Management*

The BLM is responsible for managing the National System of Public Lands and the federal minerals underlying these lands. The BLM is also responsible for managing split estate situations where federal minerals underlie a surface that is privately held or owned by state or local government. In these situations, operators on mining claims, including ISR uranium recovery operations, must submit a plan of operations and obtain BLM approval before beginning operations beyond those for casual use. Currently, the NRC and the BLM are finalizing a Memorandum of Understanding (MOU) between the two agencies such that the BLM would be a cooperating agency for the environmental reviews of future ISR projects involving BLM-managed lands. Although the MOU has not yet been signed, the NRC staff has coordinated with the BLM during preparation of this draft SEIS. The BLM has provided valuable information and guidance on energy-related activities in the region, such as coal leases, oil and gas leases, wind energy, and uranium extraction. The BLM prepared an EIS for many of these activities and has prepared resource management plans to manage their own lands. The BLM also has a Cooperating Agency agreement with the WDEQ.

The BLM has a Programmatic Agreement (PA) with the Wyoming SHPO relating to the setting of Pumpkin Buttes, a traditional cultural property (TCP) (BLM, 2009c). Based on the proposed Nichols Ranch ISR Project's proximity to Pumpkin Buttes, the BLM Buffalo Field Office was contacted via phone in November 2008 for a list of tribes that may have interest in activities surrounding the Pumpkin Buttes and the BLM provided the NRC staff with a list of tribes via e-mail that have expressed interest in the Pumpkin Buttes (BLM, 2008a).

The NRC staff met with the staff of several BLM offices in January 2009, including the BLM State Office in Cheyenne, the BLM Coal Group in Casper, the BLM Buffalo Field Office, and the BLM Casper Field Office (NRC, 2009a). The BLM provided clarification on how they administer mineral claims and leases on BLM lands. The BLM expressed concerns related to water quality and hydrology at ISR sites, cumulative effects due to the other energy operations (coal, oil and gas, wind energy, and operating ISR facilities) in the vicinity of the proposed ISR site, and the potential impacts to socioeconomics in the communities surrounding the proposed ISR site. The BLM provided guidance on typical mitigation measures to protect cultural resources (see Section 4.9.1) and sage-grouse (see Section 4.6.1).

In addition to the January 2009 meetings, the NRC staff has kept the BLM apprised of progress on the staff's environmental review analysis for the proposed Nichols Ranch ISR Project through regular teleconference calls with the appropriate BLM state and field offices, by sharing preliminary sections and a draft of the SEIS with the BLM, and by ensuring that NRC correspondence with Uranerz are also shared with the BLM.

1.7.3.2 *Coordination with Bureau of Indian Affairs*

The BIA's mission is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives. The BIA is responsible for the administration and management of 27 million ha (66 million ac) of land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives.

NRC staff met with staff from the BIA in Fort Washakie, Wyoming on January 15, 2009 (NRC, 2009a). NRC staff briefed the BIA on potential ISR facilities proposed in Wyoming, and discussed how the BIA and Indian tribes would be involved in NRC's environmental review process. The BIA stated that tribal governments should be consulted for any projects in the state. The BIA also recommended that tribal elders be involved in cultural and historical surveys.

1.7.3.3 *Interactions with Tribal Governments*

In response to guidance from Wyoming SHPO and to carry out Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," the NRC staff initiated discussions with potentially affected Native American tribes. Letters dated December 24, 2008, were sent to the following nine tribes to solicit their comments or concerns regarding cultural resources and the proposed Nichols Ranch ISR Project (NRC, 2008b):

- Eastern Shoshone;
- Northern Arapaho;
- Northern Cheyenne;

- Blackfeet;
- Three Affiliated Tribes;
- Ft. Peck Assiniboine/Sioux;
- Oglala Sioux;
- Crow; and
- Cheyenne River Sioux.

By e-mail dated February 12, 2009, Mr. Conrad Fisher of the Northern Cheyenne Tribal Historic Preservation Office (NCTHPO) provided comments (NCTHPO, 2009), which are discussed in detail in Chapters 3 and 4 of this SEIS. To date, no additional responses from these tribes have been received.

1.7.3.4 *Coordination with Wyoming Department of Environmental Quality*

NRC staff met with the WDEQ in Cheyenne on January 12, 2009 to discuss the WDEQ's role in NRC's environmental review process for the proposed Nichols Ranch ISR Project (NRC, 2009a). Issues that were brought up during the meeting included the Water Quality Division (WQD) storm water program, air quality review and permitting, and noise quality. The WDEQ also provided clarification on the classification of deep well injections. The WDEQ expressed concern related to reclamation and restoration, and noted that groundwater quality should be returned to baseline conditions. The WDEQ indicated that they would review the documents when they are issued to the public in draft. They also emphasized coordination with the BLM when ISR projects are located on BLM lands.

NRC staff also met with the WDEQ-Land Quality Division (LQD) on January 14, 2009 (NRC, 2009a). The WDEQ-LQD explained the underground injection control (UIC) Class III well application process and noted that the WDEQ would require well field packages and groundwater restoration standards for future ISR operations. They expressed concern about potential excursions and unconfined aquifers. WDEQ-LQD staff also stated their position that the parameters in groundwater affected by ISR operations need to be restored to original background levels. They supported the use of solar evaporation ponds for wastewater disposal, but stated that ISR applicants, Native Americans, and the FWS have expressed concerns regarding the use of evaporation ponds. NRC staff continues to coordinate frequently with WDEQ staff to better understand regulatory jurisdiction, status, and issues associated with the WDEQ permitting process. Such interactions have included periodic phone calls and meetings regarding the status of regulatory actions and issues of concern to each agency.

1.7.3.5 *Coordination with Wyoming Game and Fish Department*

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

The proposed project area includes habitat for a variety of big game animals, raptors, migratory birds, and small mammals that may be affected by the project. In addition, the property is part of a larger region of the state dedicated as a "core breeding area" for the greater sage-grouse. The WGFD's interest includes impacts to migratory behavior patterns, long-term population sustainability, and the effects on local hunting on big game; impacts to nesting raptors; and the loss of nesting habitat for the greater sage-grouse.

Based on the recommendation from the FWS, NRC staff initiated consultation with the WGFD via a letter sent on October 29, 2008 (NRC, 2008e) requesting information on sage-grouse habitats within the project area and appropriate mitigative measures to minimize potential impacts to the sage-grouse. The WGFD provided further detail on sage-grouse habitats via e-mail.

1.7.3.6 *Coordination with Wyoming State Engineer's Office*

NRC staff met with the WSEO on January 12, 2009 to discuss well permitting (NRC, 2009a). The WSEO was primarily concerned that proposed ISR facilities do not degrade the water quality, and that potential groundwater contamination be maintained onsite. They also expressed the need for applicants to ensure that there was close, professional supervision of well construction.

1.7.3.7 *Coordination with Wyoming Governor's Planning Office*

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

1.7.3.8 *Coordination with Wyoming Community Development Authority*

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

1.7.3.9 *Coordination with Localities*

The NRC staff interacted with several local county and city entities in the vicinity of the project area. This has included phone calls as well as face-to-face meetings. NRC met with several local county and city entities on January 13 and 15, 2009 to discuss site-specific issues for the proposed Nichols Ranch ISR Project (NRC, 2009a). Meetings were held with following local entities: City of Casper Planning Office, City of Gillette and Campbell County Office, Converse Area New Development Organization, and the Town of Wright. Meetings with the local county and city entities focused on local economies, housing availability, and community services.

1.8 Structure of the SEIS

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

Chapter 2 of this SEIS describes the proposed action and reasonable alternatives considered for the proposed Nichols Ranch ISR Project site, Chapter 3 describes the affected environment for the proposed Nichols Ranch ISR Project site, and Chapter 4 evaluates the environmental impacts from implementing the proposed action and alternatives. Cumulative impacts are discussed in Chapter 5, while Chapter 6 provides details on the environmental measurement and monitoring programs proposed for the Nichols Ranch ISR Project. A cost-benefit analysis is provided in Chapter 7 and a summary of environmental consequences is tabulated in Chapter 8.

1.9 References

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10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection against Radiation."

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material."

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

40 CFR Part 144. *Code of Federal Regulations*, Title 40, *Protection of the Environment,* Part 144, "Underground Injection Control Program."

40 CFR Part 146. *Code of Federal Regulations*, Title 40, *Protection of the Environment,* Part 146, "Underground Injection Control Program: Criteria and Standards."

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2 IN-SITU URANIUM RECOVERY AND ALTERNATIVES

This chapter describes the proposed action and alternatives for issuance of a U.S. Nuclear Regulatory Commission (NRC) license to Uranerz Energy Corporation (Uranerz) for the construction, operation, aquifer restoration, and decommissioning of the Nichols Ranch In-Situ Recovery (ISR) Project. These alternatives include a consideration of the No-Action alternative as required under the *National Environmental Policy Act of 1969* (NEPA). Section 2.1 provides details on the alternatives considered for detailed analysis, including the proposed action. Section 2.2 discusses those alternatives that were considered but eliminated from detailed analysis. Section 2.3 compares the predicted environmental impacts of the proposed action and other alternatives. Lastly, Section 2.4 provides a preliminary NEPA recommendation on the proposed action.

2.1 Alternatives Considered for Detailed Analysis

NRC staff used a variety of sources to determine the range of alternatives to consider for detailed analysis in this draft Supplemental Environmental Impact Statement (SEIS). Those sources included the application, including the Environmental Report (ER) submitted by Uranerz, the scoping and draft comments on NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS), the information gathered during the NRC staff's site visit in January 2009, and interdisciplinary discussions held between NRC staff and various stakeholders.

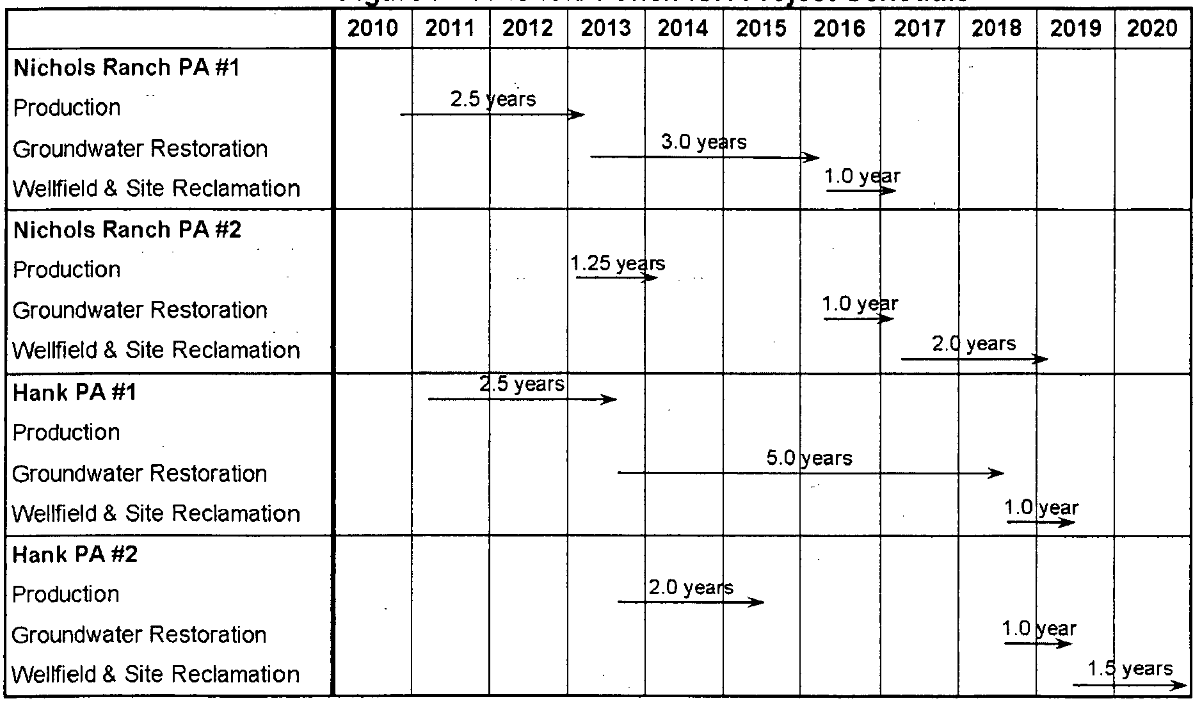
2.1.1 The Proposed Action (Alternative 1)

Under the proposed action, Uranerz is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of the ISR facilities at the Nichols Ranch ISR Project as described in the license application. The proposed Nichols Ranch ISR Project includes several facilities and well fields, which are described in the following sections. The general ISR process is described in Chapter 2 of the GEIS. The schedule for the proposed action is shown in Figure 2-1. The information contained in the following sections was obtained either from the application (Uranerz, 2007) or from the GEIS (NRC, 2009) unless otherwise stated.

2.1.1.1 *Site Description*

The proposed Nichols Ranch ISR Project is located in the Pumpkin Buttes Uranium Mining District of the Powder River Basin in Campbell and Johnson Counties in Wyoming. The proposed site is located approximately 74 km (46 mi) south-southwest of the city of Gillette and approximately 98 km (61 mi) north-northeast of the city of Casper (Figure 1-1). The total land surface ownership of the proposed Nichols Ranch ISR Project is approximately 1,365 ha (3,371 ac). Sections within the project area are considered split estate, where surface and subsurface mineral right ownership is divided between two or more owners. The total land surface ownership includes approximately 1,251 ha (3,091 ac) of private ownership, mainly by the T-Chair Livestock Company, and approximately 113 ha (280 ac) of U.S. Government ownership administrated by the Bureau of Land Management (BLM). The subsurface mineral ownership is divided between various private entities, including oil and gas, mineral extraction companies, and the U.S. Government.

Figure 2-1. Nichols Ranch ISR Project Schedule



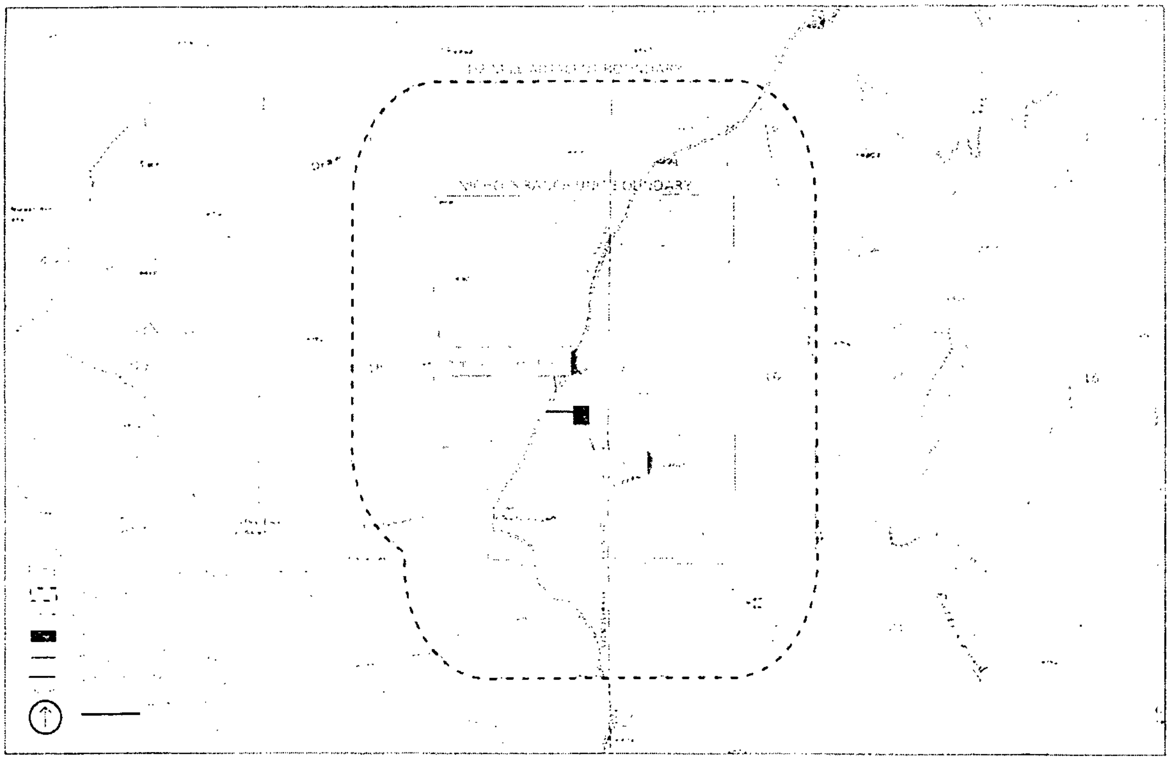
Source: Modified from Uranerz, 2007

Of the total land surface ownership, Uranerz estimates that the land surface area that would be affected by the proposed ISR operations would be approximately 120 ha (300 ac). The proposed Nichols Ranch ISR Project would be divided into two noncontiguous units, the Nichols Ranch Unit and the Hank Unit, located west and southwest of the North Middle Butte respectively. Access to the proposed Nichols Ranch ISR Project site would either be via State Route (SR 50) to Van Buggenum Road to T-Chair Livestock ranch roads or from SR 387 north on T-Chair Livestock ranch roads. Additional detail on the existing environment at the proposed site is contained in Chapter 3.

The Nichols Ranch Unit (Township 43N, Range 76 West, Sections 7, 8, 17, 18, and 20) would occupy approximately two-thirds of the project site and would be located partially in Johnson and Campbell Counties. The Nichols Ranch Unit is situated near the confluence of the Cottonwood Creek drainage with the Dry Fork of the Powder River. Topography at the proposed Nichols Ranch Unit is relatively flat with gently rolling hills and low ridges. Elevations in the proposed Nichols Ranch Unit range from 1,424 to 1,494 m (4,670 to 4,900 ft) above mean sea level (AMSL) (Figure 2-2).

The Hank Unit (Township 44N, Range 75 West, Sections 30 and 31; Township 43N, Range 75 West, Sections 5, 6, 7, and 8) would occupy one-third of the overall project site and would be located near the western flank of the North Middle Butte in southwest Campbell County. The Hank Unit would be located approximately 6.8 km (4.2 mi) northeast of the Nichols Ranch Unit. The Hank Unit is situated in the Dry Willow and Willow Creek drainages and is located approximately 26 km (16 mi) upstream of the confluence of Willow Creek and the Powder River. Topography at the proposed Hank Unit consists of gently rolling hills, low ridges, and steep terrain near the North Middle Butte and in along Dry Willow Creek. Elevations in the proposed Hank Unit range from 1,541 to 1,588 m (5,055 to 5,209 ft) AMSL (Figure 2-3).

Figure 2-2. Nichols Ranch Unit Site Layout



Source: modified from Uranerz, 2007

2.1.1.2 *Construction Activities*

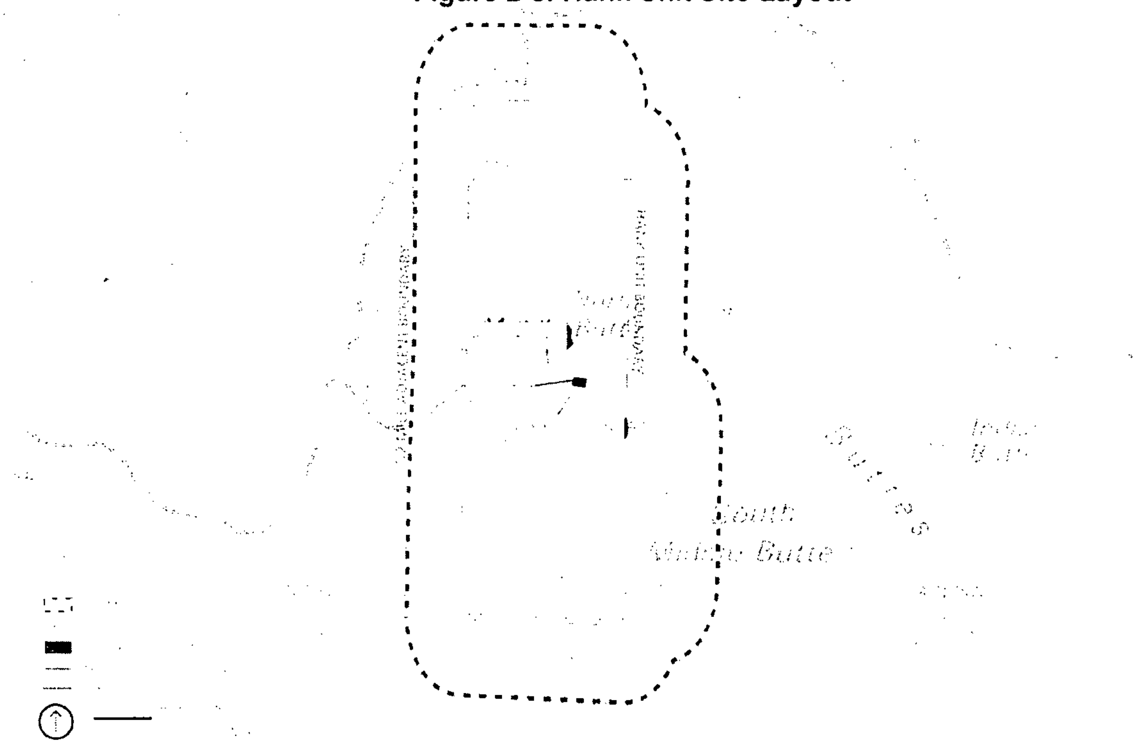
As described in Section 2.3 of the GEIS, general construction activities associated with ISR include drilling wells, clearing and grading associated with road construction and building foundations, trenching, and laying pipelines. The proposed facilities to be constructed as part of the Nichols Ranch ISR Project would include the process buildings, wells, header houses, underground piping, and access roads.

2.1.1.2.1 <u>Site Preparation</u>

Tractor trailers would deliver the materials and equipment necessary to construct the facilities and well fields at both the Nichols Ranch and Hank Units. Because the installation of ISR facilities are relatively small-scale construction projects, the magnitude of trucking activities required to support this stage of the project is minor compared to other industrial activities. Though a variety of construction vehicles would likely be required (e.g., bulldozers, excavators, front-end loaders), many would be transported to the sites on standard flatbed trailers. Exceptions may include graders, cranes, drill rigs, and perhaps oversized loads carrying ion exchange vessels or other non-standard loads related to the construction of the Nichols Ranch Unit central processing plant and Hank Unit satellite facility. Beyond outgoing commuter traffic, trucks would transfer unrestricted solid waste (e.g., rags, trash, packing materials, broken parts or equipment) to the local landfill. The construction equipment would be used intermittently and are considered to have minimal diesel emissions. Other vehicles associated with the proposed Nichols Ranch ISR Project would be equipped with air pollution control devices to minimize combustion products. Uranerz estimates eight passenger vehicles (standard light duty trucks or ¾-ton trucks, gas or diesel fuel) per day per week along with six tractor trailers (diesel) per week during the construction phase.

Topsoil salvaged during construction activities would be stored in designated topsoil stockpiles located onsite and would be stored in such a way to minimize loss of material. The location of the stockpiles would be determined during construction activities so that the stockpiles are located to minimize topsoil losses from wind and water erosion. Topsoil from building sites, permanent storage areas, main access roads, and chemical storage areas prior to construction would be salvaged in accordance with Wyoming Department of Environmental Quality-Land Quality Division (WDEQ-LQD) requirements. Each plant site is expected to be approximately 0.8 to 1.6 ha (2 to 4 ac) in size. Therefore, approximately 2,470 m^3 (3,230 yd^3) of topsoil would be removed and stockpiled at each plant site and would remain stockpiled for the life of the project. Additional topsoil would be removed for the well fields, new access roads, and header houses. An estimated 37 ha (92 ac) or 56,781 m^3 (74,213 yd^3) of topsoil would be removed for access road and header house construction. Most of the topsoil would be salvaged during the construction phase of the project and would not be reapplied until final reclamation and restoration has taken place. Uranerz estimates that 24 to 32 ha (60 to 80 ac) would be fenced off to grazing activities at any given time during the proposed project life.

Figure 2-3. Hank Unit Site Layout



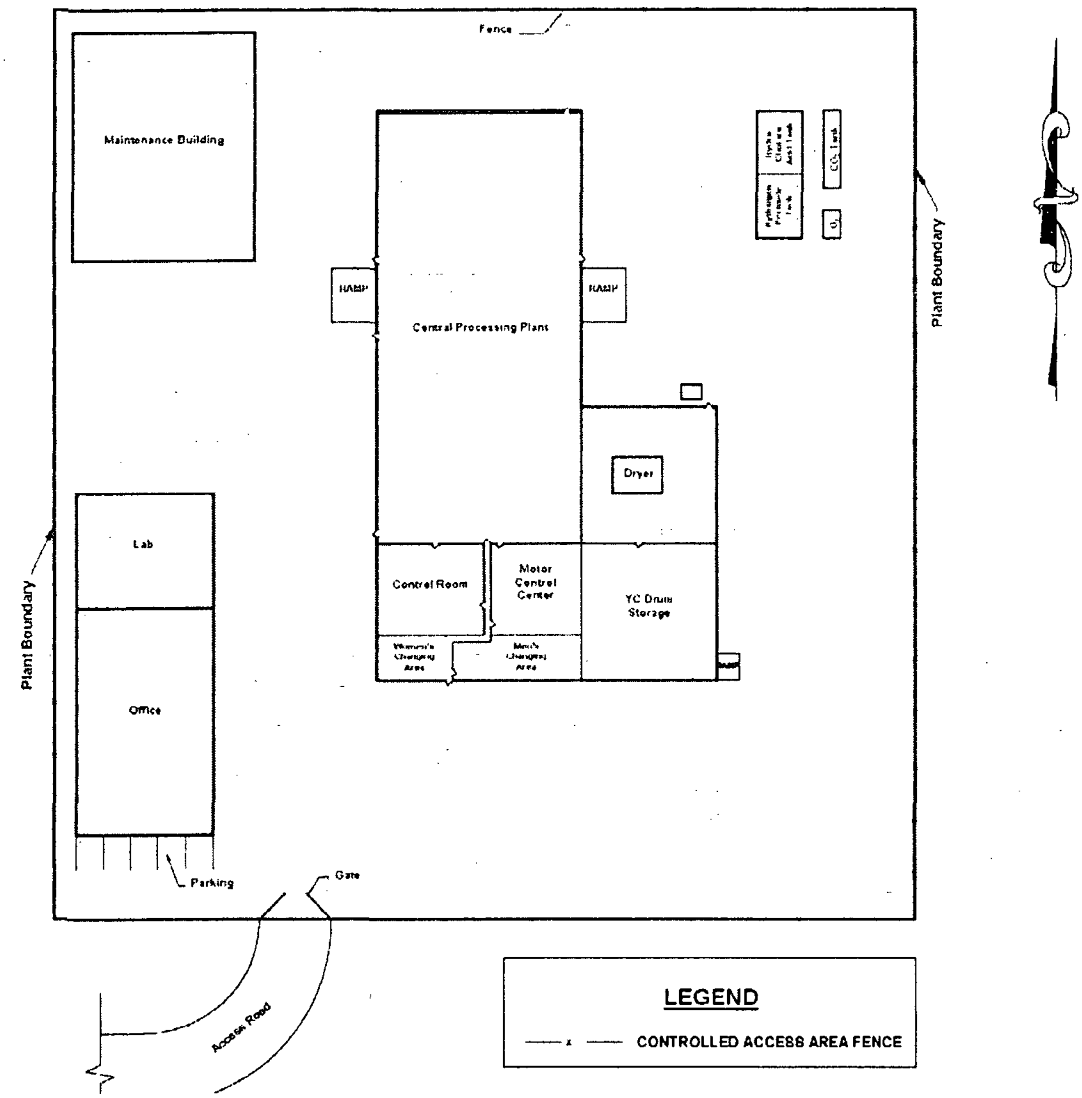
Source: modified from Uranerz, 2007

2.1.1.2.2 Buildings

The proposed facilities to be constructed as part of the Nichols Ranch ISR Project include the buildings, wells, well field structures, underground piping and access roads for both the Nichols Ranch and Hank Units. The Nichols Ranch Unit would contain the central processing plant which includes ion exchange, resin elution, and the yellowcake drying and packaging systems. The Hank Unit would contain a satellite facility which includes an ion exchange system. Uranium-loaded resins from the Hank Unit satellite facility would then be transported to the Nichols Ranch Unit central processing plant for final processing and packaging.

The general location of the Nichols Ranch Unit buildings within the project area is shown in Figure 2-2. The general layout of the Nichols Ranch Unit facilities (central processing plant and auxiliary buildings) is shown in Figure 2-4. The central processing plant would be an

Figure 2-4. General Layout of the Nichols Ranch Unit Buildings

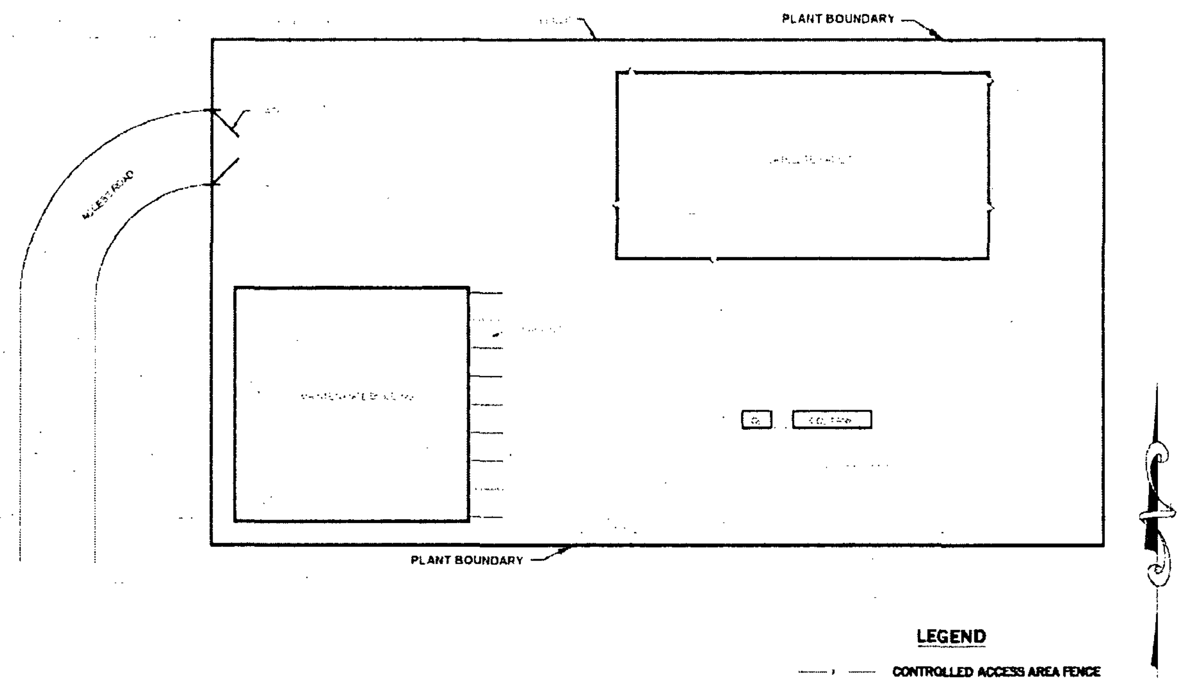


Source: modified from Uranerz, 2007

approximately 46 by 76 m (150 by 250 ft) metal building with eave heights less than 15 m (50 ft). Bulk storage tanks for process chemicals such as hydrogen peroxide, hydrochloric acid, oxygen, and carbon dioxide would be located outside of the central processing plant. Two auxiliary buildings would be located adjacent to the central processing plant. An office building, approximately 46 by 18 m (150 by 60 ft) in size, would house work space in addition to a lunch room, restroom facilities, a security monitoring room, a computer service room, and an onsite laboratory. A maintenance building would include a dedicated area for vehicle, electrical, and rotating equipment maintenance and additional office space for field and operating personnel. As seen in Figure 2-4, the central processing plant, outdoor storage areas, and the support buildings are all surrounded by a controlled access area fence.

The general location of the Hank Unit facilities (satellite facility and maintenance building) within the project area is shown in Figure 2-3. The Hank Unit would house a satellite facility, located approximately 10 km (6 mi) northeast of the proposed central processing plant, and a maintenance building, as shown in Figure 2-5. The satellite facility would be an approximately 24 by 49 m (80 by 160 ft) metal building with eave heights less than 15 m (40 ft). Major processing equipment would be housed in the satellite facility with the exception of some bulk chemical storage tanks of oxygen and carbon dioxide located outside of the facility.

Figure 2-5. General Layout of the Hank Unit Buildings



Source: modified from Uranerz, 2007

Both the Nichols Ranch Unit central processing plant and Hank Unit satellite facility would be constructed on concrete pads with curbs to prevent liquids from entering the environment. Uranerz's proposed engineering controls and operational monitoring program are designed to allow for spills and leaks to be quickly detected and minimized. Leaks from vessels and equipment on these pads, including water from equipment wash down, would drain to a sump and either pumped back into the process circuit or pumped to a Class I deep disposal well specific to each unit. This deep disposal wells would be located near the central processing plant and satellite facility and would be similar in design and depth to existing deep disposal wells at other active ISR sites. The concrete floors within the satellite facility would be designed to support the full weight of any vessel and its contents and would be designed to meet all building codes and standards. Outside chemical storage locations would be constructed with concrete curbed secondary containment for tanks.

2.1.1.2.3 Access Roads

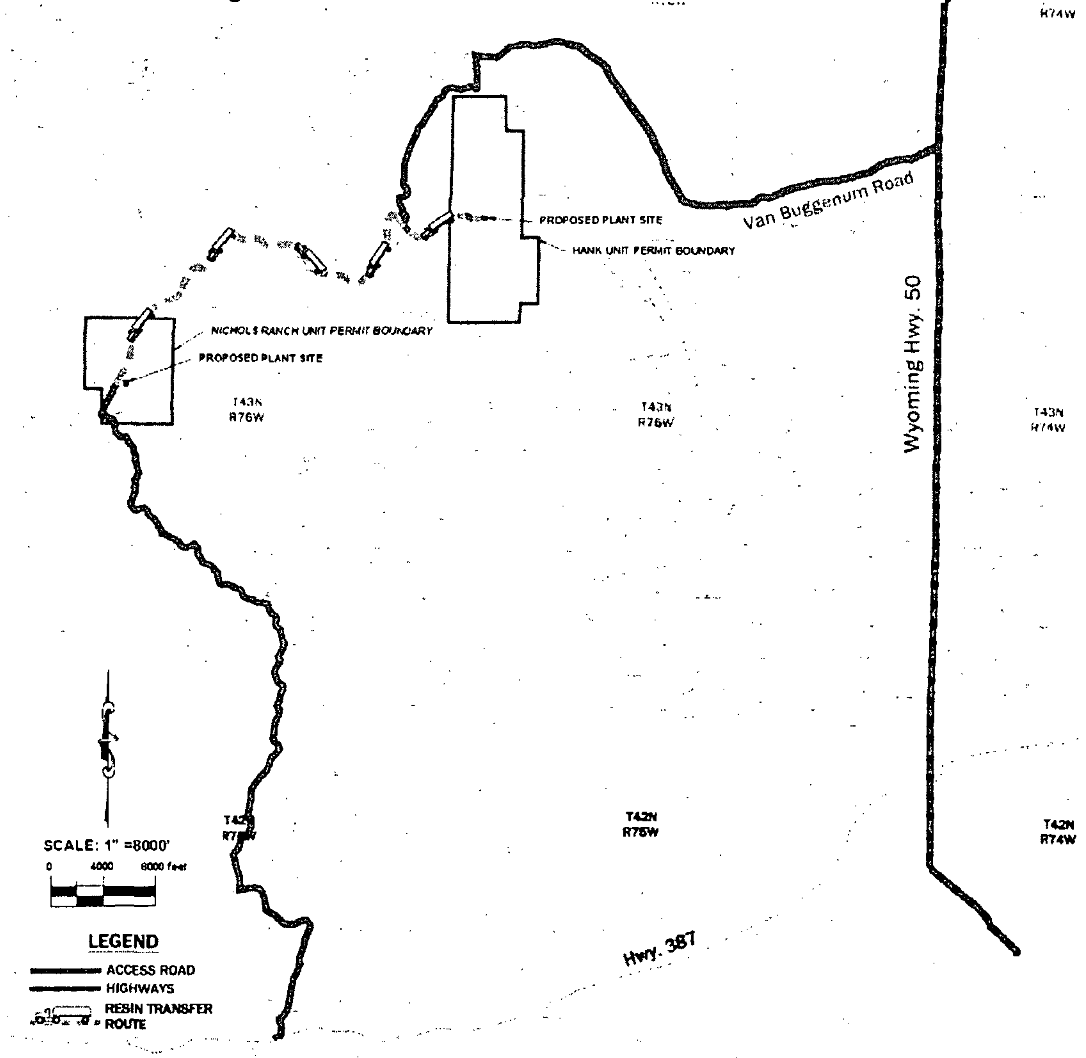
The primary method of transportation to and from the proposed Nichols Ranch ISR Project site is via highways and roadways. The proposed Nichols Ranch ISR Project area is accessible either via SR 50 to Van Buggenum Road to T-Chair Livestock ranch roads or from SR 387 north to T-Chair Livestock ranch roads (Figure 2-6). Van Buggenum Road is a crowned-and-ditched, county maintained gravel road that ranges from 5.5 to 7.3 m (18 to 24 ft) wide. It is capable of handling two tractor trailers passing one another and has a posted speed limit of 72 kilometers per hour (kph; 45 miles per hour [mph]). Ranch roads occurring on T-Chair Livestock Company property are also crowned-and-ditched, ranging from 4.6 to 6.1 m (15 to 20 ft) in width. They were installed by either the property owner or the coal bed methane (CBM) producers, and have been routinely improved by the latter. These roads have a speed limit range of 32 to 48 kph (20 to 30 mph) and would allow for the safe passage of both passenger cars and tractor trailers. Both the county and ranch roads are currently used by numerous oil and gas and CBM companies that are active in the region.

While the proposed Nichols Ranch ISR Project would utilize existing roads to the greatest degree possible, the construction of additional roads would be required. These roads fall into two categories, access roads to facilities within both the Nichols Ranch and Hank Units and access roads to the well fields. Two access roads would be constructed to connect the Nichols Ranch Unit central processing plant and the Hank Unit satellite facility with existing roads, as shown in Figures 2-2 and 2-3, respectively. Both access roads would be approximately 0.32 km (0.20 mi) in length, using 7.7 cm (3.0 in) of scoria, conglomerate, or gravel for the road surface and would follow BLM criteria for road building material. One of the roads would run straight and easterly from the ranch road to the location of the proposed Nichols Ranch Unit central processing plant and the other would extend in an easterly direction toward the flank of the North Middle Butte from an existing spur road that currently terminates at a pumpjack. The width of these roads would be similar to that of existing T-Chair Livestock access roads, ranging from 4.6 to 6.1 m (15 to 20 ft). The approximate area of disturbance for the construction of new access roads is 0.15 to 0.20 ha (0.36 to 0.48 ac). Well field access roads would follow existing two track roads and CBM roads to the greatest extent possible. All access roads would be constructed per the landowner's instructions and U.S. Department of Transportation (USDOT) specifications for roads used by heavy equipment during both the wet and dry seasons. During construction, the roads would be wetted to reduce dust emissions. Ephemeral channels would be crossed at two locations on the Nichols Ranch Unit and at three locations on the Hank Unit due to the construction of these access roads.

2.1.1.2.4 Well Fields

Well fields are the areas at the surface above the ore zones that are delineated by Uranerz to reach the desired production. The well fields and associated disturbance area would be approximately 46 ha (113 ac) for the Nichols Ranch Unit and approximately 63 ha (155 ac) for the Hank Unit. The ore zones where the lixiviant[1] is injected and recovered at the Nichols Ranch and Hank Units would each be divided into two production areas where injection and production wells would be situated, as shown in Figures 2-7 and 2-8, respectively. The well fields at each unit would be developed in a sequencing pattern, moving from one area of the site to another. The Nichols Ranch Unit ore zone is approximately 91 to 210 m (300 to 700 ft) below the surface and located in the A Sand, as described in more detail in Section 3.4.1. The Hank Unit ore zone is approximately 61 to 180 m (200 to 600 ft) below the surface and located in the F Sand, as described in more detail in Section 3.4.1. Uranerz estimates the uranium (as U_3O_8) content is 1,145,000 kg (2,521,000 lb) for the Nichols Ranch Unit and 841,100 kg (1,852,000 lb) for the Hank Unit. The average ore grade of the two units is above 0.1 percent.

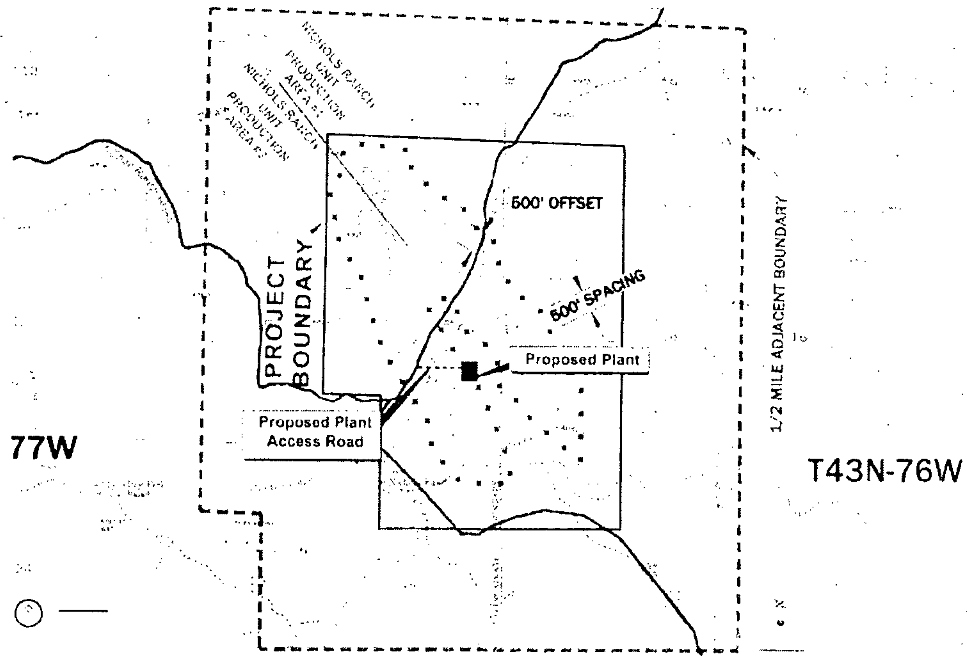
Figure 2-6. Access Roads for the Nichols Ranch ISR Project



Source: modified from Uranerz, 2007

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

Figure 2-7. Nichols Ranch Unit Production Areas



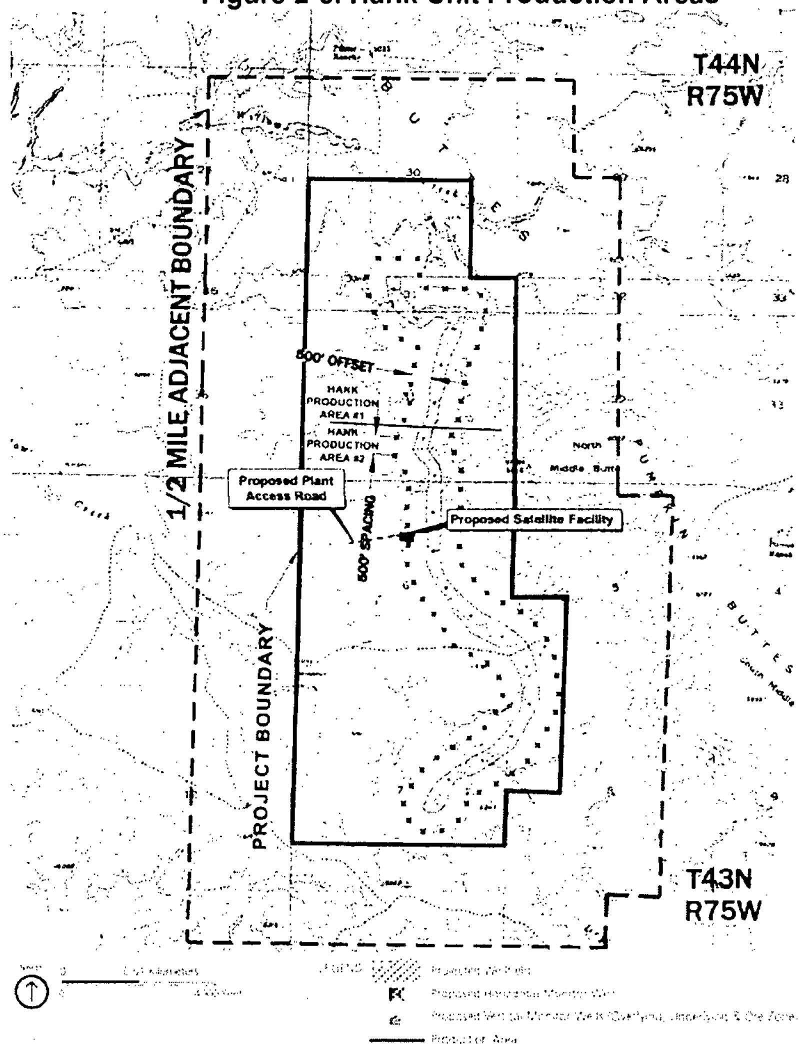
Source: modified from Uranerz, 2007

2.1.1.2.4.2 *Injection and Production Wells*

The injection and production (or recovery) wells used in the ISR process are the locations in which the lixiviant is injected and the pregnant lixiviant[2] is recovered, respectively. All wells would be drilled so they could be used for either injection or recovery. By doing this, Uranerz would be able to change well field flow patterns as needed to improve uranium recovery and to more efficiently restore groundwater. These wells would be drilled and constructed using standard mud-rotary drilling techniques for deep-water wells. In each well field, injection wells would be arranged near production wells in 4-spot, 5-spot, or 7-spot patterns, as shown in Figure 2.3-1 in the GEIS. In some cases, a line-drive pattern or staggered line-drive pattern may be utilized. The injection and production wells would be completed in the ore zone intervals of the production sand (A Sand for the Nichols Ranch Unit, F Sand for the Hank Unit). The injection wells would likely be between 15 and 46 m (50 and 150 ft) apart depending on the characteristics of the ore zone. Based on early delineation, Uranerz estimates 490 injection and recovery wells for the Nichols Ranch Unit production area #1 and 400 injection and recovery wells for the Hank Unit production area #1. Uranerz would have to conduct additional delineation to determine the number of injection and recovery wells needed for Nichols Ranch Unit production area #2 and Hank Unit production area #2.

[2] Pregnant lixiviant is defined as a solution containing a dissolved, extractable mineral that was leached from the ore; uranium leach solution pumped up from the underground ore zone through a production hole (NRC, 2009).

Figure 2-8. Hank Unit Production Areas



Source: modified from Uranerz, 2007

As part of the well fields, Uranerz would construct well header houses which would contain the manifolds that connect to the individual injection and production wells. These buildings would be approximately 12 m by 6 m (40 ft by 20 ft) with a 15-cm (6-in) concrete pad floor and actual number and location of these houses would depend on the field placement of wells. Based on early delineation, Uranerz estimates 9 header houses for the Nichols Ranch Unit production area #1 and 7 header houses for the Hank Unit production area #1. Uranerz would have to conduct additional delineation to determine the number of header houses needed for Nichols Ranch Unit production area #2 and Hank Unit production area #2.

Designing, constructing, testing, and operating injection wells are regulated by the underground injection control (UIC) program administered by the WDEQ who has primacy for the program as delegated by the U.S. Environmental Protection Agency (EPA). The proposed program would require a UIC permit from the WDEQ to use Class III injection wells. Before ISR operations can begin, the portion of the aquifer designated for uranium recovery must be exempted as an underground source of drinking water in accordance with the *Safe Drinking Water Act* (SDWA).

2.1.1.2.4.3 *Monitoring Wells*

Horizontal and vertical excursion monitoring wells would be installed at each well field as dictated by geologic and hydrogeologic parameters. The horizontal monitoring wells screened in the production zone would be located in a ring around the well fields, with approximate 150-m (500-ft) spacing between monitoring wells. Vertical monitoring wells for underlying and overlaying aquifers would be installed one for every 1.6 ha (4 ac) of well field area. Uranerz would consider the geometry of the ore body and surface topography to determine the appropriate well field pattern and locations for monitoring wells. Figures 2-7 and 2-8 show the proposed monitoring well locations for the Nichols Ranch and Hank Units, respectively, and the approximate distance between the proposed monitoring well locations and the proposed well fields.

2.1.1.2.4.4 *Well Construction and Testing*

At the Nichols Ranch and Hank Units, injection, production, and monitoring well casings would be constructed using fiberglass, plastic polyvinyl chloride (PVC), or high-density polyethylene (HDPE). Casings in injection, production, and monitoring wells would use centralizers to ensure that the casing is centered in the drill hole. Each well would be sealed to strengthen the casing and plug the annulus of the hole to prevent vertical migration of solutions. Effective sealing materials that may be used include cement slurry and/or sand-cement grout. After the well is cemented, Uranerz proposes to underream the well in the mineralized zone and complete it either as an open hole or fit it with a slotted liner or screen assembly. Figures 2-9 and 2-10 show the typical injection/recovery well and monitoring well construction designs, respectively.

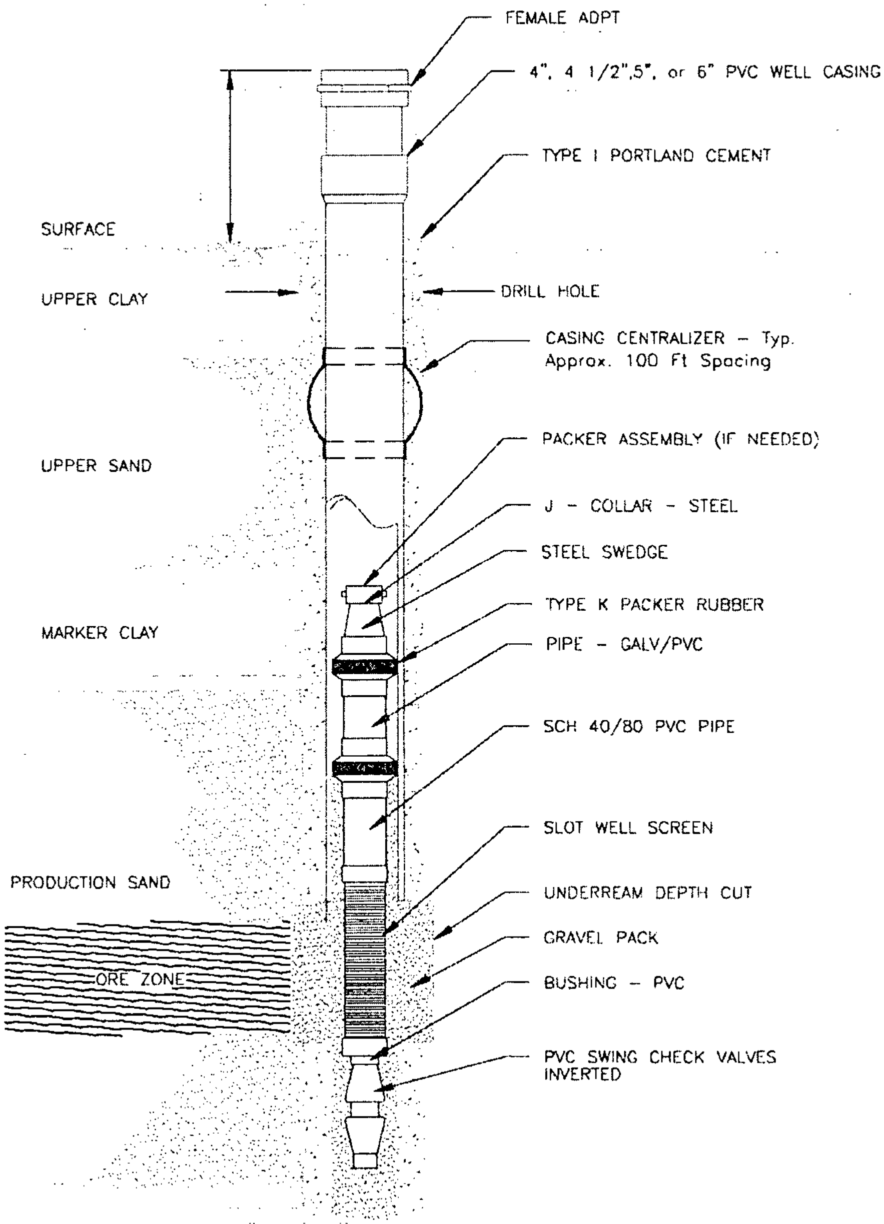
Each well would be tested for mechanical integrity before operation. As described in Section 2.3.1.1 of the GEIS, the purpose of this test is to verify that the well casing does not fail, causing water loss during injection or recovery operations. In a mechanical integrity test (MIT), the bottom and top of the casing are plugged (sealed) with a sealing device. The well is pressurized and pressure gauges monitor pressure changes inside the casing. If the repaired well cannot be fixed after several tries, the well would be plugged and abandoned. Results of these MITs are maintained onsite and available for inspection by NRC and WDEQ personnel. Results of these MITs are also reported to the WDEQ on a quarterly basis.

During construction of the well fields, drilling activities would include the construction of mud pits. During the excavation of mud pits, Uranerz would first remove the topsoil and placed it in a separate location. Uranerz would then remove and deposit the subsoil next to the mud pit. When the use of the mud pit is complete (usually within 30 days of initial excavation), Uranerz would re-deposit the subsoil in the mud pit and followed by replacement of the topsoil. Uranerz would follow a similar approach for pipeline ditch construction.

2.1.1.2.4.5 *Pipelines*

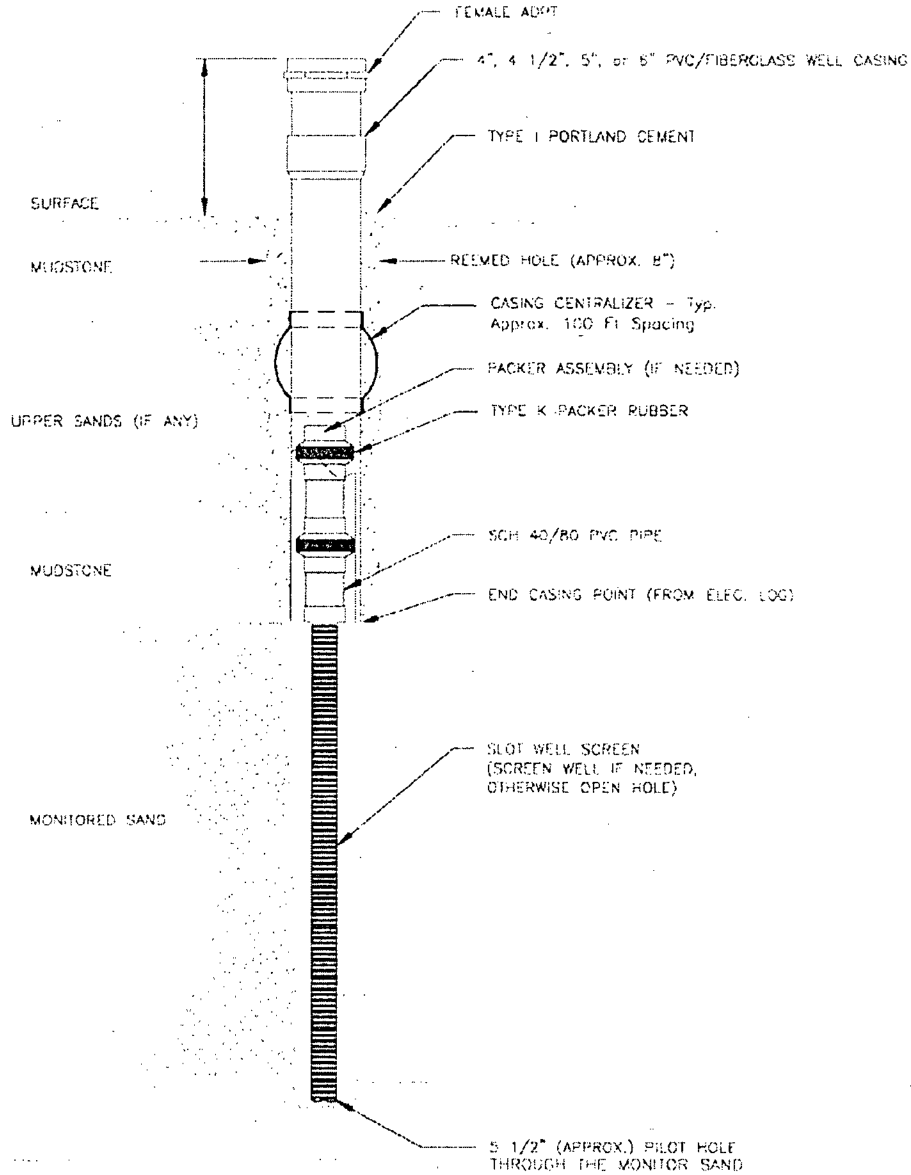
Uranerz proposes to use HDPE, PVC, and/or stainless steel piping for its well field distribution pipelines. These would include lines from the ion exchange facilities, header houses, and individual well lines. The majority of the lines would be buried to prevent freezing during winter months. At most, less than 6 m (20 ft) of piping would be located above ground and would be located within a fenced off area. All piping would be designed for an operating pressure of 150 pounds per square inch gauge (psig). The lines would be tested for mechanical integrity before use. Automatic valves would be installed on the lines for flow control. The main trunk lines would have electronic pressure gauges with the information monitored from the control room.

Figure 2-9. Typical Injection/Recovery Well Design



Source: Uranerz, 2007

Figure 2-10. Typical Monitoring Well Design



Source: Uranerz, 2007

Based on early delineation, Uranerz estimates 4,210 m (13,800 ft) of piping for the Nichols Ranch Unit production area #1 and 4,000 m (13,000 ft) of piping for the Hank Unit production area #1.

2.1.1.2.5 Other Structures and Systems

Uranerz plans to dispose of liquid effluent wastes generated during uranium recovery operations in Class I deep disposal wells. One deep disposal well would be located at the Nichols Ranch Unit and another at the Hank Unit. Uranerz would have to obtain UIC permits for the construction and use of these deep disposal wells from the WDEQ-Water Quality Division

(WQD), who has primacy for the program as delegated by the EPA. These deep disposal wells would be completed in approved formations and their exact locations would depend on field placement. Uranerz estimates a 380 liters per minute (Lpm) (100 gallon per minute [gpm]) flow of liquid effluent wastes into each of the deep disposal wells.

Wastes from the lunchroom and restrooms would flow to septic leach fields, constructed at each of the Nichols Ranch and Hank Units. Uranerz estimates the location of the septic systems to be south of the Nichols Ranch Unit central processing plant and north of the Hank Unit satellite facility. The septic systems would be designed in order to accommodate the estimated maximum of 55 employees at each site. Uranerz would have to obtain a permit to construct the onsite septic systems from the county in which they are located.

Uranerz would utilize fencing during construction. Approximately 12 to 16 ha (30 to 40 ac) would be fenced off to grazing activities at any given time during the life of the proposed Nichols Ranch ISR Project. Uranerz would utilize a typical 3-strand livestock fence when constructing well fields to prevent livestock from entering the well field. Uranerz would also fence around the Nichols Ranch Unit central processing plant and auxiliary facilities and Hank Unit satellite facility and auxiliary facilities. Uranerz would utilize a typical chain link fence with a height of at least 1.8 m (6 ft).

2.1.1.2.6 Construction Workers and Equipment

As mentioned earlier, earth-moving equipment such as rubber tire scrapers and front end loaders would be used during construction. Also, passenger vehicles transporting workers and tractor trailers would be used during construction, as discussed further in Section 2.1.1.7. Uranerz estimates approximately 45 to 55 workers to be needed during the construction phase. Workers on the proposed Nichols Ranch ISR Project are likely to come from areas such as Gillette, Wright, or Casper, Wyoming with distances ranging from 35 to 98 km (22 to 61 mi) away from the proposed project site.

2.1.1.2.7 Schedule

Uranerz estimates that the construction of the well fields and buildings would take approximately nine months to one year. The construction of the Nichols Ranch Unit production area #1 well fields would likely overlap with the development of the Hank Unit production area #1 well fields. The construction of the Nichols Ranch Unit production area #2 well fields and Hank Unit production area #2 well fields would likely overlap with the operation stage of Nichols Ranch Unit production area #1 and Hank Unit production area #1.

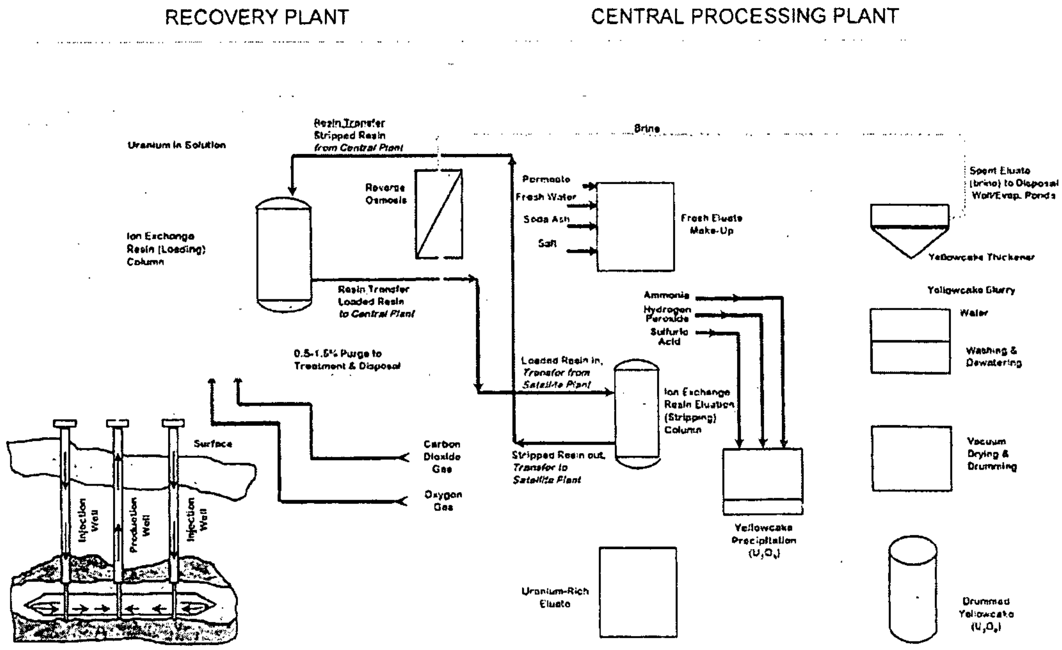
2.1.1.3 *Operation Activities*

As discussed in Section 2.4 of the GEIS, the ISR process as part of the proposed Nichols Ranch ISR Project would involve two operations. First would be the injection of barren lixiviant (new or recharged leaching solution prior to injection into the well field and that has no or low concentrations of dissolved uranium) to mobilize uranium in the underground aquifer and second would be the extraction and processing of the pregnant lixiviant in surface facilities to recover the uranium and prepare it for shipment.

2.1.1.3.1 Uranium Mobilization

During ISR operations as part of the proposed Nichols Ranch ISR Project, chemicals such as oxygen or hydrogen peroxide would be added to the groundwater to produce a lixiviant. Sodium bicarbonate would also be added to complex the uranium in the solution. The lixiviant would then be injected into the production zone to dissolve uranium from the underground formation, remove it from the deposit, and transport it to the processing facility where uranium would be removed from solution via ion exchange. Figure 2-11 shows the general flow of the ISR process.

Figure 2-11. General Flow Schematic for the ISR Process



Source: Uranerz, 2007

2.1.1.3.1.2 *Lixiviant Chemistry*

Uranium, present in the aquifer in a reduced insoluble form, would be oxidized and dissolved by the lixiviant solution injected into the ore zone. Once uranium is oxidized, it easily complexes with bicarbonate anions in the groundwater and becomes mobile.

Uranerz proposes to use a lixiviant solution composed of a dilute carbonate/bicarbonate aqueous solution fortified with an oxidizing agent. During injection, oxygen or hydrogen peroxide would be added to oxidize the uranium underground. Oxygen would be used as an oxidant in the lixiviant. Hydrogen peroxide would be used to precipitate out uranium and as an oxidant in the lixiviant. In addition, a small amount of chlorine (approximately 3 milligrams per liter [mg/L]) or sodium hypochlorite may be added during injection to prevent bacterial plugging of the wells. Carbon dioxide would be provided to both keep the pH around neutral and to provide another source of carbonate and bicarbonate ions. Hydrochloric acid would also be used for pH adjustment. The oxidized uranium would react with the lixiviant to form either a soluble uranyl tricarbonate complex or a bicarbonate complex.

2.1.1.3.1.3 *Lixiviant Injection and Recovery*

The uranium-bearing solution would migrate through the pore spaces in the sandstone and be recovered by production wells. Uranerz estimates that the flow rates range from approximately 3,800 to 13,300 Lpm (1,000 to 3,500 gpm) in the Nichols Ranch Unit and 3,800 to 9,500 Lpm (1,000 to 2,500 gpm) in the Hank Unit. Uranerz would pump uranium-enriched pregnant solution from production wells to the Nichols Ranch Unit central processing plant or the Hank Unit satellite facility for uranium extraction by ion exchange. The resulting barren lixiviant would then be chemically refortified with carbonate/bicarbonate and oxidant and re-injected into the well field to repeat the leaching cycle.

Uranium mobilization at the proposed Nichols Ranch ISR Project would produce excess water containing 11e.(2) byproduct material that must be properly managed. The production wells extract slightly more water than is re-injected into the host aquifer, which creates a net inward flow of groundwater into the well field. Production rates would be controlled by withdrawing a small portion of the barren solution from the ion exchange circuit which is then disposed of via the deep disposal wells at both the Nichols Ranch and Hank Units. Production bleed is discussed in more detail in Section 2.1.1.3.3.

2.1.1.3.1.4 *Excursion Monitoring*

Uranerz proposes an operational groundwater monitoring program to detect and correct for any condition that could lead to an excursion affecting groundwater quality near the well fields. These excursions can be caused by improper water balance between injection and recovery rates, undetected high permeability strata or geological faults, improperly abandoned exploration of drill holes, discontinuity within the confining layers, poor well integrity, or hydrofracturing of the ore zone or surrounding units. The program would include monitoring process variable such as flow rates and operating pressures of operating wells (injection, production, and monitoring) and the main pipelines going to and from the central processing plant and satellite facility. The monitoring program is required per the *Code of Federal Regulations*, Title 10, Part 40 (10 CFR Part 40), Appendix A, Criterion 7.

The monitoring wells in the ore zone and overlying and underlying aquifers would be sampled twice a month at approximate two week intervals. Samples from these wells would be analyzed for conductivity, chloride, and total alkalinity and the data would be compared to the upper control limits (UCLs) for those parameters. Uranerz would also collect static water level data prior to each sampling event. Uranerz would adequately maintain all of the analytical data from the monitoring wells and submit the data to the WDEQ quarterly. In addition, Uranerz would maintain copies onsite of all of the analytical data from the monitoring wells in case of an NRC inspection. If an excursion is suspected, Uranerz would notify the NRC and WDEQ verbally within 24 hours and in writing within 7 days of a verified excursion. Additional and more frequent sampling may be warranted to confirm that an excursion occurred. Corrective actions such as adjusting the injection and recovery flow rates in the affected area would be implemented as soon as practical and as long as it takes the excursion to be mitigated. Within 60 days of the confirmed excursion, Uranerz would have to file a written report to the NRC describing the event and corrective actions taken.

2.1.1.3.2 Uranium Processing

Uranium would be recovered from the pregnant lixiviant and processed as yellowcake in a multistep process. Those steps include ion exchange, elution, precipitation, drying, and packaging. Figure 2-11 shows the general flow of the ISR process.

2.1.1.3.2.1 *Ion Exchange*

For the proposed Nichols Ranch ISR Project, the pregnant lixiviant would be pumped from the well fields to the ion exchange systems at either the central processing plant at the Nichols Ranch Unit or at the satellite facility at the Hank Unit for the extraction of uranium. The ion exchange system proposed for the Nichols Ranch ISR Project consists of a series of downflow ion exchange columns. Uranerz estimates approximately 6 ion exchange columns at the Nichols Ranch Unit and 4 ion exchange columns at the Hank Unit. Uranium from the uranium-rich solution (ranging in concentration from 20 mg/L to 250 mg/L) would be absorbed by ion exchange onto resin beads. As resins in the ion exchange column become saturated with uranium, the column would be taken offline for the elution circuit to be discussed in the next section. Uranerz anticipates using production flow rates of up to 13,300 Lpm (3,500 gpm) for the ion exchange system for the Nichols Ranch Unit and up to 9,500 Lpm (2,500 gpm) for the ion exchange system for the Hank Unit.

2.1.1.3.2.2 *Elution*

The elution circuit at the Nichols Ranch Unit central processing plant would be designed to accept and elute uranium-loaded resin from the Hank Unit satellite facility. Therefore, uranium-loaded resin with barren lixiviant that has a uranium concentration ranging from 1 to 3 mg/L U_3O_8 from the Hank Unit satellite facility would be trucked over to the central processing plant via USDOT-approved trailers. These specially designed tanker trailers would each hold approximately 14 m^3 (500 ft^3) of loaded resin. The resin would then be hydraulically removed from the trailer and screened for debris and other particulates. The resin would flow via gravity into a dedicated elution vessel, which may include uranium-loaded resin from the Nichols Ranch Unit ion exchange system. Based on the yearly production from the Hank Unit, resin truck shipments from the Hank Unit to the Nichols Ranch Unit would occur approximately once every two to three days.

In the elution circuit, the uranium would be released from the loaded ion exchange resin in the dedicated elution vessel by applying an aqueous solution or brine composed of salt and sodium carbonate or sodium bicarbonate. The resulting solution, pregnant eluant, would contain approximately 20 to 40 g/L of uranium. Once enough pregnant eluant is obtained, the final precipitation and drying circuit can begin, as shown in Figure 2-11.

2.1.1.3.2.3 *Precipitation, Drying, and Packaging*

Precipitation and drying at the central processing plant would be initiated when the pregnant eluant is treated slowly with acid to break the carbonate portion of the dissolved uranium complex. Hydrogen peroxide would be used to precipitate the uranium. Sodium hydroxide or ammonia may also be added at this time to adjust the pH prior to settling of the precipitated uranyl peroxide or yellowcake slurry. Following settling, the precipitated yellowcake slurry would be run through a filter to remove excess liquid. The yellowcake slurry would then be washed with fresh water to flush the dissolved chlorides and dried to further reduce the moisture content. The dryer would be operated under a vacuum to reduce the ability of water soluble uranium oxides and other compounds to form and to pull solids and water vapor toward the center of the system, which helps to prevent unwanted releases. The dryer would operate at a temperature of approximately 74 to 88 °C (165 to 190 °F) and would be of similar design to the dryer used at Power Resources Inc. (PRI) Smith-Highland facility located nearby.

Following drying, the yellowcake would be packaged in approved 55-gallon drums and trucked offsite for transport to a licensed uranium conversion facility located in Metropolis, Illinois approximately 1,900 km (1,200 mi) away. Uranerz would transport the yellowcake to Metropolis via SR 387 east to Wright, SR 59 south to Douglas, Interstate (I)-25 south to Cheyenne, I-80 east to I-29, I-29 south to Kansas City, I-70 east to I-64 south, I-64 south to I-57 south, and then I-57 south to I-24 east to Metropolis.

Uranerz estimates the maximum annual production rate to be 910,000 kg (2,000,000 lb) of yellowcake per year from the Nichols Ranch Unit with an initial production rate of 230,000 kg (500,000 lb) per year and 140,000 kg (300,000 lb) of yellowcake per year from the Hank Unit. An independent ventilation and filtration system for particulate radiological effluent would be installed as part of the drying and packaging operations. Audible and/or visual alarms would sound if the vacuum level for the dryer is outside specifications.

2.1.1.3.3 Management of Production Bleed and Other Liquid Effluents

Uranium mobilization at the proposed Nichols Ranch ISR Project would produce excess water that must be properly managed. The production wells extract slightly more water than is re-injected into the host aquifer, which creates a net inward flow of groundwater into the well field. As mentioned earlier, during normal operations, production rates would be controlled by withdrawing a small portion of the barren solution from the ion exchange circuit which is then disposed of via the deep disposal wells at both the Nichols Ranch and Hank Units. Uranerz would have to obtain a UIC permit from the WDEQ, who has primacy for the program as delegated by the EPA, to use Class I injection wells. As mentioned earlier, these deep disposal well would be located near the central processing plant and satellite facility and would be similar in design and depth to existing deep disposal wells at other active ISR sites. The production bleed for the Nichols Ranch Unit would be approximately one percent of the overall flow rate or 150 Lpm (40 gpm) and the production bleed for the Hank Unit would be approximately three percent of the overall flow rate or 280 Lpm (75 gpm).

Other liquid waste streams would be produced as part of the proposed Nichols Ranch ISR Project. These include liquids from process drains, well development water, pumping test water, elution circuit bleed, and wash down water. The maximum anticipated flow rate of these other liquid waste streams is 3.8 to 7.6 Lpm (1 to 2 gpm). These waste streams would be handled in the same manner as the production bleed.

2.1.1.3.4 Schedule

Uranerz estimates that operation of the well fields in each of the production areas at each unit would range from 1.25 to 2.5 years. There would be some overlap between the operation of the well fields at the Nichols Ranch and Hank Units with the construction of the second production areas as well as the restoration of the first production areas, as shown in Figure 2-1. Similar to the construction phase, Uranerz estimates approximately 45 to 55 workers to be needed during the operation phase. Workers on the Nichols Ranch ISR Project are likely to come from areas such as Gillette, Wright, or Casper, Wyoming with distances ranging from 35 to 98 km (22 to 61 mi) away from the proposed project site.

2.1.1.4 *Aquifer Restoration Activities*

As described in Section 2.5 of the GEIS, aquifer restoration is necessary to return well field water quality parameters to the standards in 10 CFR Part 40 Appendix A, Criterion 5(B)(5). After the uranium is recovered, the groundwater in the well field contains constituents that were mobilized by the lixiviant. The process whereby groundwater constituents are selected for monitoring throughout the life of the project is further discussed in Section 6.3.1.2. Uranerz plans to begin aquifer restoration in each well field as the uranium recovery operations end. Consistent with current ISR restoration practices, Uranerz proposes that restoration criteria or restoration target values (RTVs) be established on a parameter-by-parameter basis and that the primary goal of restoration be to return all parameters to pre-ISR baseline conditions. Prior to operation, background (baseline) groundwater quality would be determined. Baseline water quality data would be collected from the monitoring wells before any ISR operations take place.

In the event that water quality parameters cannot be returned to average pre-ISR baseline levels through reasonable restoration efforts, Uranerz would have to propose an alternate standard for those constituents not returned to background and these Alternate Concentration Limits (ACLs) must be demonstrated to maintain public health and safety.

The aquifer restoration program for the proposed Nichols Ranch ISR Project would include three stages: groundwater sweep, groundwater transfer, and groundwater treatment. These three stages would be designed to effectively and efficiently restore the groundwater so that groundwater loss is minimized and restoration equipment is optimized. Depending on the progress of restoration, Uranerz may not need all of the stages of restoration to achieve the RTVs. Restoration monitoring would also be conducted as part of the program.

2.1.1.4.1 Groundwater Transfer

During the groundwater transfer stage of the proposed Nichols Ranch ISR Project, water would be transferred between the well field where groundwater restoration is beginning and another well field where ISR operations are beginning or within the same well field, if one area is in a more advanced state of restoration than another. The water containing higher total dissolved solids (TDS) from the well field in the process of restoration would be recovered and injected into the well field that is beginning ISR operations. This direct transfer of water would both lower the TDS in the well field being restored and blend the water in the two well fields until they are similar in conductivity. If needed, the water recovered from the well field being restored may be passed through an ion exchange column and filtered if the concentration of suspended solids poses a blockage problem in the injection well screens. Groundwater transfer reduces the amount of water sent to the deep disposal wells during restoration because water is transferred from one well field to another.

2.1.1.4.2 Groundwater Sweep

During the groundwater sweep stage of the proposed Nichols Ranch ISR Project, groundwater from a well field beginning restoration would be pumped to the ion exchange systems at the Nichols Ranch and Hank Units through all production wells without re-injection. To accomplish this, cleaner baseline groundwater is drawn into the well field to flush contaminants from the ore zone or "sweeping" the aquifer. The water produced by the groundwater sweep would then be sent to the Nichols Ranch Unit central processing plant and Hank Unit satellite facility for treatment and removal of any uranium. Following treatment, the swept water would be disposed of in the deep disposal wells located at the Nichols Ranch and Hank Units. The rate of groundwater sweep is dependent on the capacity of the deep disposal wells and the ability of the well field to sustain the withdrawal rate.

2.1.1.4.3 Groundwater Treatment

During the groundwater treatment stage of the proposed Nichols Ranch ISR Project, groundwater would be passed through ion exchange and reverse osmosis treatment equipment. Groundwater would then either be sent to the deep disposal wells or back into the well field. The ion exchange columns would remove most of the soluble uranium and replace it with chloride or sulfate. Prior to or following ion exchange treatment, the groundwater may pass through a de-carbonation unit to remove any residual carbon dioxide. During treatment, an amount of reductant, a substance capable of bringing about the reduction of another substance as it itself is oxidized, sufficient to reduce any oxidized minerals may be metered into the injection stream. The purpose of this addition is to decrease the concentrations of oxidation-reduction sensitive elements in the water. Also, sodium hydroxide may be used during this treatment phase to adjust pH levels. This pH adjustment would also assist in immobilizing certain parameters such as trace metals.

All or some portion of the restoration recovery water can be sent to the reverse osmosis system. The reverse osmosis system serves to reduce the TDS in groundwater being restored, reduces the quantity of water needed to be removed from the aquifer to achieve the RTVs, concentrates the dissolved contaminants in a smaller volume of brine to facilitate waste disposal, and enhances ion exchange. A high percentage of water passes through the reverse osmosis membranes, leaving approximately 60 to 90 percent of the dissolved salts in the resulting brine water. The clean water or permeate would either be re-injected into the well field, stored for use in the ISR process, or sent to the deep disposal wells. The permeate may also be de-carbonated prior to re-injection into the well field. The brine water contains most of the dissolved salts and is sent to the deep disposal wells. Make-up water coming from a number of sources may be added prior to reverse osmosis or well field injection stream to control the amount of bleed into the restoration area. These sources would include water from a well field in a more advanced state of restoration, water being exchanged with a new well field production area, water from a different aquifer, or the purge of an operating well field. The number of pore volumes treated and re-injected during this phase would depend on the efficiency of returning the production area back to pre-ISR baseline water quality conditions and thus the efficiency of the reverse osmosis in removing contaminates.

2.1.1.4.4 Monitoring and Stabilization

During restoration, lixiviant injection ceases while improving the quality of the groundwater back to restoration standards. Therefore, the possibility of an excursion is greatly reduced and frequencies of sampling the monitoring wells are changed. During aquifer restoration, Uranerz would sample the horizontal, overlying aquifer, and underlying aquifer monitoring wells once every 60 days and they are analyzed for the excursion parameters of chloride, total alkalinity, and conductivity. Uranerz would also measure static water levels prior to sampling. Uranerz would sample the production wells on a frequent basis to determine the effectiveness and efficiency of their aquifer restoration techniques. Uranerz would sample the production wells for the following parameters:

- Alkalinity
- Ammonium
- Arsenic
- Barium
- Bicarbonate
- Boron
- Cadmium
- Calcium
- Carbonate
- Chloride
- Chromium
- Copper
- Electrical conductivity @ 25 °C (77 °F)
- Fluoride
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Molybdenum
- Nickel
- Nitrate
- pH
- Potassium
- Radium-226
- Selenium
- Sodium
- Sulfate
- Total dissolved solids
- Uranium
- Vanadium

Restoration is complete when Uranerz is able to demonstrate stability through monitoring. NRC regulations require that the groundwater quality be returned to the standards identified in

Criterion 5(B)(5) of 10 CFR Part 40 Appendix A. Those standards are background, the values in the table in Criterion 5C of 10 CFR Part 40 Appendix A, or an ACL established by NRC in accordance with Criterion 5B(6). According to this criterion, ACLs may be proposed when background concentrations are not practically achievable at the site and that present no substantial hazard to human health or the environment. Uranerz would have to provide the basis for these ACLs including consideration of practicable corrective actions and that the ACLs are as low as reasonable achievable.

Once NRC and WDEQ deem the production area as being restored, a six month stability period begins to ensure that the restoration goals are maintained. The monitoring ring wells would be sampled once every two months and analyzed for the UCL parameters of chloride, total alkalinity, and conductivity. At the beginning, middle, and end of the stability period, the production wells would be sampled and analyzed for the same parameters listed above.

2.1.1.4.5 Schedule

Uranerz estimates that groundwater restoration of the well fields in each of the production areas at each Unit would range from 1 to 5 years. There would be some overlap between the restoration activities and operation activities of certain well fields at the Nichols Ranch and Hank Units, as shown in Figure 2-1. Uranerz estimates approximately 20 workers to be needed during the restoration phase. Workers on the proposed Nichols Ranch ISR Project are likely to come from areas such as Gillette, Wright, or Casper, Wyoming with distances ranging from 35 to 98 km (22 to 61 mi) away from the proposed project site.

2.1.1.5 *Decontamination, Decommissioning, and Reclamation Activities*

As discussed in Section 2.6 of the GEIS, all of the buildings and structures related to the Nichols Ranch ISR Project would be decontaminated in accordance with NRC regulatory standards as set in 10 CFR Part 40 Appendix A. Decommissioning of the proposed Nichols Ranch ISR Project would be based on an NRC-approved decommissioning plan. For lands administered by the BLM or other surface management agencies, other reclamation standards may be applicable. Unless otherwise specified, Uranerz would be required under 10 CFR 40.42 to complete site decommissioning within two years from the time the decommissioning plan had been approved. Decommissioning activities proposed by Uranerz for the proposed Nichols Ranch ISR Project include conducting radiological surveys, removing contaminated equipment and materials, decontaminating items to be used again, cleaning up areas, plugging and abandoning wells, removing the buildings and other onsite structures, and backfilling and re-contouring disturbed areas.

2.1.1.5.1 Radiological Surveys and Contamination Control

Uranerz would conduct a pre-remediation radiological survey to identify areas on the proposed Nichols Ranch ISR Project site that need to be cleaned up to the applicable regulatory limits. The survey would include soils, structures, and equipment. The purpose of these decommissioning surveys are so that Uranerz can determine how to best handle various soils, structures, and other materials as either process-contaminated or otherwise contaminated.

2.1.1.5.2 Well Fields

All production, injection, monitoring wells, and drill holes would be abandoned in place according to WDEQ regulations to prevent adverse impacts to groundwater quality. Well abandonment would include plugging all wells with a gel specifically designed for well abandonment. The casing would be cut off and plugged with well abandonment gel from total depth to within 1.5 m (5 ft) of the collar. A plug, either cement or plastic, would be placed at the top of the well casing. Well field decommissioning would include the removal of well field piping, well heads, and associated equipment. If still usable, the well field piping, well heads, and associated equipment would be taken to a new production area. However, if no longer usable, the equipment would be gamma surveyed and placed in either a contaminated or non-contaminated bone yard located near the central processing plant or satellite facility for temporary storage until disposal. If the final production area is being reclaimed, the contaminated piping, well heads, and associated equipment that are not salvageable would be taken to an NRC-approved disposal facility. Options considered by Uranerz include the low-level waste disposal sites at Pathfinder-Shirley Basin in Mills, Wyoming; EnergySolutions in Clive, Utah; or White Mesa in Blanding, Utah.

Uranerz would provide a land reclamation plan to the NRC for review and approval within 12 months prior to commencing reclamation of a well field. The plan would include a description of the areas to be reclaimed, a description of the planned reclamation activities, a description of methods to be used to protect workers and environment against radiation hazards, a description of the planned final radiation survey, and a cost estimate.

2.1.1.5.3 Process Buildings and Equipment and Other Structures

Following completion of groundwater restoration in the final production area, the Nichols Ranch Unit central processing plant and the Hank Unit satellite facility and auxiliary facilities associated with both units would be decommissioned. All process equipment associated with the processing plant and satellite facility would be dismantled and either sold to another NRC-licensed facility or decontaminated in accordance with NRC regulations and guidance documents. Materials unable to be decontaminated would be disposed of at one of the NRC-approved facilities mentioned earlier. Materials able to be decontaminated would be reused, sold, or removed and disposed of offsite. Once the buildings have been removed, the former building sites would be contoured to blend in with the surrounding terrain. Gamma surveys would be conducted to verify that radiation levels are within acceptable NRC limits. As mentioned earlier, Uranerz would provide a land reclamation plan to the NRC for review and approval within 12 months prior to commencing reclamation of a well field. The plan would include a description of the areas to be reclaimed, a description of the planned reclamation activities, a description of methods to be used to protect workers and environment against radiation hazards, a description of the planned final radiation survey, and a cost estimate.

2.1.1.5.4 Engineered Structures and Site Roads

The site access and well field access roads would either be reclaimed or if the landowners desire, the roads would be left in place when operations are complete. For those roads on BLM lands, BLM would require complete reclamation. If the site access roads are reclaimed, the scoria or gravel on the road surface would be picked up and removed, topsoil re-applied onto the road surface, and then mulch and seeding applied on top.

2.1.1.5.5 Final Contouring and Re-Vegetation

Topsoil salvaged during construction would be reapplied during reclamation. The topsoil stockpiles would have berms constructed around their base and seeding of a mixture of Western Wheatgrass and Thickspike Wheatgrass atop. This would serve to reduce the risk of sediment runoff. Final re-vegetation of the project area would consist of seeding the area with a seed mixture approved by the private landowners and WDEQ-LQD. For non-BLM administered surface lands, the proposed reclamation seed mix would include a combination of Western Wheatgrass, Revenue Slender Wheatgrass, Bozoisky Russian Wildrye, Greenleaf Pubescent, Gulf Annual Ryegrass, Yellow Blossom Sweet Clover, and Ladak 65 Alfalfa. For BLM-administered surface lands, the seed mix would include a combination of Thickspike Wheatgrass, Western Wheatgrass, Bluebunch Wheatgrass, Green needlegrass, American vetch, White or Purple Prairie Clover, Lewis, Winterfat, and Fourwing saltbush. The seed mix would be applied at a rate of 7 to 14 kg (15 to 30 lb) per acre using a rangeland drill. Final re-vegetation and bond release would be determined by the WDEQ-LQD.

2.1.1.5.6 Schedule

Uranerz estimates that site reclamation at each unit would range from 1 to 2 years. There would be some overlap between the site reclamation activities and the groundwater restoration activities at the Nichols Ranch and Hank Units, as shown in Figure 2-1. Similar to the groundwater restoration phase, Uranerz estimates approximately 20 workers to be needed during the reclamation phase. Workers on the proposed Nichols Ranch ISR Project are likely to come from areas such as Gillette, Wright, or Casper, Wyoming with distances ranging from 35 to 98 km (22 to 61 mi) away from the proposed project site.

2.1.1.6 *Effluents and Waste Management*

As discussed in Section 2.7 of the GEIS, all stages of the proposed Nichols Ranch ISR Project (construction, operation, aquifer restoration, and decommissioning) would generate effluents and waste streams, all of which must be handled and disposed of properly. These would include gaseous emissions, liquid wastes, and solid wastes. Any wastewater generated during or after the uranium extraction phase of site operations are classified as 11e.(2) byproduct material (NRC, 2000).

2.1.1.6.1 Gaseous or Airborne Particulate Emissions

Gaseous emissions generated during the lifetime of the proposed Nichols Ranch ISR Project would primarily consist of fugitive dusts, combustion engine exhausts, radon gas emissions from various stages of the processing system, and uranium particulate emissions from yellowcake drying.

2.1.1.6.1.1 *Fugitive Dust and Diesel Emissions*

Fugitive dusts and engine exhausts would be generated primarily from vehicle traffic within the proposed Nichols Ranch ISR Project site and on and off the project site during the various phases. The fugitive dust would be generated by travel on unpaved roads and from disturbed land associated with the construction of well fields, roads, and auxiliary facilities. Uranerz expects that negligible amounts of fugitive dust would be generated from the soil disturbance during construction of the wells. With the prevailing wind direction out of the south-southwest during the day time, dust produced during operation of the Nichols Ranch ISR Project would generally blow in the northeast direction. In addition, access roads would be maintained via motorized patrol and Uranerz would minimize disturbance to natural vegetation when possible to minimize wind erosion. Combustion engine exhausts would also be generated by workers' vehicles commuting to and from the project site, trucks transporting construction materials and product, drill rigs, diesel-powered water trucks, and other construction equipment. Uranerz estimates approximately 123 t (136 T) of fugitive dust would be emitted annually as a result of the construction and operation phases of the project and approximately 99 t (109 T) of fugitive dust would be emitted annually during the decommissioning and aquifer restoration stages.

2.1.1.6.1.2 *Radioactive Emissions*

Radon gas emissions are most likely to occur during the operation and aquifer restoration stages of the proposed Nichols Ranch ISR Project, as discussed further in Chapter 4. Radon can be released in the well field when the pregnant lixiviant is brought to the surface from the ore zone aquifer. Radon gas would quickly disperse into the air. With the prevailing wind direction out of the south-southwest during the day time, radon gas produced during operation and aquifer restoration stages of the proposed Nichols Ranch ISR Project would generally blow in the northeast direction. Radon gas can also be released when the downflow ion exchange columns are taken offline for resin transfer and opened to the atmosphere. The use of general area and local ventilation systems would aid in controlling the buildup of radon within the onsite facilities. General area ventilation may involve forced air ventilation of work areas in process buildings. Local ventilation for process vessels where radon releases are more likely may involve ducting or piping near the point of release and fans that exhaust to the outside.

The yellowcake dryer located at the Nichols Ranch Unit central processing plant would also be a potential source for airborne particulate emissions. In a vacuum dryer, the heating source is contained in a separate, isolated system so that no radioactive materials are entrained in the heating system or the exhaust it generates. The drying chamber containing yellowcake slurry would be subject to strong vacuum pressure. Moisture in the yellowcake would be the only source of vapor remaining in the system.

The dust deposited in the closed loop dust collection system would then be emptied into 55-gallon drums. Instrumentation used to monitor drying and packaging operations would provide an audible and/or visible alarm if the vacuum level exceeds specifications. As discussed in Section 2.1.1.3.2.3, an independent ventilation and filtration system for particulate radiological effluent would be installed as part of the drying and packaging operations. Audible and/or visual alarms would sound if the vacuum level for the dryer is outside specifications.

2.1.1.6.2 Liquid Wastes

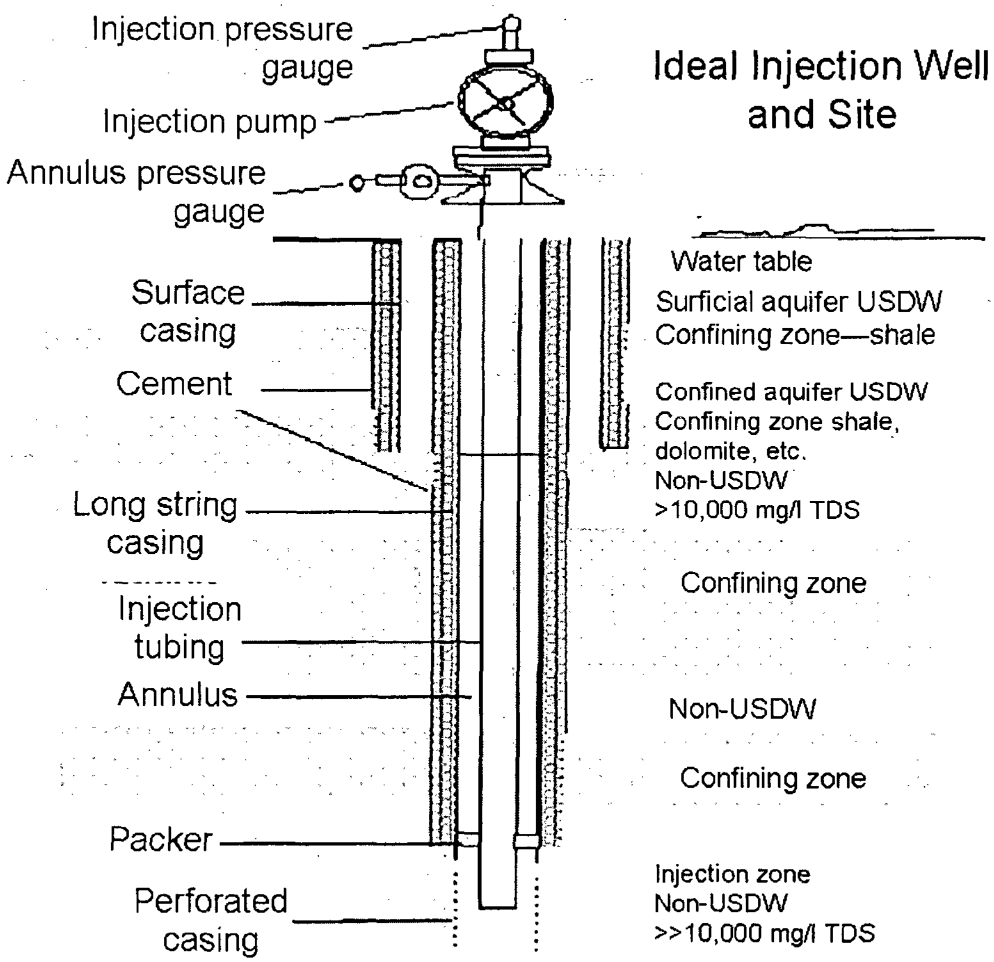
Liquid wastes would be generated during all phases of uranium recovery at the proposed Nichols Ranch ISR Project. Such wastes include well development water, pumping test water, process bleed, process solutions, wash down water, and restoration water. Any wastewater generated during or after the uranium extraction phase of site operations are classified as 11e.(2) byproduct material (NRC, 2000). Process bleed and wash down water would be transferred to Class I deep disposal wells located near the central processing plant and satellite facility. These deep disposal wells would be approximately 1,800 m (6,000 ft) deep or greater. The deep disposal well design is shown in Figure 2-12. Uranerz would have to obtain a UIC permit from the WDEQ, who has primacy for the program as delegated by the EPA, to use Class I injection wells. The restoration water would be treated by reverse osmosis and then re-injected into the production area undergoing restoration. Restoration water bleed would be transferred to the Class I deep disposal wells. Uranerz estimates a 380 Lpm (100 gpm) flow of liquid effluent wastes into each of the deep disposal wells.

Sanitary wastes would also be generated from restrooms and lunchrooms. Sanitary wastes would be disposed of in onsite septic systems. Uranerz estimates the location of the septic systems to be south of the Nichols Ranch Unit central processing plant and north of the Hank Unit satellite facility. The septic systems would be designed in order to accommodate the estimated maximum of 55 employees at each site. Uranerz would have to obtain a permit to construct the onsite septic systems from the county in which they are located.

2.1.1.6.3 Solid Wastes

All phases of the proposed Nichols Ranch ISR Project would generate solid wastes. These wastes would include spent resin, empty chemical containers and packaging, pipes and fittings, tank sediments, and domestic trash. Solid wastes are classified as non-radioactive or radioactive prior to disposal. Non-radioactive solid wastes would be collected onsite in designated areas and disposed of in a sanitary landfill located near the city of Gillette. Uranerz estimates that approximately 540 to 770 m^3 (700 to 1,000 yd^3) of non-radioactive solid waste would be generated by the proposed Nichols Ranch ISR Project annually. Radioactive wastes are disposed of as 11e.(2) byproduct material at a licensed waste disposal site or mill tailings facility. Uranerz plans to temporarily store these wastes onsite and periodically transport them to off site facilities for disposal. Uranerz estimates that approximately 46 to 69 m^3 (60 to 90 yd^3) of radioactive solid waste would be generated by the proposed Nichols Ranch ISR Project annually. As mentioned earlier, Uranerz has not yet selected a site. Options considered by Uranerz include disposal at Pathfinder-Shirley Basin in Mills, Wyoming; EnergySolutions in Clive, Utah; or White Mesa in Blanding, Utah.

Figure 2-12. Deep Disposal Well Design



Source: Uranerz, 2007

Based on the industrial nature of the operations, the proposed Nichols Ranch ISR Project would generate small quantities of hazardous wastes and would be considered a Conditionally Exempt Small Quantity Generator (CESQG). A CESQG is a generator that produces less than 100 kg (220 lb) of hazardous waste per month) and complies with applicable hazardous waste program requirements. Such hazardous wastes include waste oil and universal hazardous wastes such as spent batteries and spent fluorescent bulbs. Uranerz would develop management programs to meet the applicable WDEQ regulatory requirements.

2.1.1.7 *Transportation*

As mentioned earlier, earth-moving equipment such as rubber tire scrapers and front end loaders would be used during construction. During the construction and operation phases of the project, Uranerz estimates eight passenger vehicles (standard light duty trucks or ¾-ton trucks, gas or diesel fuel) per day per week along with six tractor trailers (diesel) per week. During the aquifer restoration and decommissioning phases, Uranerz expects a decrease in the traffic volume since less workers are needed, less shipments of yellowcake are expected, and less chemicals and supplies are needed as compared to construction and operation.

2.1.1.8 *Financial Surety*

As stated in Section 2.10 of the GEIS, NRC regulations (10 CFR Part 40 Appendix A, Criterion (9)) require that applicants cover the costs to conduct decommissioning, reclamation of disturbed areas, waste disposal, dismantling, disposal of all facilities including buildings and well fields, and groundwater restoration. Uranerz would maintain financial surety arrangements to cover such costs for the proposed Nichols Ranch ISR Project. The initial surety estimate would be based on the first year of operation, which includes the construction of the Nichols Ranch Unit central processing plant, start up of the Nichols Ranch Unit production area #1, construction of the Hank Unit satellite facility, and start up of the Hank Unit production area #1. Annual revisions to the surety estimate would be required by the NRC and WDEQ-LQD to reflect existing operations and planned construction or operation the following year. Once the NRC, WDEQ-LQD, and Uranerz have agreed to the estimate, Uranerz would submit a reclamation performance bond, irrevocable letter of credit, or other surety instrument to the NRC and WDEQ-LQD. The NRC reviews financial surety in detail as part of its review for the Safety Evaluation Report (SER).

2.1.2 No-Action (Alternative 2)

The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action before acting on a proposal. The No-Action alternative means that "the proposed activity" would not take place. The resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward" (46 FR 18026). Under this alternative, Uranerz would not be issued a license to construct and operate ISR facilities at the proposed site. Existing activities such as grazing and CBM operations would be expected to continue in the case of the No-Action alternative. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impacts of the other alternatives, including the proposed action.

2.1.3 Modified Action – No Hank Unit (Alternative 3)

Under this alternative, NRC would only issue Uranerz a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing for the Nichols Ranch Unit and not the Hank Unit. By doing so, the project would only consist of extracting uranium from the Nichols Ranch Unit and processing at a central processing plant located at the Nichols Ranch Unit. The Hank Unit satellite facility, well fields, access roads, and related infrastructure would not be developed. Thus, the land surface area that would be affected by the modified action would range from approximately 61 to 81 ha (150 to 200 ac) instead of the 120 ha (300 ac) in the proposed action. The location of buildings and well fields on the Nichols Ranch Unit and the access road to connect the buildings to existing ranch roads as described in the proposed action would be constructed as part of this alternative. Less land would be disturbed for wells and less piping and associated structures would be needed for this alternative.

2.2 Alternatives Eliminated from Detailed Analysis

As described in Section 2.13 and Appendix C of the GEIS, alternate methods for uranium recovery include conventional mining/milling and mining/heap leaching at the Nichols Ranch Project. This section provides the rationale for why these two alternatives, in addition to two other alternatives (alternate lixiviants and alternate waste disposal methods) were considered but not carried forward for detailed analysis.

2.2.1 Conventional Mining and Milling at the Nichols Ranch ISR Project Site

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

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

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

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

Ore extracted from the open pit or underground mine would be processed in a conventional mill. As discussed in Appendix C of the GEIS (NRC, 2009), ore processing at a conventional mill involves a series of steps (handling and preparation, concentration, and product recovery). While the conventional milling techniques recovers approximately 90 percent of the uranium content of the feed ore (NRC, 2009), the process does generate substantial wastes (known as tailings) since roughly 95 percent of the ore rock is disposed as waste (NRC, 2006). This process also can consume large amounts of water (e.g., approximately 534 liters per minute

(Lpm; 141 gallons per minute [gpm]) for the proposed Pinon Ridge mill in Colorado (EFRC, 2009)).

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

As discussed in section 2.1.1.2.4, the average ore grade of the uranium deposit at the Nichols Ranch Project is above 0.1 percent, while the depth to the deposit is approximately 91 to 213 m (300 to 700 ft) below ground surface (bgs) in the Nichols Ranch Unit and approximately 61 to 183 m (200 to 600 ft) bgs in the Hank Unit. While the ore grade and depth to ore are consistent with deposits mined either by open pit or underground workings, the environmental impacts from mining and conventional milling are more substantial than impacts from the ISR process at this site (see Chapter 4). For these considerations, this alternative is not carried forward for detailed analysis.

2.2.2 Conventional Mining and Heap Leaching at the Nichols Ranch ISR Project Site

Heap leaching is discussed in Appendix C of the GEIS. For low-grade ores, heap leaching is a viable alternative. Low-grade ore removed from open-pit or underground mining operations undergo further processing to remove and concentrate the uranium. Heap leaching is typically use when the ore body is small and situated far from the milling site. The low-grade ore is crushed to approximately 2.6 cm (1 in) in size and mounded above grade on a prepared pad. A sprinkler or drip system positioned over the top continually distributes leach solution over the mound. Depending on the lime content, an acid or alkaline solution can be used. The leach solution trickles through the ore and mobilizes the uranium, as well as other metals, into solution. The solution is collected at the base of the mound by a manifold and processed to extract the uranium. The uranium recovery from heap leaching is expected to range from 50 to 80 percent, resulting in a final tailings material of around 0.01 percent U_3O_8 content. Once heap leaching is complete, the depleted materials are AEA section 11e.(2) byproduct material that must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for disposal in place. While the impacts from heap leaching may be less than those from conventional milling, the impacts from the associated open pit or underground mining would still be substantial. For these considerations, similar to those listed in Section 2.2.1, this alternative is not carried forward for detailed analysis.

2.2.3 Alternate Lixiviants

Alternate lixiviants such as acid or ammonium carbonate solutions have been used in the past in ISR operations but are not currently used by NRC-licensed facilities because of the difficulties in restoring and stabilizing the affected aquifers. In addition, the WDEQ has indicated that the composition of the soil in the Powder River Basin in combination with an acid lixiviant would yield the formation of gypsum which would plug the wells and reduce efficiency of well field circulation. For these reasons, alternative lixiviants were not carried forward for detailed analysis.

2.2.4 Alternate Waste Disposal Methods

Alternate waste disposal methods such as evaporation ponds or land application (typically spray irrigation) have been used in the past or are in use at currently licensed ISR operations. Both of these disposal methods pose potential environmental impacts (NRC, 2009, Section 4.3.12.2). The construction and operation of evaporation ponds involves both land disturbance and the potential for additional impacts to soils and near surface aquifers from pond leaks. These impacts would be expected to be mitigated through pond design features (e.g., double synthetic liners with a leak detection system) and best management practices (e.g., topsoil and erosion management controls). The land application of treated wastewater could potentially impact soils by allowing accumulation of residual radionuclide or chemical constituents in the irrigated soils over time. At NRC-licensed facilities, irrigation areas are monitored to maintain radionuclide and other constituents within allowable release standards. Additionally, licensees monitor the wastewater prior to application to ensure release limits would be met. As discussed in the GEIS, the potential environmental impacts of these waste disposal methods would be expected to be SMALL. Because the impact significance of these disposal methods is the same as would be expected for deep well injection of process-related wastewater (the disposal method proposed by the applicant), these alternate waste disposal methods were not carried forward for detailed analysis.

2.3 Comparison of the Predicted Environmental Impacts

NRC's NUREG-1748 (NRC, 2003) categorizes the significance of potential environmental impacts as follows:

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

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

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

Table 2-1 provides the conclusions (SMALL, MODERATE, or LARGE) of the potential environmental impacts of the proposed action. A short written summary of impacts to each resource area for the proposed action can be found in the Executive Summary and impacts are described in detail in Chapter 4.

Table 2-1. Impacts Summary for the Nichols Ranch ISR Project

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.2 Land Use Impacts			
Construction	**SMALL** 4.2.1.1	**NONE** 4.2.2	**SMALL** 4.2.3.1
Operation	**SMALL** 4.2.1.2	**NONE** 4.2.2	**SMALL** 4.2.3.2
Aquifer Restoration	**SMALL** 4.2.1.3	**NONE** 4.2.2	**SMALL** 4.2.3.3

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
Decommissioning	**SMALL** 4.2.1.4	**NONE** 4.2.2	**SMALL** 4.2.3.4
4.3 Transportation Impacts			
Construction	**SMALL** 4.3.1.1	**NONE** 4.3.2	**SMALL** 4.3.3.1
Operation	**SMALL** 4.3.1.2	**NONE** 4.3.2	**SMALL** 4.3.3.2
Aquifer Restoration	**SMALL** 4.3.1.3	**NONE** 4.3.2	**SMALL** 4.3.3.3
Decommissioning	**SMALL** 4.3.1.4	**NONE** 4.3.2	**SMALL** 4.3.3.4
4.4 Geology and Soils Impacts			
Construction	**SMALL** 4.4.1.1	**NONE** 4.4.2	**SMALL** 4.4.3
Operation	**SMALL** 4.4.1.2	**NONE** 4.4.2	**SMALL** 4.4.3
Aquifer Restoration	**SMALL** 4.4.1.3	**NONE** 4.4.2	**SMALL** 4.4.3
Decommissioning	**SMALL** 4.4.1.4	**NONE** 4.4.2	**SMALL** 4.4.3
4.5 Water Resources Impacts (Surface Waters and Wetlands Impacts)			
Construction	**SMALL** 4.5.1.1.1	**NONE** 4.5.2	**SMALL** 4.5.1.3
Operation	**SMALL** 4.5.1.1.2	**NONE** 4.5.2	**SMALL** 4.5.1.3
Aquifer Restoration	**SMALL** 4.5.1.1.3	**NONE** 4.5.2	**SMALL** 4.5.1.3
Decommissioning	**SMALL** 4.5.1.1.4	**NONE** 4.5.2	**SMALL** 4.5.1.3

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.5 Water Resources Impacts (Groundwater Impacts)			
Construction	**SMALL**	**NONE**	**SMALL**
	4.5.2.1.1	4.5.2.2	4.5.2.3.1
Operation	**SMALL**	**NONE**	**SMALL**
	4.5.2.1.2	4.5.2.2	4.5.2.3.2
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.5.2.1.3	4.5.2.2	4.5.2.3.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.5.2.1.4	4.5.2.2	4.5.2.3.4
4.6 Ecological Resources Impacts (Vegetation)			
Construction	**SMALL**	**NONE**	**SMALL**
	4.6.1.1.1	4.6.1	4.6.3.1
Operation	**SMALL**	**NONE**	**SMALL**
	4.6.1.2.1	4.6.1	4.6.3.2
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.6.1.3	4.6.1	4.6.3.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.6.1.4	4.6.1	4.6.3.4
4.6 Ecological Resources Impacts (Wildlife)			
Construction	**SMALL**	**NONE**	**SMALL**
	4.6.1.1.2	4.6.2	4.6.3
Operation	**SMALL**	**NONE**	**SMALL**
	4.6.1.1.2	4.6.2	4.6.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.6.1.3	4.6.2	4.6.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.6.1.4	4.6.2	4.6.3

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.7 Air Quality Impacts			
Construction	**SMALL**	**NONE**	**SMALL**
	4.7.1.1	4.7.2	4.7.3.1
Operation	**SMALL**	**NONE**	**SMALL**
	4.7.1.2	4.7.2	4.7.3.2
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.7.1.3	4.7.2	4.7.3.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.7.1.4	4.7.2	4.7.3.4
4.8 Noise Impacts			
Construction	**SMALL**	**NONE**	**SMALL**
	4.8.1.1	4.8.2	4.8.3.1
Operation	**SMALL**	**NONE**	**SMALL**
	4.8.1.2	4.8.2	4.8.3.2
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.8.1.3	4.8.2	4.8.3.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.8.1.4	4.8.2	4.8.3.4
4.9 Historical, Cultural, and Paleontological Resources Impacts			
Construction	**MODERATE**	**NONE**	**MODERATE**
	4.9.1.1	4.9.2	4.9.3.1
Operation	**SMALL**	**NONE**	**SMALL**
	4.9.1.2	4.9.2	4.9.3.2
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.9.1.3	4.9.2	4.9.3.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.9.1.4	4.9.2	4.9.3.4

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.10 Visual and Scenic Resources Impacts			
Construction	**MODERATE** 4.10.1.1	**NONE** 4.10.2	**SMALL** 4.10.3.1
Operation	**SMALL** 4.10.1.2	**NONE** 4.10.2	**SMALL** 4.10.3.2
Aquifer Restoration	**SMALL** 4.10.1.3	**NONE** 4.10.2	**SMALL** 4.10.3.3
Decommissioning	**SMALL** 4.10.1.4	**NONE** 4.10.2	**SMALL** 4.10.3.4
4.11 Socioeconomics (Demographics)			
Construction	**SMALL** 4.11.1.1.1	**NONE** 4.11.2	**SMALL** 4.11.3
Operation	**MODERATE** 4.11.1.2.1	**NONE** 4.11.2	**SMALL** 4.11.3
Aquifer Restoration	**SMALL** 4.11.1.3	**NONE** 4.11.2	**SMALL** 4.11.3
Decommissioning	**SMALL** 4.11.1.4	**NONE** 4.11.2	**SMALL** 4.11.3
4.11 Socioeconomics (Income)			
Construction	**SMALL** 4.11.1.1.2	**NONE** 4.11.2	**SMALL** 4.11.3
Operation	**SMALL** 4.11.1.2.2	**NONE** 4.11.2	**SMALL** 4.11.3
Aquifer Restoration	**SMALL** 4.11.1.3	**NONE** 4.11.2	**SMALL** 4.11.3
Decommissioning	**SMALL** 4.11.1.4	**NONE** 4.11.2	**SMALL** 4.11.3

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
	4.11 Socioeconomics (Housing)		
Construction	**SMALL**	**NONE**	**SMALL**
	4.11.1.1.3	4.11.2	4.11.3
Operation	**MODERATE**	**NONE**	**MODERATE**
	4.11.1.2.3	4.11.2	4.11.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.11.1.3	4.11.2	4.11.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.11.1.4	4.11.2	4.11.3
	4.11 Socioeconomics (Employment Rate)		
Construction	**SMALL**	**NONE**	**SMALL**
	4.11.1.1.4	4.11.2	4.11.3
Operation	**SMALL**	**NONE**	**SMALL**
	4.11.1.2.4	4.11.2	4.11.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.11.1.3	4.11.2	4.11.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.11.1.4	4.11.2	4.11.3
	4.11 Socioeconomics (Local Finance)		
Construction	**SMALL**	**NONE**	**SMALL**
	4.11.1.1.5	4.11.2	4.11.3
Operation	**MODERATE**	**NONE**	**MODERATE**
	4.11.1.2.5	4.11.2	4.11.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.11.1.3	4.11.2	4.11.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.11.1.4	4.11.2	4.11.3

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.11 Socioeconomics (Education)			
Construction	**SMALL**	**NONE**	**SMALL**
	4.11.1.1.6	4.11.2	4.11.3
Operation	**SMALL**	**NONE**	**SMALL**
	4.11.1.1.6	4.11.2	4.11.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.11.1.3	4.11.2	4.11.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.11.1.4	4.11.2	4.11.3
4.11 Socioeconomics (Health and Social Services)			
Construction	**SMALL**	**NONE**	**SMALL**
	4.11.1.1.7	4.11.2	4.11.3
Operation	**SMALL**	**NONE**	**SMALL**
	4.11.1.2.7	4.11.2	4.11.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.11.1.3	4.11.2	4.11.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.11.1.4	4.11.2	4.11.3
4.12 Environmental Justice Impacts			
Construction	**NONE**	**NONE**	**NONE**
	4.12.1	4.12.2	4.12.3
Operation	**NONE**	**NONE**	**NONE**
	4.12.1	4.12.2	4.12.3
Aquifer Restoration	**NONE**	**NONE**	**NONE**
	4.12.1	4.12.2	4.12.3
Decommissioning	**NONE**	**NONE**	**NONE**
	4.12.1	4.12.2	4.12.3

	Alternative 1: Proposed Action	Alternative 2: No-Action	Alternative 3: No Hank Unit
4.13 Public and Occupational Health and Safety Impacts			
Construction	**SMALL**	**NONE**	**SMALL**
	4.13.1.1	4.13.2	4.13.3.1
Operation	**SMALL**	**NONE**	**SMALL**
	4.13.1.2	4.13.2	4.13.3.2
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.13.1.3	4.13.2	4.13.3.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.13.1.4	4.13.2	4.13.3.4
4.14 Waste Management Impacts			
Construction	**SMALL**	**NONE**	**SMALL**
	4.14.1.1	4.14.2	4.14.3
Operation	**SMALL**	**NONE**	**SMALL**
	4.14.1.2	4.14.2	4.14.3
Aquifer Restoration	**SMALL**	**NONE**	**SMALL**
	4.14.1.3	4.14.2	4.14.3
Decommissioning	**SMALL**	**NONE**	**SMALL**
	4.14.1.4	4.14.2	4.14.3

2.4 Preliminary Recommendation

After weighing the impacts of the proposed action and comparing the alternatives, the NRC staff, in accordance with 10 CFR 51.71(f), sets forth its preliminary NEPA recommendation regarding the proposed action. The NRC staff recommends that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Nichols Ranch ISR Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

The NRC staff has concluded that the overall benefits of the proposed action outweigh the environmental disadvantages and costs based on consideration of the following:

- Potential impacts to all environmental resource areas are expected to be SMALL, with the exception of

  1) historical and archaeological resources during construction,

  2) visual and scenic resources during construction, and

  3) socioeconomics (specifically, demographics, housing, and local finance) during operation,

  where such impacts would be MODERATE.

- Regarding the Pumpkin Buttes TCP, a PA has been developed by the BLM and Wyoming State Historic Preservation Officer (SHPO), which includes mitigation measures for construction activities within the 3.2-km (2-mi) radius of the Pumpkin Buttes. If signed by Uranerz, the implementation of the requirements of the PA for the Pumpkin Buttes TCP would limit potential cultural and visual impacts. If not signed by Uranerz, a separate MOA with agreed upon mitigation measures would have to be developed with BLM.

- Regarding groundwater, ISR operations would take place in ore zone aquifers previously exempted by the U.S. Environmental Protection Agency as potential drinking water sources. Additionally, Uranerz would be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Uranerz would also be required to restore groundwater parameters affected by ISR operations to levels that are protective of public health and safety.
- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site.
- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

2.5 References

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3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Introduction

The proposed Nichols Ranch In-situ Recovery (ISR) Project is located in the Powder River Basin, in a rural area that bisects Johnson and Campbell Counties, Wyoming. The Powder River Basin is an energy-rich area that possesses some of the largest coal, coal bed methane (CBM), and natural gas deposits in the United States. The proposed project is approximately 74 km (46 mi) south-southwest of the city of Gillette and approximately 98 km (61 mi) north-northeast of the city of Casper (Figure 1-1).

This chapter describes the existing site conditions of the proposed Nichols Ranch ISR Project. The resource areas described in this section include land use, transportation, geology and soils, water resources, ecology, noise, air quality, historical and cultural resources, visual and scenic resources, socioeconomics, and public and occupational health. Relevant impact topics were selected based on agency and public concerns, regulatory and planning requirements, and known resource issues. The information provided in this chapter would be used as context for comparing the potential impacts of each alternative, which are presented in Chapter 4.

3.2 Land Use

The proposed project area is located within the Powder River Basin, which holds the largest deposits of coal in the United States, as well as other minerals and oil and gas. As a result, various mining operations have been, and continue to be, prevalent in the area. The lands within the proposed Nichols Ranch ISR Project have historically been used for cattle grazing and wildlife habitat. Ranching was the first major industry in the project area and remained the predominant industry until the 1970s. Railroads grew simultaneously with ranching as cattle were shipped from Campbell and Johnson Counties to markets in the east. The emergence of Wyoming's rich energy resources, including coal, oil and gas, natural gas, uranium, and wind subsequently attracted energy producing industries to the project area. Presently, the lands within the project area are used for a variety of purposes. Livestock grazing, oil and gas extraction, CBM extraction, and uranium recovery activities are all currently taking place on or near the proposed project area. The immediate future land use for the proposed project area and adjacent areas would be continued livestock grazing, ISR activities, CBM extraction, and oil and gas extraction.

The proposed Nichols Ranch ISR Project includes approximately 1,365 ha (3,371 ac) of land located in the Powder River Basin. The proposed Nichols Ranch ISR Project is divided into two units; the Nichols Ranch Unit and the Hank Unit. The Nichols Ranch Unit encompasses approximately 453 ha (1,120 ac) located in Township 43 North Range 76 West, Sections 7, 8, 17, 18, and 20. The Hank Unit encompasses approximately 911 ha (2,251 ac) located in Township 44 North Range 75 West, Sections 30 and 31 and Township 43 North Range 75 West, Sections 5, 6, 7, and 8. Parts of the proposed Nichols Ranch ISR Project area are considered split estates, where surface and subsurface mineral right ownership is divided between two or more owners. The current surface ownership of the proposed Nichols Ranch ISR Project includes approximately 1,251 ha (3,091 ac) of private ownership, mainly by the T-Chair Livestock Company, and approximately 113 ha (280 ac) of U.S. Government ownership administered by the U.S. Bureau of Land Management (BLM). The subsurface mineral ownership is divided between various private entities, including oil and gas and mineral extraction companies, and the U.S. Government administered by the BLM (Uranerz, 2007).

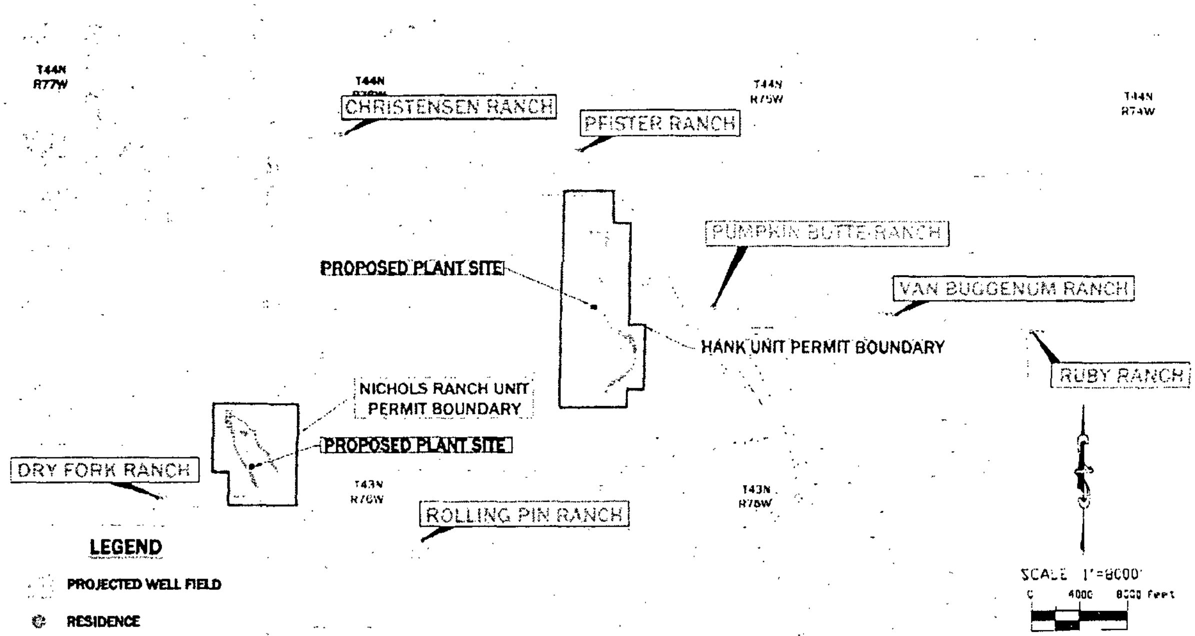
Uranerz Energy Corporation (Uranerz) has formed surface use agreements with most of the proposed project area landowners.

The town of Wright, located approximately 32 km (20 mi) east of the proposed Nichols Ranch ISR Project, is the closest major population center. The towns of Edgerton and Midwest are located approximately 40 km (25 mi) to the southwest of proposed project area. No residential sites are located within the proposed Nichols Ranch ISR Project area. The two residences located within 2 km (1 mi) of the proposed project area are Pfister Ranch, approximately 1 km (0.6 mi) north of the Hank Unit, and Dry Fork Ranch, which is located approximately 1.5 km (0.9 mi) west of the Nichols Ranch Unit (Figure 3-1). The 110 ha (280 ac) of BLM land near the Hank Unit is landlocked by private land and thus has limited access. The Pumpkin Buttes, which flank the northern and southeastern boundaries of the Hank Unit, are recognized by the BLM as a Traditional Cultural Property (TCP).

3.2.1 Rangeland

Livestock grazing is the main activity at the proposed Nichols Ranch ISR Project area and adjacent lands. Hay was grown in the past on approximately 52 ha (128 ac) of the southern part of the Nichols Ranch Unit, but ceased due to past drought conditions.

Figure 3-1. Nearest Residential Receptors to the Nichols Ranch ISR Project



Source: modified from Uranerz, 2007

3.2.2 Hunting and Recreation

The proposed project area is within the Pumpkin Buttes Pronghorn Herd Unit and Hunt Area 23 and within portions of the Pumpkin Buttes Mule Deer Herd Unit, which is comprised of Hunt Areas 19, 20, 29, and 31 (WGFD, 2007). Hunting is limited to the allowable seasons set for the respective game, which are predominantly elk and deer.

Recreational activities within an 80 km (50 mi) radius of the proposed Nichols Ranch ISR Project are mainly outdoor activities such as camping, hiking, fishing, and hunting. Almost all of the land on and adjacent to the Nichols Ranch ISR Project area is private with limited access, but public lands such as the Thunder Basin National Grassland, located approximately 38 km (24 mi) to the east/southeast of the Hank Unit, and the Bighorn Mountains, approximately 43 km (27 mi) to the west of the proposed project area, are used for recreational activities. The Powder River, located approximately 14 km (9 mi) to the west of the proposed project area, also provides recreational opportunities for public users. Most recreational activities occur during the summer months when mild weather conditions grant easier and more diverse access. The historic Bozeman Trail, located approximately 3.2 km (2 mi) west of the proposed Nichols Ranch ISR Project area was a route used first by Native Americans and then later by traders and homesteaders moving west during the nineteenth century.

3.2.3 Minerals and Energy

CBM activity is widespread throughout the Powder River Basin. The methane is produced at a depth of approximately 300 m (1,000 ft) and greater which is approximately 120 m (400 ft) deeper than the uranium mineralization found in the Nichols Ranch and Hank Units. In comparison, the typical depth to gas and oil-bearing strata generally ranges from 1,220 to 4,116 m (4,000 to 13,500 ft), but some wells are as shallow as 76 m (250 ft) (BLM, 2005).

Currently, there are a number of permitted and completed CBM wells located in or adjacent to the Nichols Ranch Unit. Permitted and completed CBM wells are also found in the lands in and adjacent to the Hank Unit. There are approximately 472 oil and gas production units in the Powder River Basin in various stages of production. These are also evenly dispersed throughout the entire Powder River Basin. The Wyoming Oil and Gas Conservation Commission reported that, in 2003, the oil and gas wells in the Powder River Basin produced approximately 13 million barrels of oil and 1.1 billion m^3 (41 billion ft^3) of conventional gas (BLM, 2005).

Table 3-1 below provides a summary of the number of permitted or completed CBM wells and oil and gas wells within the Nichols Ranch and Hank Units and those within 4.8 km (3 mi) of the Nichols Ranch and Hank Units. Infrastructure such as pipes and pipelines are attendant structures associated with each energy extraction operation found within at least a 4.8-km (3-mi) radius of the Nichols Ranch and Hank Units. These infrastructure systems occupy vertical subsurface space for extraction purposes as well as horizontal surface area for pipelines that either transport fuel or wastewater to and from each facility.

Three U.S. Nuclear Regulatory Commission (NRC)-licensed ISR facilities are located within 129 km (50 mi) of the proposed Nichols Ranch ISR Project. Cogema's Irigaray/Christensen Ranch ISR facility is located approximately 6.4 km (4 mi) to the northwest of the Hank Unit. Power Resources Inc. (PRI)-licensed North Butte amendment area is located approximately 3.2 km (2 mi) north of the Hank Unit. PRI's Smith Ranch-Highland ISR facility is located approximately 72 km (45 mi) southeast of the proposed Nichols Ranch ISR Project. Two of the licensed facilities, Irigaray/Christensen Ranch and Smith Ranch-Highland, currently have existing yellowcake processing plants with the latter in operation.

Table 3-1. CBM and Oil and Gas Wells On and Within 4.8 km (3 mi) of the Nichols Ranch ISR Project

CBM wells	Within Project Area	Within 4.8 km (3 mi)
Nichols Ranch Unit	6	200
Hank Unit	11	180
Oil and Gas wells	**Within Project Area**	**Within 4.8 km (3 mi)**
Nichols Ranch Unit	0	1
Hank Unit	3	27
Source: Uranerz, 2007		

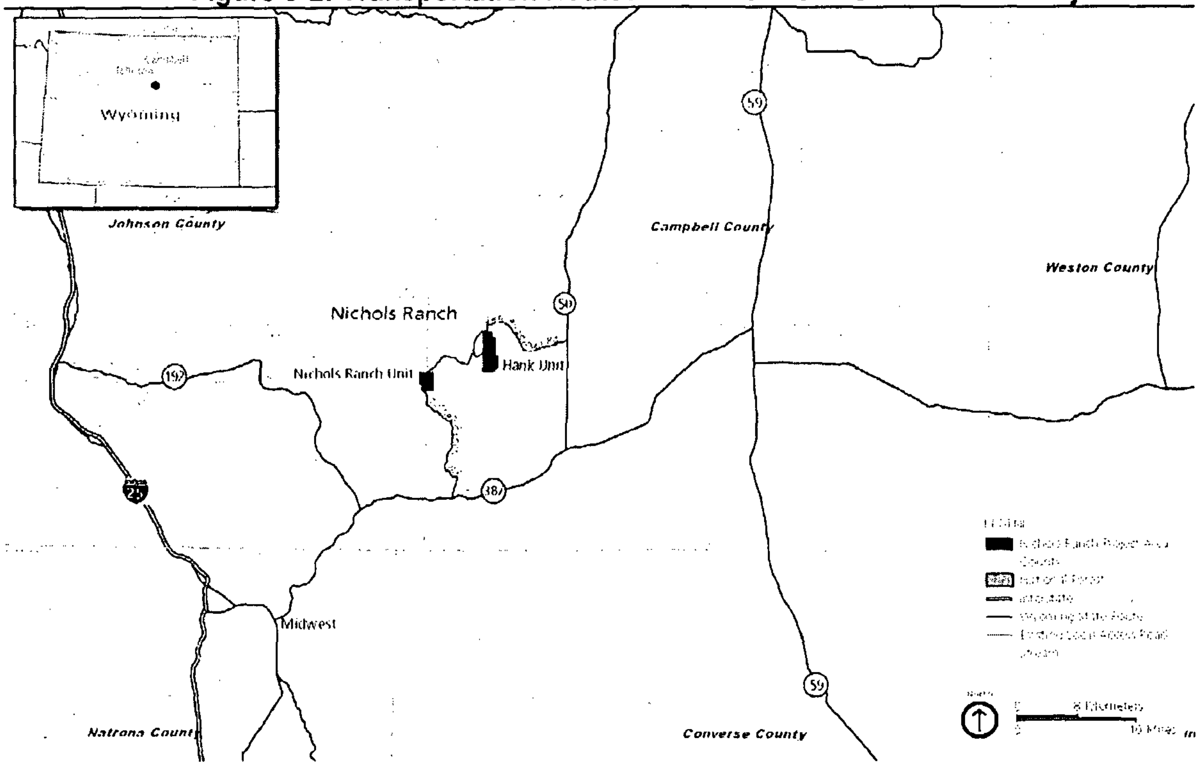
3.3 Transportation

The proposed Nichols Ranch ISR Project area lies within the Powder River Basin of Wyoming, wherein there are only two four-lane interstate highways. Interstate 25 (I-25) extends north from Colorado, terminating where it merges with I-90 at Buffalo, Wyoming. I-90 enters northeastern Wyoming from South Dakota at Beulah, continues west through Gillette and turns north at Buffalo, exiting the state into Montana just beyond Sheridan (Figure 3-2). Primary two-lane highways within the Powder River Basin include U.S. 14 and U.S. 16. The paved roads closest to the proposed Nichols Ranch ISR Project area are State Route (SR) 387 and SR 50. SR 387 runs east-west from Wright to I-25 at Midwest. SR 50 commences in Gillette and runs southerly, terminating at the intersection with SR 387 (Figure 3-2). Numerous county roads provide access to public and private lands, many of which consist of maintained gravel surfaces. Unimproved or minimally improved private roads are also common in this area. The maximum posted speed limit for rural portions of interstates is 120 kilometers per hours (kph) (75 miles per hours [mph]), with urban settings being 97 kph (60 mph). State highways have a maximum posted speed limit of 105 kph (65 mph).

The proposed Nichols Ranch ISR Project area can be accessed from the north via SR 50 by travelling 13.7 km (8.5 mi) west along Van Buggenum Road and Christensen Road and continuing westerly for another 13.7 km (8.5 mi) on T-Chair Livestock ranch roads (Figure 2-6). Both Van Buggenum Road and Christensen Road are county-maintained gravel roads that provide access to several ranches located in the project region. These roads are 7.3-m (24-ft) wide, which allows for two tractor trailers to pass one another, and are crowned-and-ditched. Both Van Buggenum Road and Christensen Road are currently being used as access routes for tractor trailer traffic associated with CBM activities in the vicinity. The speed limit is posted at 72 kph (45 mph). Access from the south can be gained by travelling north from SR 387 on T-Chair Livestock ranch roads.

Ranch roads occurring on the T-Chair Livestock Company property are also crowned-and-ditched gravel roads. Recent activities by CBM producers have improved the major ranch roads that Uranerz would use. These roads range from 4.6- to 6.1-m (15- to 20-ft) wide and are constructed and maintained by the land owner and the CBM producers. These roads would allow for safe passage of both passenger cars and tractor trailers when traveling to and from the proposed Nichols Ranch ISR Project. The speed limit on these roads is 50 kph (30 mph).

Figure 3-2. Transportation Routes Near the Nichols Ranch ISR Project



Source: Uranerz, 2007

The distance from the proposed Hank Unit satellite facility to the nearest major road (SR 50), is approximately 16 km (10 mi). The distance from the proposed Nichols Ranch Unit central processing plant to the nearest major road (SR 387) is just over 19 km (12 mi). In 2006, annual average daily traffic counts (AADTs) for trucks using SR 387 in the vicinity of the proposed project ranged from 220 to 410 trucks, and the AADT for all vehicle types combined was 970 to 3,130 per day (NRC, 2009b). The AADT for SR 50 all vehicles was 550 in 1999, based on most recent available data (BLM, 2003). However, this estimate is likely low because new CBM development has increased traffic on this road. No traffic count data are available for Van Buggenum Road or the T-Chair ranch roads. Table 3-2 provides traffic count data for the state routes surrounding the proposed Nichols Ranch ISR Project area. The expected route for yellowcake shipments from the proposed Nichols Ranch ISR Project are discussed in Section 2.1.1.3.2.3.

3.4 Geology and Soils

The proposed Nichols Ranch ISR Project is located in the Pumpkin Buttes Uranium District of the Wyoming East Uranium Milling Region established in NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS) (NRC, 2009b). The Pumpkin Buttes Uranium District lies within the Powder River Basin. Section 3.3.3 of the GEIS provides general description of the geology and soils of the Powder River Basin and Pumpkin Buttes Uranium District. The following is a discussion of the geology and soils of the region and, more specifically, the proposed Nichols Ranch ISR Project area based on the description provided in the GEIS and by Uranerz.

Table 3-2. Traffic Counts for State Routes Near the Nichols Ranch ISR Project

Route Name	Description	All Vehicles 1998	1999	2005	2006	Trucks 2005	2006
SR 59	Gillette South of Urban Limits	18,690	17,760				
SR 59	Johnson-Campbell County Line	1,110	1,210				
SR 59	Wright	2,150	2,250	3,630	3,930	690	750
SR 59	Converse-Campbell County Line	1,350	1,450				
SR 387	Johnson-Campbell County Line	1,110	1,210				
SR 387	Between SR 50 and SR 59			970 - 3,130	970 - 3,130	210-410	220-410
Sources: NRC, 2009b; BLM, 2003							

3.4.2 Geology

The Powder River Basin is a large structural and topographic depression parallel to the Rocky Mountain range. The boundaries of the basin are the Hartville Uplift and the Laramie Range to the south, the Black Hills to the east, the Big Horn Mountains and Casper Arch to the west, and the Miles City Arch in southeastern Montana to the north. Overall, the drainage is approximately 5.6 million ha (14 million ac) in size. As indicated in the GEIS, the dominant source of sediment in the Powder River Basin was Precambrian[3] granitic rock of the Sweetwater Arch and northern Laramie Range. The Powder River Basin formed during the Laramide Orogeny (mountain-building era) during the Paleocene to early Eocene[3]. Rapidly subsiding portions of the basin received thick clastic wedges (i.e., made of fragments of other rocks) of predominantly arkosic sediment (i.e., sediments containing a significant fraction of feldspar), while large more slowly subsiding portions of the basin received a greater proportion of paludal (marsh) and lacustrine (lake) sediments.

The Powder River Basin hosts a sedimentary rock sequence with sediments that range in age from recent (Holocene) to early Paleozoic[3] and overlie a basement complex of Precambrian-age igneous and metamorphic rocks (Figure 3-3). As noted in the GEIS, the upper part of the sedimentary sequence present in other portions of central Wyoming has been eroded away in the Powder River Basin, leaving only the Tertiary aged White River, Wasatch, and Fort Union Formations. The White River Formation is of Oligocene age and is the shallowest Tertiary unit in the Powder River Basin. Underlying the White River Formation is the Wasatch Formation which is of Eocene Age. The Paleocene age Fort Union Formation directly underlies the Wasatch Formation, which directly overlies the Cretaceous Lance Formation.

As indicated above, the White River Formation is the youngest Tertiary unit that still exists in the Powder River Basin with remnants found on top of the Pumpkin Buttes. A basal conglomerate forms the resistant cap rock of the Pumpkin Buttes. Elsewhere, the White River Formation

[3] The United States Geological Survey (USGS) defines the Precambrian Era to be between 2.5 billion and 544 million years ago; the Eocene era to be between 55.5 and 33.7 million years ago; and the Paleozoic era to be between 544 and 248 million years ago. <http://geology.er.usgs.gov/paleo/glossary.shtml#p> (17 September 2009)

consists of thick sequences of buff colored tuffaceous sediments mixed with lenses of fine sand and siltstone. This formation is not known to contain significant uranium resources in this area. The next underlying unit, the Wasatch Formation, consists of interbedded mudstones, carbonaceous shales, silty sandstones, and relatively clean sandstones. In the vicinity of the Pumpkin Buttes, the Wasatch Formation is approximately 480 m (1,575 ft) thick. The interbedded mudstones, siltstones, and relatively clean sandstones in the Wasatch Formation are varying degrees of lithification from uncemented to moderately well-cemented sandstones, and from weakly compacted and cemented mudstones to fissile shales. The Wasatch Formation contains significant uranium resources and hosts the ore bodies for which Uranerz is proposing to conduct ISR operations. The Fort Union Formation in the Powder River Basin is lithologically similar to the Wasatch Formation. The Fort Union Formation includes interbedded silty claystones, sandy siltstones, relatively clean sandstones, claystones, and coal with varying degrees of lithification ranging from virtually un-cemented sands to moderately well cemented siltstones and sandstones. The total thickness of the Fort Union Formation in this area is approximately 915 m (3,000 ft). The Fort Union Formation contains significant uranium resources at various locations in the basin and is also the target formation for CBM extraction operations.

The proposed Nichols Ranch ISR Project site is located on the outcrop of the Wasatch Formation. With the exception of alluvial deposits overlying the Wasatch Formation along Cottonwood Creek, the Wasatch Formation comprises the most surficial deposits in the proposed project area. The stratigraphy of the Wasatch Formation in the proposed project area consists of alternating layers of sand and shale with lignite marker beds. The mineralized intervals are found in these sands. These mineralized sand horizons are in the lower part of the Wasatch Formation, at an approximate average depth of 168 m (550 ft) and are depicted in Figure 3-4. These host sands are mostly arkosic in composition, friable, and have trace amounts of carbonaceous material and organic debris. There are locally sandy mudstone/siltstone intervals within the sands, which may thicken or thin to the point of removal in some areas.

The ore zones at the Nichols Ranch and Hank Units are typical Powder River Basin roll front deposits. Where present, uranium ore is found at the naturally occurring chemical boundary between reduced and oxidized sandstone facies. The Nichols Ranch Unit and Hank Unit ore zones have uranium mineralization composed of amorphous uranium oxide, sooty pitchblende, and coffinite. The uranium is deposited upon individual detrital sand grains and within authigenic clays in the void spaces. The host sandstones are made up of quartz, feldspar, accessory biotite and muscovite mica, and locally occurring carbon fragments. The sand grain sizes range from very fine-grained sand to conglomerate. The sandstones are weakly to moderately cemented and friable. The reduced facies are associated with pyrite and calcite whereas the oxidized facies are associated with hematite or limonite stain from pyrite and montmorillonite and kaolinite clays from oxidized feldspars (Uranerz, 2007).

Uranerz has identified a series of sand layers in the upper portion of Wasatch Formation present in the proposed project area and have labeled these layers from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands (Figure 3-4). The intervening shales that separate these sands have been identified by the overlying and underlying sands (i.e., the shale separating the H and G Sands is the HG Shale or Aquitard). While generally present throughout the proposed project area, the nature and extent of these sands differ somewhat across the proposed project area from the Nichols Ranch Unit to the Hank Unit. In addition, depth and expression of these sands at the ground surface is influenced by the topographical relief of the proposed project area. The sand layers have been observed to dip gently 0.5 to 1.0

degrees to the west. The following sections provide more information on the site-specific geology at each unit.

3.4.2.1 *Nichols Ranch Unit Geology*

There are three primary Wasatch Formation sand members in the Nichols Ranch Unit and one minor sand unit. The primary sand members are the F, B, and A Sands, while the minor sand unit is the 1 Sand (Figure 3-4). The F Sand member is the shallowest and the 1 Sand is the deepest. The main uranium ore zone sand member is the A Sand and is 18 to 30 m (60 to 100 ft) thick and is located 91 to 213 m (300 to 700 ft) below the surface. The A Sand is thickest to the northeast and thins to the southwest and is fine to coarse grained. The A sand is extensive and has been correlated across the site from the Nichols Ranch Unit to the Hank Unit.

Underlying the A Sand ore zone at the Nichols Ranch Unit are the A1 Aquitard and the 1 Sand. The A1 Aquitard is comprised of mudstones and carbonaceous shale with occasional thin lenses of poorly developed coal. This unit ranges in thickness from 6 to 11 m (20 to 35 ft). The underlying 1 Sand is variable in thickness, ranging from 3 to 26 m (10 to 85 ft) in thickness, and occurs at depths of 171 to 216 m (560 to 710 ft) below ground surface (bgs). The sand is very fine to coarse grained.

Overlying the A Sand ore zone at the Nichols Ranch Unit are the BA Aquitard and the B Sand. In this portion of the unit, the BA Aquitard varies from 8 to 27 m (25 to 90 ft), thickening to the northwest and thinning to the southeast. The BA Aquitard consists of mudstones and thin discontinuous light gray siltstones. The B Sand ranges in thickness from 30 to 183 m (100 to 600 ft) at the Nichols Ranch Unit and is fine to coarse grained. The body of the B sand is occasionally separated by lenses of mudstone, siltstone, and carbonaceous shale. Some of these mudstone splits exceed 8 m (25 ft) in thickness and may extend for thousands of feet. The B Sand is very extensive and has been correlated across the gap between the Nichols Ranch and Hank Units.

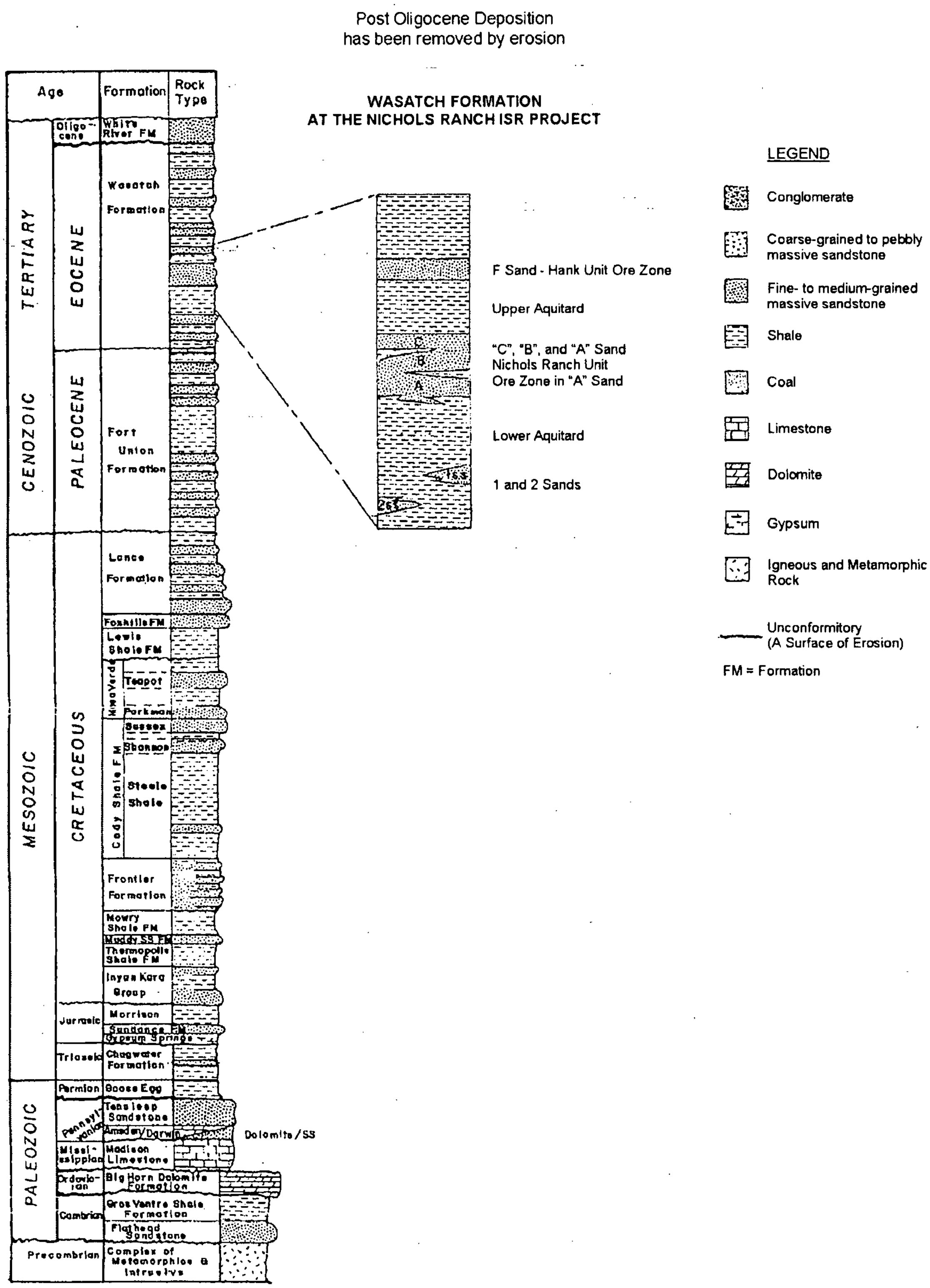
3.4.2.2 *Hank Unit Geology*

Uranerz has identified four primary Wasatch Formation sand members and two minor sand units at the Hank Unit. The primary sand members at the Hank Unit are the F, C, B, and A Sands and the minor sand units are the G and H Sand units (Figure 3-4). The main uranium ore zone sand member at the Hank Unit is the F Sand, which is approximately 23 m (75 ft) thick and 61 to 83 m (200 to 600 ft) bgs in this portion of the unit. At the Hank Unit, the F Sand is composed of fine to coarse grained sand.

Underlying the F Sands at the Hank Unit are the FC aquitard and the C Sand. The C Sand at the Hank Unit is 1.5 to 6.1 m (5 to 20 ft) thick, discontinuous, and is composed of fine and very fine grained sand. The C sand is not always present below the F Sand at the Hank Unit. When the C sand is not present, the B Sand is the sand unit underlying the production sand (F sand). The FC aquitard is composed of mudstones, siltstones, gray carbonaceous shales, and poorly developed coal. The aquitard ranges in thickness from 14 to 24 m (45 to 110 ft) depending on the presence of the C Sand. Where the C Sand is not present, it merges with the CB aquitard overlying the B Sand.

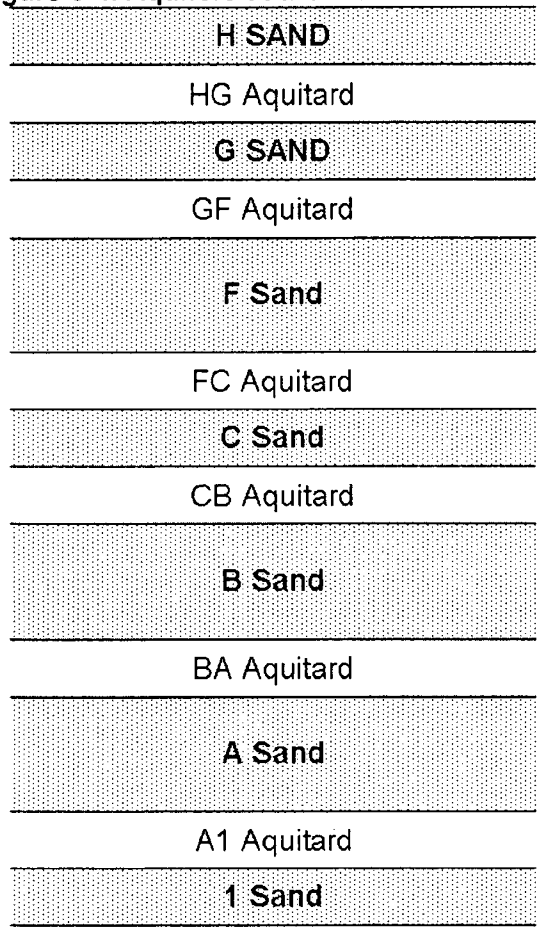
Overlying the F Sands at the Hank Unit are the GF Aquitard and the G Sand. At the Hank Unit, the G sand is comprised of up to three individual sand units that are fine- to very fine-grained and 3 to 7.6 m (10 to 25 ft) thick. The entire G sand sequence is up to 23-m (75-ft) thick with inter-sand zones comprised of gray mudstone. The GF Aquitard at the Hank Unit is composed mostly of gray mudstones and is 9.1 to 17 m (30 to 55 ft) thick.

Figure 3-3. Geologic Composition at the Nichols Ranch ISR Project



Source: Uranerz, 2007

Figure 3-4. Aquifers at the Nichols Ranch ISR Project



Source: Uranerz, 2007

3.4.3 Soils

Based on an inventory and mapping of soils conducted by Uranerz, soils occurring in the Nichols Ranch and Hank Units were found to be generally fine textured throughout. Patches of sandy loam were identified on upland areas and fine-textured soils occurred in or near drainages. The proposed project area was found to contain deep soils on lower toeslopes and flat areas near drainages with shallow and moderately deep soils located on upland ridges and shoulder slopes (Uranerz, 2007). Uranerz also conducted soil sampling which indicated that the topsoil is suitable for plant growth (in the case of reclamation) and that the soils had a clay texture. The Natural Resource Conservation Service (NRCS) conducted a reconnaissance survey, which indicated that no prime farmland[4] is present in the proposed project area.

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[4] Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses. http://www.nrcs.usda.gov/technical/NRI/maps/meta/t5839.html (16 September 2009)

3.5 Water Resources

3.5.1 Surface Waters and Wetlands

Surface water in the vicinity of the proposed Nichols Ranch ISR Project site includes CBM stock ponds and ephemeral streams that flow after snow melt or heavy storms. Generally, the ephemeral streams flow west to the Powder River, a tributary of the Yellowstone River in eastern Montana. The Powder River Basin, in which the proposed Nichols Ranch ISR Project is located, includes the Powder River, Little Powder River, Clear Creek, Piney Creek, Crazy Woman Creek, and eight major reservoirs. As discussed in Section 3.3.4.1 of the GEIS, the Wyoming Department of Environmental Quality (WDEQ) categorizes the channels within the Nichols Ranch and Hank Units as Class 3B waters. Class 3B waters are generally intermittent, ephemeral, or isolated waters that support aquatic life other than fish and may include adjacent wetlands along stream channels (HKM, 2002).

3.5.1.1 *Drainage Basins*

Within the Powder River Basin, the Nichols Ranch Unit lies within the Cottonwood Creek drainage areas and the Hank Unit lies within the Willow Creek and Dry Willow Creek drainage areas (Figure 3-5).

The Cottonwood Creek drainage area encompasses about 20,800 ha (51,300 ac) and has an elevation range of 1,400 to 1,820 m (4,590 to 5,974 ft) above mean sea level (AMSL) (Uranerz, 2007). Cottonwood Creek is a tributary that flows west from the proposed project site to the Dry Fork of the Powder River. The majority of the channels on the Nichols Ranch Unit drain to Cottonwood Creek, though channels in the northern portion of the site drain to Tex Draw, another tributary of the Dry Fork. None of the Tex Draw channel is located within the Nichols Ranch Unit.

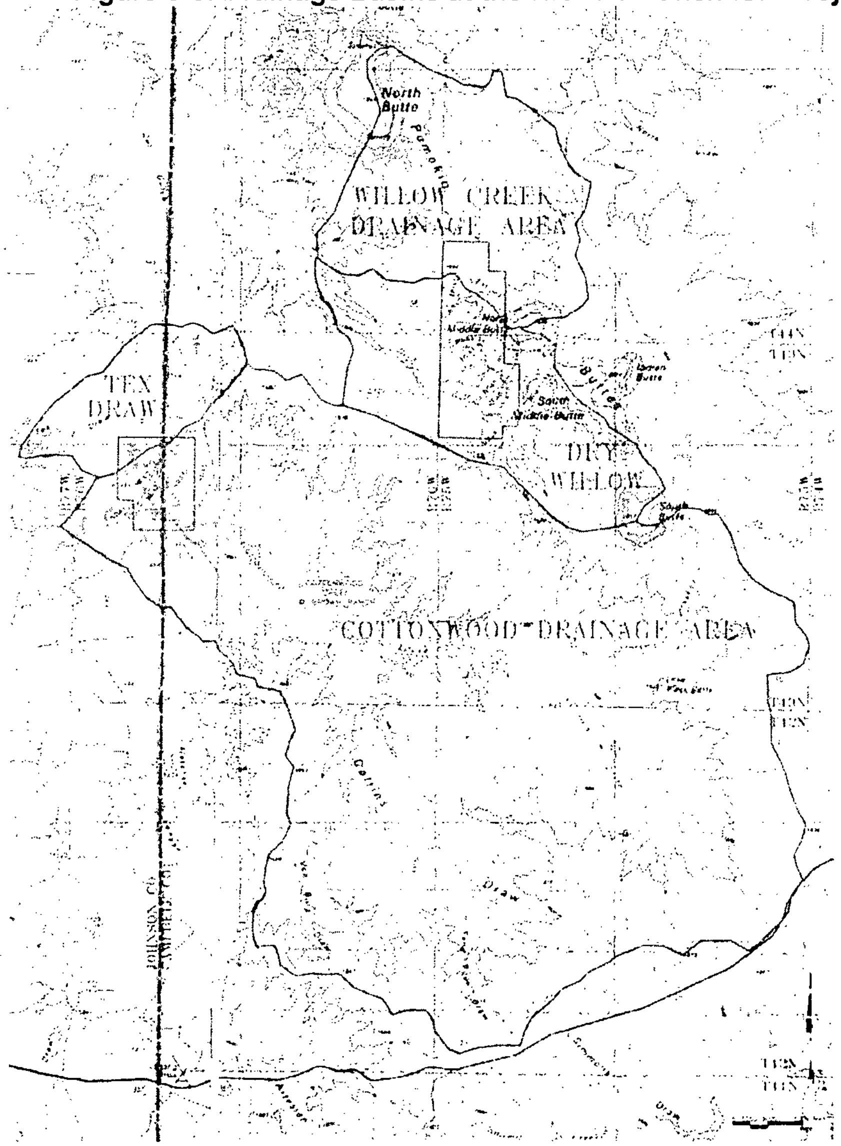
The Willow Creek and Dry Willow Creek drainage areas encompass about 3,420 ha (8,450 ac) and 3,160 ha (7,800 ac), respectively, and elevation ranges of 1,529 to 1,536 m (5,015 to 5,040 ft) AMSL and 1,522 to 1,550 m (4,995 to 5,084 ft) above AMSL, respectively (Uranerz, 2007). Dry Willow Creek flows into Willow Creek, which is a tributary of the Powder River.

3.5.1.2 *Surface Water Features*

Approximately 6,020 linear m (21,722 linear ft) of ephemeral channels and washes occur within the Nichols Ranch Unit (Uranerz, 2007). Channels are moderately to deeply incised and have banks ranging from 0.3 to 4.5 m (1 to 15 ft) in height and widths of 0.3 to 4.5 m (1 to 15 ft). Irrigation ditches used for hay production divert some ephemeral channel waters for agricultural use. Four emergent wetland areas, discussed in Section 3.5.1.5, were identified within the Nichols Ranch Unit.

Ephemeral channels and washes on the Hank Unit total 15,133 linear m (49,649 linear ft) (Uranerz, 2007). Channels are deeply incised at the western boundary of the Hank Unit and have banks ranging from 3.0 to 15 m (10 to 50 ft) in height. Typical channel widths range from 6.1 to 9.1 m (20 to 30 ft) at the western boundary of the Hank Unit and 0.3 to 0.6 m (1 to 2 ft) over the rest of the unit. Direction of flow generally occurs from east to west.

Figure 3-5. Drainage Basins at the Nichols Ranch ISR Project



Source: Uranerz, 2007

3.5.1.3 *Surface Water Flow*

The channels within both the Nichols Ranch and Hank Units are ephemeral and remain dry during the majority of the year. The rolling terrain and deeply incised channels generally yields confined flow patterns without defined floodplains. Flood waters conveyed during storm events are expected to remain within the channel banks, with the exception of one stretch of Cottonwood Creek located in the southern end of the Nichols Ranch Unit where flood waters may reach bank-full and begin to spread into the floodplain. Peak flows and velocities for Cottonwood Creek, Tex Draw, Dry Willow Creek, and Willow Creek using the Lowham methodology (Lowham, 1976) and are presented in Table 3-3 below.

Table 3-3. Peak Flows of Major Drainages for the Nichols Ranch ISR Project

	Cottonwood Creek	Tex Draw	Dry Willow Creek	Willow Creek
Drainage Area in ha (ac)	20,800 (51,300)	1350 (3,330)	3160 (7,800)	3420 (8,450)
Estimated Peak Flows [m^3/s (cfs)] by Recurrence Interval				
2-Year	12.9 (454)	4.81 (170)	6.54 (231)	6.71 (237)
5-Year	34.5 (1220)	12.9 (456)	17.6 (620)	18.1 (638)
10-Year	60.1 (2150)	22.1 (782)	30.3 (1070)	31.1 (1100)
25-Year	106 (3760)	38.8 (1370)	52.9 (1870)	54.7 (1930)
50-Year	153 (5420)	55.8 (1970)	76.5 (2700)	78.7 (2780)
100-Year	212 (7500)	77.0 (2720)	106 (3730)	109 (3840)
Source: Uranerz, 2007				

3.5.1.4 *Surface Water Quality*

Water quality data were collected in June 2008 within channels with flowing water, namely Dry Willow Creek and Cottonwood Creek (Uranerz, 2007). Uranium and ammonia concentrations in Cottonwood Creek were higher than samples previously taken in 1979; however, the overall water quality results from 2008 do not show any major deviations when compared to the 1979 sampling results. Within Cottonwood Creek (Nichols Ranch Unit), total dissolved solids (TDS), sulfate, iron, manganese, and uranium all exceeded Wyoming Class I or U.S. Environmental Protection Agency (EPA) drinking water standards. The concentrations for all other constituents regulated by the WDEQ were found to be below the state threshold (Uranerz, 2007).

3.5.1.5 *Wetlands*

A wetland assessment was performed on behalf of Uranerz for the proposed Nichols Ranch ISR Project site in 2006 by a U.S. Army Corps of Engineers (USACE)-certified wetland delineator with TRC Environmental Corporation (Uranerz, 2007). Four emergent wetlands were identified in the southeastern portion of the Nichols Ranch Unit. Three of these are linear, palustrine depressions found within the Cottonwood Creek floodplain, which were created prior to 1950 due to excavation to the groundwater table. The fourth wetland is also in the Cottonwood Creek floodplain and occurs downstream of an overflowing stock tank associated with ranching operations. The total area of wetlands on the Nichols Ranch Unit is 0.5 ha (1.2 ac). Because of the ephemeral nature of the channels and the artificial hydrology of the pools, these systems do not have a significant nexus to interstate, navigable waters and, therefore, would not be regulated under Section 404 of the Clean Water Act (CWA).

The U.S. Fish and Wildlife Service (FWS) National Wetland Inventory (NWI) indicates the potential for wetlands on the Hank Unit; however, the wetland assessment concluded that no wetlands exist on the unit (Uranerz, 2007).

3.5.2 Groundwater

3.5.2.1 *Regional Groundwater Resources*

As discussed in Section 3.3.4.3 of the GEIS, the Northern Great Plains aquifer system is the major regional aquifer system in the Wyoming East Uranium Milling Region. This regional aquifer system has been subdivided into five major aquifers (Whitehead, 1996). These aquifers, from the shallowest to the deepest, are the Lower Tertiary, Upper Cretaceous, Lower Cretaceous, Upper Paleozoic, and Lower Paleozoic aquifers. The Lower Tertiary aquifers consist of the sandstone beds with the Wasatch Formation and the Fort Union Formation. Both formations consist of alternating sandstone, siltstone, and claystone beds and containing lignite and subbituminous coal. Most water is stored in and flows through the more permeable sandstone beds. In the Lower Tertiary aquifers, which include the ore horizons as described below, the regional flow direction is northward and northeastward from the recharge area in northeastern Wyoming. In Wyoming, the potentiometric surface of the Lower Tertiary aquifers is higher than the underlying Upper Cretaceous aquifers; consequently, groundwater moves vertically downward from the Lower Tertiary aquifers to the Upper Cretaceous units through the confining layer separating the two aquifers. (NRC, 2009b)

The Upper Cretaceous aquifer consists of sandstone beds interbedded with siltstone and claystone in the Lance and Hell Creek Formations and the Fox Hill Sandstone. The Fox Hills Sandstone is one of the most continuous water-yielding formations in the Northern Great Plains aquifer system. The Upper Cretaceous aquifers are separated from the Lower Cretaceous aquifers by several thick confining units. The Pierre Shale, the Lewis Shale, and the Steele Shale are the regionally thickest and most extensive confining units. The lower Cretaceous aquifers are the most widespread aquifers in the Northern Great Plain aquifer system and contain several sandstones. However, the lower Cretaceous aquifers contain little freshwater. The water becomes saline in the deep parts of the Powder River Basin. The Paleozoic aquifers cover a larger area, but they are deeply buried in most places and contain little freshwater.

As previously discussed in Section 3.4 of this supplemental environmental impact statement (SEIS), the Wasatch Formation outcrops in the study area and represents most of the surficial deposits in the area except for limited Quaternary deposits within surface drainages. Extensive alluvial deposits are present in the proposed project area along Cottonwood Creek. The sandstone beds within the Wasatch Formation comprise the shallowest aquifers within the proposed project area. There are commonly multiple water-bearing sands within the Wasatch Formation. Due to their higher permeability, these water- bearing sands provide the primary sources for groundwater withdrawal. Groundwater within the Wasatch Formation aquifers is typically under confined (artesian) conditions, although locally unconfined conditions exist. Well yields from the Wasatch Formation in the southern part of the Powder River Basin where the proposed site is located are reported to be as high as 1,900 liters per minute (Lpm) (500 gallons per minute [gpm]). In the vicinity of the Pumpkin Buttes, the Wasatch Formation is known to be 480 m (1,575 ft) thick (Sharp and Gibbons, 1964).

3.5.2.2 *Local Groundwater Resources*

As discussed in Section 3.4 of this SEIS, Uranerz has identified a series of sand layers in the upper portion of Wasatch Formation present in the proposed project area and have labeled these layers from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands. The sands are considered aquifers in the proposed project area. The intervening shales that separate these sands are considered aquitards due to their hydraulic properties (i.e., low permeability) and have been identified by the overlying and underlying sands. For example, the shale separating the H and G Sands has been labeled the HG Aquitard. A schematic of the typical aquifer and aquitard sequence in the proposed project area is shown in Figure 3-4. While generally present throughout the proposed project area, the nature and extent of these sands differ somewhat across the proposed project area from the Nichols Ranch Unit to the Hank Unit. In addition, depth and expression of these sands at the ground surface is influenced by the topographical relief of the proposed project area. The production aquifer at the Nichols Ranch Unit is the A Sand, while the production aquifer at the Hank Unit is the F Sand. The geologic nature and extent of the specific sands and aquitards identified in the proposed project area is discussed further in Section 3.4.

The depth at which groundwater is first encountered across the site varies and depends on surface topography. The specific sand that acts as the surficial aquifer similarly varies across the proposed project area depending on the outcropping of these sands and the surface topography. Limited groundwater level data are available to define depth to shallow groundwater across the Nichols Ranch Unit and additional wells are planned to better define shallow groundwater levels in this area. In the southern portion of the Nichols Ranch Unit, shallow groundwater is first encountered in the Cottonwood alluvium and has been shown to within 3 m (10 ft) of the ground surface. Moving north from the Cottonwood alluvium, shallow groundwater is first encountered in the F aquifer at depths ranging from 15 to 30 m (50 to 100 ft). However, in the northernmost portion of the Nichols Ranch Unit, the G sand is likely to be the shallow aquifer, with depth to groundwater ranging between 30 to 50 m (100 to 150 ft). Groundwater flow in the F and G Sands is projected to be in a westerly direction, most likely a result of the local topography.

Depth to shallow groundwater at the Hank Unit is similarly uncertain and the installation of additional wells are planned to identify shallow water levels in the Hank Unit. However, the H Sand should be the surficial aquifer in this area with depth to groundwater ranging between 15 m (50 ft) in the low lying areas to the west of the Hank Unit area to 61 m (200 ft) along the eastern border of the Hank Unit (Uranerz, 2007). Groundwater flow in the H Sand at the Hank Unit is expected to flow in a westerly direction. The Willow Creek and Dry Willow Creek alluvial materials in the Hank Unit are not expected to contain water except during short periods of time after runoff events.

Groundwater in the surficial aquifers is likely unconfined, although there may be portions of these aquifers that are locally confined. Those sands that underlie the surficial aquifer, particularly at depth, are generally confined.

3.5.2.3 *Uranium-Bearing Aquifer*

The principal uranium bearing aquifer at the Nichols Ranch Unit is the A Sand (Figure 3-4). As indicated in Section 3.4.1, the A Sand is 18 to 30 m (60 to 100 ft) thick and is located 91 m to 213 m (300 to 700 ft) below the surface at the Nichols Ranch Unit. The A Sand is thickest to the northeast and thins to the southwest and is fine- to coarse-grained. Groundwater in the A Sand is confined. The A Sand is underlain by the A1 Aquitard and the 1 Sand. The 1 Sand has been identified as the production aquifer. The A1 Aquitard is comprised of mudstones and carbonaceous shale with occasional thin lenses of poorly developed coal. This unit ranges in thickness from 6 to 11 m (20 to 35 ft). The underlying 1 Sand is variable in thickness, ranging from 3 to 26 m (10 to 85 ft) in thickness, and occurs at depths of 171 to 216 m (560 to 710 ft) bgs. The sand is very fine to coarse grained.

The A Sand is overlain by the BA Aquitard and the B Sand. The B Sand has been identified as the aquifer overlying the production aquifer. The BA Aquitard varies from 7.6 to 27 m (25 to 90 ft) in this area, thickening to the northwest and thinning to the southeast. This unit consists of mudstones and thin discontinuous light gray siltstones. The BA Aquitard has been shown to extend across the site from the Nichols Ranch Unit to the Hank Unit, where it is 24 m (80 ft) thick and is composed mainly of mudstones. The B Sand ranges in thickness from 30 to 183 m (100 to 600 ft) at the Nichols Ranch Unit. This unit is fine- to coarse-grained. The body of the B sand is occasionally separated by lenses of mudstone, siltstone, and carbonaceous shale. Some of these mudstone splits exceed 8 m (25 ft) in thickness and may extend for thousands of feet. The B Sand is very extensive and has been correlated across the gap between the Nichols Ranch and Hank Units.

The principal uranium ore zone sand member at the Hank Unit is the F Sand, which is approximately 23 m (75 ft) thick and 61 to 183 m (200 to 600 ft) bgs in this portion of the proposed project area. The water levels in the F sand fall below the base of the overlying GF Aquitard in the northern portion of the Hank Unit and slightly above in the southern portion. The F sand is therefore both an unconfined and slightly confined aquifer across the Hank Unit. The F Sand is underlain by the FC Aquitard and the C Sand. The C Sand has been designated the aquifer underlying the production zone in areas where it is present. The C Sand at the Hank Unit is 1.5 to 6.1 m (5 to 20 ft) thick, discontinuous, and is composed of fine- and very fine-grained sand. The C sand is not always present below the F Sand at the Hank Unit. At these locations, the B Sand is the sand unit underlying the production sand. The FC Aquitard is composed of mudstones, siltstones, gray carbonaceous shale, and poorly developed coal. The aquitard ranges in thickness from 14 to 24 m (45 to 110 ft), depending on the presence of the C Sand. Where the C Sand is not present, it merges with the CB Aquitard overlying the B Sand.

Water levels have been measured in wells installed in the proposed project area to define the direction and gradient of groundwater movement. The location of wells installed at the Nichols Ranch and Hank Units are shown in Figures 3-6 and 3-7, respectively. While wells have been installed in many of the identified sand aquifers, these wells have been concentrated in the production zones at the Nichols Ranch and Hank Units. Based on these water level measurements, a potentiometric map has been presented for the A Sand at the Nichols Ranch Unit (Figure 2-19 of the Technical Report [TR]) (Uranerz, 2007). This potentiometric map indicates that groundwater in the A Sand is flowing to the northwest with an average gradient of 0.0033. Based on this gradient, an effective porosity of 0.05, and an average hydraulic conductivity of 0.15 m/day (0.5 ft/day), the average rate of groundwater flow is estimated to be 0.01 m/day (0.033 ft/day). A similar potentiometric map has been presented for the F Sand across both the Nichols Ranch and Hank Units (Figure 2-20 of the TR) (Uranerz, 2007). This map indicates that water in the F Sand is flowing west with an average gradient of 0.005. Based on this gradient, an effective porosity of 0.005, and an average hydraulic conductivity of 0.18 m/day (0.6 ft/day), the average rate of groundwater flow in the F Sand aquifer across the proposed project area is estimated to be 0.018 m/day (0.06 ft/day). Similar gradients and flow directions have been observed in the B and C Sand aquifers as in the A and F Sand aquifers. The shallow sands in the Hank Unit are more likely to be affected by local topographical changes than the deeper sands. Water level data for the G Sand in the Hank Unit show a much steeper groundwater gradient.

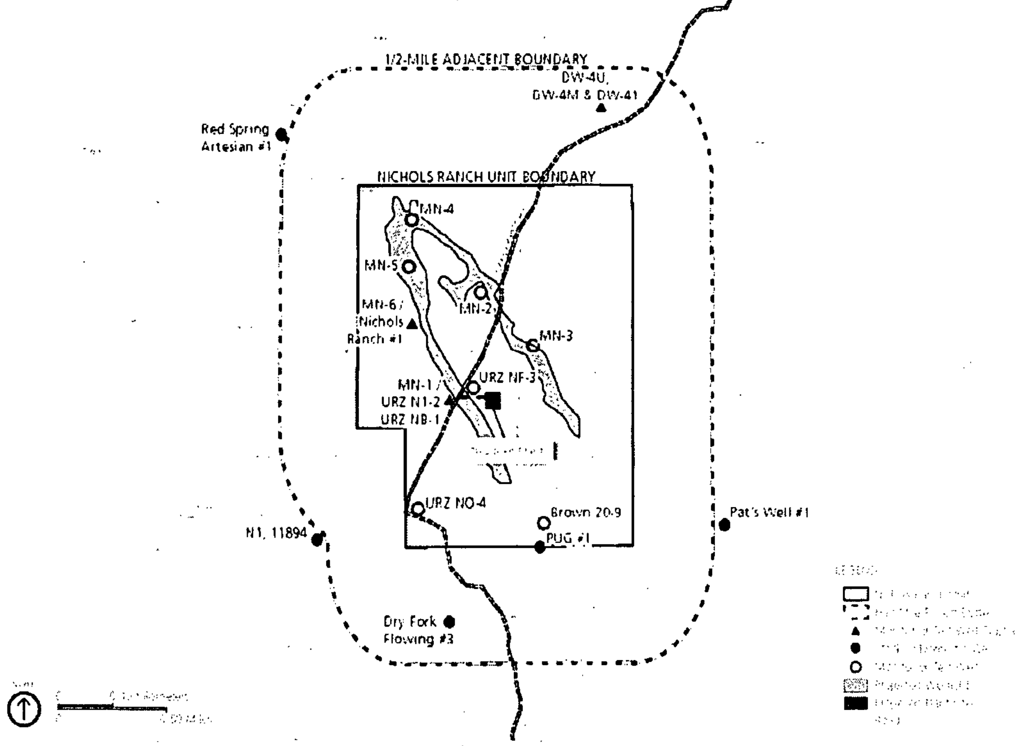
3.5.2.3.1 Hydrogeologic Characteristics

The hydraulic properties of the production aquifers as well as the associated underlying and overlying aquifers have been evaluated in the project area using both multi-well pumping tests and single tests. Aquifer testing was previously conducted between 1978 and 1979 by Cleveland-Cliffs and Uranerz. Additional aquifer testing was conducted by Uranerz in 2006 and 2007. The hydraulic conductivity of the A Sand at the Nichols Ranch Unit was found to vary from approximately 0.55 to 21.3 cm/day (0.018 to 0.7 ft/day). Uranerz estimated that 15.2 cm/day (0.5 ft/day) for hydraulic conductivity best represents the A Sand in this area. A single-well test for the B Sand aquifer indicated that the hydraulic conductivity of 11.3 cm/day (0.37 ft/day) for this sand. Two single-well tests for the 1 Sand resulted in hydraulic conductivities of 5.5 and 7.9 cm/day (0.18 and 0.26 ft/day) for this sand. A single-well test in the F sand yielded a higher hydraulic conductivity of 110 cm/day (3.6 ft/day).

The hydraulic properties of the F Sand at the Hank Unit were found to vary greatly. The hydraulic conductivities of this unit were found to vary from 4.3 cm/day to 287 cm/day (0.14 to 9.4 ft/day). Uranerz estimated that 18.3 cm/day (0.6 ft/day) for hydraulic conductivity best represents the majority of the F sand in this area. The water-level in the ore zone at the Hank

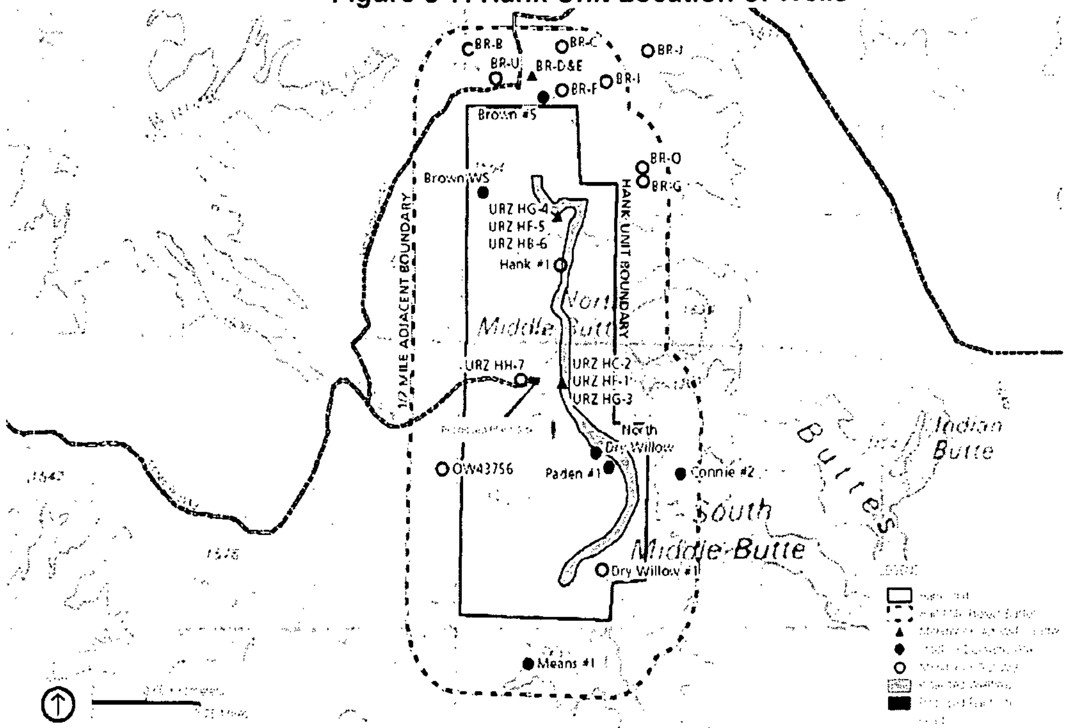
Unit is near the top of the sand and therefore the F Sand is not fully saturated. Accordingly, the F Sand aquifer is an unconfined aquifer. The primary storage property for an unconfined aquifer is specific yield. Uranerz has estimated that a specific yield of 0.05 best represents the F Sand in this area. Test results from two G Sand wells yielded hydraulic conductivity measurements for this sand of 0.15 and 0.67 cm/day (0.005 and 0.022 ft/day). A single measurement in the C Sand indicated a hydraulic conductivity value of 0.76 cm/day (0.025 ft/day). Two single well tests in the B Sand yielded hydraulic conductivity measurements of 11.6 and 67.1 cm/day (0.38 and 2.2 ft/day).

Figure 3-6. Nichols Ranch Unit Location of Existing Wells



Source: modified from Uranerz, 2007

Figure 3-7. Hank Unit Location of Wells



Source: modified from Uranerz, 2007

3.5.2.3.2 Level of Confinement

Vertical permeabilities of the aquitards in the Powder River Basin have been defined at numerous locations, including just north of the Hank Unit during the permitting of the PRI North Butte ISR Project. These permeabilities have been measured using multi-well pumping tests and a variety of analytical methods. These permeabilities have also been determined using laboratory measurements. Uranerz reported that data and analysis presented in the PRI North Butte ISR Project application indicate that the vertical permeability for the aquitard separating the F and C Sands was 0.004 cm/day (1.1 x 10^{-4} ft/day). A second multi-well test at the PRI North Butte ISR Project site indicated that the aquitard permeability between the A Sand and the 1 Sand was 0.004 cm/day (1.2 x 10^{-4} ft/day). Laboratory measurements of permeabilities of samples from two aquitards were submitted for the PRI North Butte ISR Project site. These permeabilities varied from 54.9 to 0.001 cm/day (1.8 ft/day to 3.7 x 10^{-5} ft/day). These data were considered sufficient to demonstrate the confinement of the uranium-bearing sands at the project area. Aquifer confinement would be further verified at each of the well fields during the required well field multi-well pumping tests. These data would be submitted as part of the well field data packages and would be reviewed and approved by the NRC before each well field would begin operation.

3.5.2.3.3 Groundwater Quality

In Wyoming, the quality of groundwater is measured against either EPA Drinking Water Standards (40 CFR Part 142 and 40 CFR Part 143) which establish Maximum Contaminant Levels (MCLs) for specific chemical constituents or Wyoming Groundwater Quality standards. The Wyoming standards are based on ambient water quality and are divided into three classes (WDEQ, 2005):

- Class I is defined as suitable for domestic use;
- Class II is defined as suitable for agriculture;
- Class III is defined as suitable for livestock;
- Class IV is defined as suitable for industrial use; and
- Class Special (A) is defined as suitable for fish and aquatic life.

Groundwater quality in the proposed project area has been defined by sampling numerous wells in many of the aquifers identified in the area. The resulting groundwater quality data are presented below in Table 3-4. The data in this summary have been grouped for the A Sand, the F Sand, the B and C Sands, the G and H Sands, and the 1 Sand. Included in this summary table are EPA Drinking Water Standards (40 CFR Part 142 and 40 CFR Part 143) and Wyoming Class I, Domestic Ground Water Quality standards.

The groundwater quality summary data indicate that the A Sand water has very low TDS (less than 500 mg/L), with major components being sodium, sulfate, and bicarbonate. Uranium concentrations in A Sand groundwater varied between detection and 0.027 mg/L. Radium-226 concentrations varied between detection and 36.3 pCi/L. Typically, uranium-bearing aquifers, particularly in the ore zone, exhibit uranium and radium-226 levels exceeding their respective EPA MCLs (NRC, 2009b). The relatively low concentrations found in the A Sand in the area of Nichols Ranch and Hank Units appear to be related to the length of the well screens (ranging from 21 to 34 m [69 to 110 ft] in length) which extend over the entire A Sand and are not limited to the ore zone. This would lead to dilution of the samples with water from outside the ore zone.

Groundwater quality data for the F Sand indicate that average TDS concentrations were greater than 1,000 mg/L. Sodium, calcium, bicarbonate, and sulfate are the major dissolved constituents in this water. Uranium concentrations were measured in this ore-bearing sand at an average of 0.16 mg/L, with a maximum concentration of 5.25 mg/L. Radium concentrations as high as 562 pCi/L were also measured, with an average value of 43 pCi/L. Consequently, the F Sand does not meet the Wyoming Class I, II, or III groundwater quality standards and exceeds the EPA MCL for uranium.

Water quality for the B and C Sands were grouped together by Uranerz. These sands lie between the two production zones and are connected in some areas. TDS in these aquifers averaged 793 mg/L with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in these aquifers averaged 0.059 mg/L, with a maximum of 2.16 mg/L. Radium concentrations in the B and C aquifers average 16 pCi/L with a maximum measured concentration of 128 pCi/L. Consequently, the B and C Sands do not meet the Wyoming Class I, II, or III groundwater quality standards and exceed the EPA MCL for uranium.

Water quality for the H and G Sands were grouped together by Uranerz. TDS in these aquifers averaged 427 mg/L with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in these aquifers were generally low, averaging 0.004 mg/L. Radium concentrations in the H and G aquifers average 0.44 pCi/L with a maximum measured concentration of 1.9 pCi/L. Uranium concentrations averaged 0.059 mg/L. As a result, the H and G Sands meet the Wyoming Class II groundwater quality standards and are suitable for agriculture.

Water quality for the 1 Sand is also good. TDS in this aquifer averaged 232 mg/L with the major constituents being sodium, bicarbonate, and sulfate. Uranium concentrations in this aquifer were very low, averaging 0.00015 mg/L. Radium concentrations were on average 0.1 pCi/L. Consequently, the 1 Sand meets the Wyoming Class I groundwater quality standards.

1 **Table 3-4. Water Quality of Specific Aquifers in the Nichols Ranch Unit**

Water Quality Parameter	Nichols Ranch Unit			
	"B and C sand" Overlying Aquifer	"A sand" Ore zone Aquifer	"1 sand" Underlying Aquifer	Water Quality Standards[a]
Bicarbonates as HCO_3 (mg/L)	120.65	138.86	233.75	
Carbonates as CO_3 (mg/L)	3.43	4.41	15.75	
Chloride (mg/L)	53.22	8.06	5.00	250
Conductivity (umhos/cm)	1162.68	564.13	411.5	
Fluoride (mg/L)	0.174	0.24	0.65	2.0 – 4.0
pH (s.u.)	8.15	8.48	8.63	6.5 – 8.5
Total Dissolved Solids (mg/L)	**797.11**[b]	333.14	232.0	500
Sulfate (mg/L)	**466.24**[b]	135.05	1.5	250
Radium-226 (pCi/L)	**15.44**[b]	**5.02**[b]	0.1	5.0
Nitrogen, Ammonia as N (mg/L)	**0.627**[b]	0.09	0.07	0.5
Nitrogen, Nitrate+Nitrite as N (mg/L)	0.069	0.05	0.05	10
Aluminum (mg/L)	0.095	0.05	0.05	0.05 to 0.2
Arsenic (mg/L)	0.002	0.0	0.0005	0.01
Barium (mg/L)	0.052	0.05	0.05	2.0
Boron (mg/L)	0.110	0.08	0.05	
Cadmium (mg/L)	0.004	0.0	0.0025	0.005
Calcium (mg/L)	53.22	7.61	3.75	
Chromium (mg/L)	0.016	0.02	0.025	0.1 (total)
Copper (mg/L)	0.012	0.01	0.005	1.0
Iron (mg/L)	0.109	0.07	0.015	0.3
Lead (mg/L)	0.01	0.01	0.005	0.015
Magnesium (mg/L)	10.94	0.57	0.50	
Manganese (mg/L)	0.025	0.01	0.005	0.05
Mercury (mg/L)	0.001	0.0	0.0005	0.002
Molybdenum (mg/L)	0.069	0.07	0.05	
Nickel (mg/L)	0.02	0.02	0.025	0.1
Potassium (mg/L)	6.89	2.23	2.25	
Selenium (mg/l)	0.0	0.0	0.0005	0.05
Sodium (mg/l)	189.49	113.62	99.5	
Uranium (mg/L)	**0.06**[b]	0.01	0.00015	0.03

Water Quality Parameter	Nichols Ranch Unit			
	"B and C sand" Overlying Aquifer	"A sand" Ore zone Aquifer	"1 sand" Underlying Aquifer	Water Quality Standards[a]
Vanadium (mg/L)	0.05	0.05	0.05	
Zinc (mg/L)	0.23	0.01	0.005	5.0

[a] EPA Drinking Water Standards - 40 CFR Part 142 and 40 CFR Part 143, *Wyoming Water Quality, Rules and Regulations, Chapter 8, Class I, Domestic Ground Water*
[b] Bolded values exceed either EPA or Wyoming Class I Groundwater Standards

Table 3-5. Water Quality of Specific Aquifers in the Hank Unit

Water Quality Parameters	Hank Unit			
	"G sand" Overlying Aquifer	"F sand" Ore Zone Aquifer	"B and C sand" Underlying Aquifer	Water Quality Standards[a]
Bicarbonates as HCO_3 (mg/L)	151.1	171.43	120.65	
Carbonates as CO_3(mg/L)	8.8	0.63	3.43	
Chloride (mg/L)	7.6	5.53	53.22	250
Conductivity (umhos/cm)	804.9	1426.96	1162.68	
Fluoride (mg/L)	0.2486	0.15	0.174	2.0 – 4.0
pH (s.u.)	8.4	7.82	8.15	6.5 – 8.5
Total Dissolved Solids (mg/L)	**504.4**[b]	**1020.95**[b]	**797.11**[b]	500
Sulfate (mg/L)	243.1	**597.33**[b]	**466.24**[b]	250
Radium-226 (pCi/L)	0.73	**44.6**[b]	**15.44**[b]	5.0
Nitrogen, Ammonia as N (mg/L)	0.103	0.05	**0.627**[b]	0.5
Nitrogen, Nitrate+Nitrite as N (mg/L)	0.05	0.05	0.069	10
Aluminum (mg/L)	**0.425**[b]	**0.05**[b]	0.095	0.05 to 0.2
Arsenic (mg/L)	0.0033	0.0068	0.002	0.01
Barium (mg/L)	0.055357	0.05	0.052	2.0
Boron (mg/L)	0.24643	0.08	0.110	
Cadmium (mg/L)	0.00329	0.0034	0.004	0.005
Calcium (mg/L)	48.6	99.77	53.22	
Chromium (mg/L)	0.0221	0.02	0.016	0.1 (total)
Copper (mg/L)	0.00714	0.02	0.012	1.0
Iron (mg/L)	**0.499**[b]	**0.30**[b]	0.109	0.3
Lead (mg/L)	**0.0231**[b]	0.01	0.01	0.015

Water Quality Parameters	Hank Unit			
	"G sand" Overlying Aquifer	"F sand" Ore Zone Aquifer	"B and C sand" Underlying Aquifer	Water Quality Standards[(a)]
Magnesium (mg/L)	9.8	24.37	10.94	
Manganese (mg/L)	**0.051**[(b)]	**0.07**[(b)]	0.025	0.05
Mercury (mg/L)	0.00047	0.0005	0.001	0.002
Molybdenum (mg/L)	0.05	0.05	0.069	
Nickel (mg/L)	0.0232	0.02	0.02	0.1
Potassium (mg/L)	6.0	7.12	6.89	
Selenium (mg/L)	0.0026	0.02	0.00	0.05
Sodium (mg/L)	110.9	185.73	189.49	
Uranium (mg/L)	0.009475	**0.15**[(b)]	**0.06**[(b)]	0.03
Vanadium (mg/L)	0.0363	0.05	0.05	
Zinc (mg/L)	0.021	0.02	0.23	5.0

[(a)] EPA Drinking Water Standards - 40 CFR Part 142 and 40 CFR Part 143, *Wyoming Water Quality, Rules and Regulations, Chapter 8, Class I, Domestic Ground Water*

[(b)] Bolded values exceed either EPA or Wyoming Class I Groundwater Standards

3.5.2.3.4 Current Groundwater Uses

Uranerz contacted the Wyoming State Engineer's Office (WSEO) to identify all permitted wells within each unit and within a 4.8-km (3-mi) radius of each unit. Numerous wells have been identified in these surveys, including wells associated with mining and aquifer monitoring, stock watering wells, and domestic wells. The survey indicates that excluding the monitoring and mining-related wells, most wells are used for livestock watering through the use of windmills or electric well pumps. The depth of these wells generally ranges between 30 and 305 m (100 and 1,000 ft). A number of the identified wells are noted to have sufficient hydraulic heads to allow the wells to discharge to the surface without pumping (flowing wells). In the proposed project area, wells that are completed in the ore-bearing zone will be abandoned per Wyoming regulations/guidance or will be used as monitoring wells if deemed appropriate (i.e., proper screen interval).

Inspection of these data for wells identified within the Nichols Ranch Unit and within a 4.8-km (3-mi) radius of the unit with depths of between 91 to 210 m (300 to 700 ft) bgs (i.e., potentially screened within the A Sand) indicates available ground water head averages around 136 m (446 ft). The survey has identified nine existing wells within the Nichols Ranch Unit excluding aquifer testing or monitoring wells. All of these wells are used for stock watering. The review of these wells conducted by Uranerz indicates that several of these wells are completed in the ore-bearing sands and would need to be abandoned or converted to monitoring wells. The survey also indicates three domestic wells within 4.8 km (3 mi) of the Nichols Ranch Unit well fields. Two of the wells (Doughstick and Garden Well) are approximately 3.62 km (2.25 mi) southeast and upgradient of the proposed well fields, while Dry Fork #1 is about 2.01 km (1.25 mi) southwest and crossgradient from the proposed well fields.

Inspection of these data for wells identified within the Hank Unit and within a 4.8-km (3-mi) radius of the unit with depths of between 61 to 180 m (200 to 600 ft) bgs (i.e., potentially screened within the F Sand) indicates available groundwater head averages around 75 m (246 ft). Six permitted wells were identified within 0.8 km (0.5 mi) of the Hank Unit. All of these are used for stock watering. Several of these wells appear to be completed in the F Sand, while other wells are screened through multiple sands including the C, B, and A Sands. Several of these wells would need to be abandoned or converted to monitoring wells. The survey also indicates three domestic wells within 4.8 km (3 mi) of the Hank Unit. A domestic well was identified 1 km (0.6 mi) north of the northern boundary of the Hank Unit. This well (BR-T) is reported to be completed in the B Sand below the westward flowing production zone (F Sand) at the Hank Unit. The other two domestic wells (Doughstick and Garden Well) are approximately 4.8 km (3 mi) southwest and crossgradient from the proposed well fields.

3.5.2.4 *Surrounding Aquifers*

As indicated in Section 3.3.4.3.4 of the GEIS, the Wasatch and Fort Union Formations are important aquifers for water supplies on a regional scale. The Fox Hill Sandstone is one of the most continuous water-yielding formations in the Northern Great Plans aquifer system. Except at outcrop areas, the Paleozoic aquifers are not usually used for water production because they are either deeply buried or contain saline water.

Based on the survey of water wells within a 4.8-km (3-mi) radius of the proposed site, water supply wells are generally completed within 300 m (1,000 ft) of the ground surface in the sands of the Wasatch Formation. The Fort Union Formation is not extensively used because sufficient yields of groundwater are available from the overlying Wasatch Formation.

Deep well injection has been proposed for the disposal of liquid effluent wastes. Typically, deep well injection in the Powder River Basin occurs in the Upper Cretaceous Lance Formation (e.g., Irigaray/Christensen Ranch) several thousand feet below the Lower Tertiary production zones. Uranerz has indicated that it will apply for an Underground Injection Control (UIC) permit through WDEQ. As required, the disposal well will be completed (i.e., screened) in an approved subsurface formation and will be operated according to permit requirements.

3.6 Ecology

The Wyoming East Uranium Milling Region, as described in the GEIS, encompasses the Wyoming Basin, Northern Great Plains, Southern Rockies, and Western High Plains. The proposed Nichols Ranch ISR Project is located within the Powder River Basin of the Northwestern Great Plains ecoregion. Section 3.3.5.1 of the GEIS provides the following description of this region:

> The Northwestern Great Plains encompass the Missouri Plateau section of the Great Plains. This area includes semiarid rolling plains of shale and sandstone derived soils punctuated by occasional buttes and badlands. For the most part, it has not been influenced by continental glaciation. Cattle grazing and agriculture with spring wheat and alfalfa farming are common land uses. Agriculture is affected by erratic precipitation and limited opportunities for irrigation. In Wyoming, mining for coal and coal-bed methane production is prevalent, with a large increase in the number of coal-bed methane wells drilled in recent years. Native grasslands and some woodlands persist, especially in areas of steep or broken topography (Chapman, et al., 2004).

Section 3.3.5.1 of the GEIS provides the following description of the Powder River Basin:

> The Powder River Basin ecoregion of the Northwestern Great Plains covers rolling prairie and dissected river breaks surrounding the Powder, Cheyenne, and Upper North Platte Rivers. The Powder River Basin has less precipitation and less available water than the neighboring regions. Vegetation within this region is composed of sagebrush and mixed-grass prairie dominated by blue grama (*Bouteloua gracilis*), western wheatgrass (*Elymus smithii*), prairie junegrass (*Koeleria macrantha*), Sandberg Bluegrass (*Poa secunda*), needle-and-thread grass (*Stipa comata*), rabbitbrush (*Chrysothamnus*), fringed sage (*Artemisia frigida*), and other forbs, shrubs, and grasses (Chapman et al., 2004).

The Nichols Ranch Unit has elevations ranging from 1,423 to 1,494 m (4,670 to 4,900 ft) AMSL. Topography in this area is relatively flat with gently rolling hills and low ridges that drain south toward Cottonwood Creek, an intermittent stream that is located in the southern portion of the unit.

The Hank Unit is located approximately 6.7 km (4.2 mi) northeast of the Nichols Ranch Unit, with elevations ranging from 1,541 to 1,588 m (5,055 to 5,209 ft) AMSL. The topography includes gently rolling hills and low ridges, as well as steep terrain near North Middle Butte and some steeply eroded areas associated with Dry Willow Creek, an ephemeral stream that is located in the southern portion of this unit.

3.6.1 Terrestrial Ecology

The proposed project site is comprised primarily of sagebrush shrubland and mixed grasslands. Sagebrush shrubland dominates the Hank Unit, and mixed grasslands cover most of the Nichols Ranch Unit. No perennial streams or other permanent water bodies exist within either unit; however, four wetlands were found in the southeast corner of the Nichols Ranch Unit. These wetlands are described in detail in Section 3.5.1.5 of this SEIS.

3.6.1.1 *Vegetation*

The proposed project area is comprised of eight vegetation/habitat types, with approximately 88 percent of the area represented by two vegetation communities: sagebrush shrubland and mixed grasslands. In June and July of 2006, Uranerz conducted vegetation studies in accordance with a study plan approved by the WDEQ-Land Quality Division (LQD) for non-coal project areas (Uranerz, 2007).

Sagebrush shrublands are dominated by shrubs and also contain some grasses and forbs. The proposed Nichols Ranch ISR Project site contains 774.7 ha (1,914.4 ac) of sagebrush shrublands, which accounts for 56.8 percent of the site. The community is dominated by threadleaf sedge (*Carex filifolia*), a grasslike species. Other characteristic species include Wyoming sagebrush (*Artemisia tridentata wyomingensis*) and a number of perennial and annual grasses. Alyssum (*Alyssum parvifolia*) and wooly plantain (*Plantago patagonia*), both annual forbs, as well as several scattered plains cottonwood (*Populus deltoids*) and Rocky Mountain juniper (*Juniperus scopulorum*) trees also occur in this community and are generally found growing along the drainages.

Mixed grasslands are common across eastern Wyoming and generally receive more moisture and have greater species diversity than other types of prairie habitats (WGFD, 2006a). The proposed Nichols Ranch ISR Project site contains 428.3 ha (1,058.3 ac) of mixed grasslands, which accounts for 31.4 percent of the site. The community is composed of mainly perennial grasses such as needle-and-thread (*Stipa comata*), Sandberg bluegrass (*Poa secunda*), blue grama (*Bouteloua gracilis*), western wheatgrass (*Elymus smithii*), and bluebunch wheatgrass

(*Elymus spicatus*) and grasslike species such as threadleaf sedge. Some perennial forbs, annual forbs, and shrub species are scattered in low-density stands throughout this community. No trees occur in this plant community.

Other vegetative communities present on the project site include 60.0 ha (148.3 ac) of juniper outcrop (4.4 percent of the site), 50.4 ha (124.6 ac) of bottomland (3.7 percent), 25.9 ha (64.0 ac) of greasewood shrubland (1.9 percent), 0.5 ha (1.1 ac) of wetland (less than 0.1 percent), 7.1 ha (17.5 ac) of rock outcrop (0.5 percent), and 17.1 ha (42.3 ac) of disturbed lands (1.2 percent). A full list of species identified in each plant community during the vegetation study is presented in Table 3-6.

Table 3-6. Plant Species by Habitat Occurrence at the Nichols Ranch ISR Project

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Perennial Grass						
Agropyron cristatum	Crested wheatgrass		X			
Aristida purpurea longiseta	Three-awn	X	X			
Bromus inermis	Smooth brome				X	
Bouteloua gracilis	Blue grama	X	X	X		X
Calamovilfa longifolia	Prairie sandreed	X	X	X		
Distichlis stricta	Inland saltgrass				X	X
Elymus cinereus	Basin wild rye			X		
Elymus intermedium	Intermediate wheatgrass				X	
Elymus spicatus	Bluebunch wheatgrass	X	X	X		X
Elymus smithii	Western wheatgrass	X	X		X	X
Hordeum jubatum	Foxtail barley		X		X	
Koeleria macrantha	Prairie junegrass	X	X	X	X	X
Poa secunda	Sandberg bluegrass	X	X	X	X	X
Poa spp.	Bluegrass species			X	X	
Oryzopsis hymenoides	Indian ricegrass	X	X	X		X
Sporobolus airoides	Alkali Sacaton				X	X
Stipa comata	Needle-and-thread	X	X	X		X
Stipa viridula	Green needlegrass	X	X			
Unknown perennial grass	--			X	X	

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Annual Grasses						
Festuca octoflora	Six-week fescue	X	X			
Bromus japanicus	Japanese brome	X	X	X		X
Bromus tectorum	Cheatgrass (Downy brome)	X	X	X	X	X
Other Grasslike Species						
Carex filifolia	Threadleaf sedge	X	X	X	X	X
Carex praegracilis	Clustered field sedge				X	
Equisetum spp.	Scouring rush				X	
Juncus balticus	Baltic rush				X	
Perennial Forb						
Achillea millefolium	Yarrow			X	X	
Arenaria hookeri	Sandwort			X		
Asclepias specious	Milkweed			X	X	
Astralagus bisulcatus	Two-groove milkvetch	X	X	X	X	
Cirsium arvense	Canada thistle			X	X	
Chaenactis douglasii	Chaenactis			X		
Cryptantha flava	Cryptantha					
Eriogonium ovalifolium	Oval-leaf desert buckwheat	X				
Eriogonium spp.	Buckwheat		X			
Grindellia squarosa	Curlycup gumweed				X	
Haplopappus acaulis	Goldenweed		X	X		
Heterotheca villosa	Golden aster		X	X		
Iva axillaris	Poverty sumpweed	X			X	X
Lupinus spp.	Lupine	X		X		
Lygodesmia juncea	Skeletonweed	X	X			
Melilotus officinalis	Yellow sweetclover					
Phlox hoodii	Hood's phlox		X			X
Psoralea tenuiflora	Scurfpea	X	X	X		
Sphaeralcea coccinea	Globe mallow		X	X		X
Unknown forb	--				X	
Unknown aster	--				X	

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Yucca glauca	Yucca		X			
Annual Forbs						
Alyssum parvifolia	Alyssum	X	X	X	X	X
Descurainia sophia	Flixweed tansymustard				X	
Kochia scoparia	Summer cypress				X	X
Lappula redowski	Blue-seed stickseed	X		X		
Madia glomerata	Tarweed				X	
Plantago patagonia	Wooley plantain	X	X		X	X
Unknown annual forb	--		X		X	
Subshrub						
Artemisia frigida	Fringed sage	X	X	X	X	
Artemisia pedatifida	Birdfoot sage					X
Leptodactylon pungens	Granite prickly gila	X	X	X		
Gutierrezia sarothrae	Broom snakeweed	X	X	X		
Succulent						
Opuntia polyacantha	Pricklypear cactus	X	X	X		X
Shrub						
Artemisia cana	Silver sagebrush	X	X	X	X	X
Artemisia tridentata wyomingensis	Wyoming big sagebrush	X	X	X		X
Atriplex gardneri	Gardner's saltbrush					X
Cercocarpus montanus	Mountain mahogany	X		X		
Chrysothamnus nauseosus	Rubber rabbitbrush		X	X		
Chrysothamnus viscidiflorus	Douglas rabbitbrush			X		X
Krascheninnikovia lanata	Winterfat	X	X	X	X	
Rhus tribolata	Skunkbrush			X		
Sarcobatus vermiculatus	Greasewood					
Symphoricarpos occidentalis	Snowberry			X		

Scientific Name	Common Name	Sagebrush Shrubland	Mixed Grassland	Juniper Outcrop	Bottomland	Greasewood Shrubland
Trees						
Juniperus scopulorum	Rocky Mountain juniper			X		
Pinus flexilis	Limber pine			X		
Populus deltoides	Plains cottonwood	X			X	
Source: Uranerz, 2007						

No federal threatened, endangered, candidate, or proposed plant species are known to occur on or in the vicinity of the proposed Nichols Ranch ISR Project site. A number of State-listed species are known to occur on and in the vicinity of the site and are discussed in more detail in Section 3.6.3. One designated noxious weed species, Canada thistle (*Cirsium arvense*), was found during surveys conducted by Uranerz (2007) in disturbed areas and in small numbers.

3.6.1.2 *Wildlife*

Uranerz conducted wildlife inventories on the proposed project site and surrounding 3.2-km (2.0-mi) radius in April, May, June, and July 2006 and February 2007 (Uranerz, 2007). The wildlife inventories included a big game winter survey, greater sage-grouse lek monitoring, raptor nest activity and productivity surveys, prairie dog colony mapping, federal threatened, endangered, candidate, or proposed species surveys, bald eagle winter roost and nesting surveys, surveys for sensitive species or their habitat, and incidental wildlife observations (big game, birds, mammalian predators, small mammals, reptiles, and amphibians).

The vegetative communities on the proposed Nichols Ranch ISR Project site have the potential to provide habitat for a great diversity of wildlife. Predominant species include mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra Americana*), jackrabbit (*Lepus townsendii*), cottontail rabbit (*Sylvilagus audubonii*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), sage-grouse (*Centrocercus urophasianus*), gray partridge (*Perdix perdix*) and a number of small mammals, songbirds, and raptors. Most species are yearlong residents of Wyoming. However, during migration periods, some species such as elk, eagles, songbirds, and waterfowl are more abundant (Uranerz, 2007). Wildlife species that were identified during the wildlife inventories conducted by Uranerz are listed in Table 3-7. The characterization of the predominant wildlife species in the wildlife inventories is consistent with the Draft Environmental Impact Statement (EIS) for the Wright Area Coal Lease Applications (BLM, 2009a), which analyzes lands in Campbell County.

3.6.1.2.1 Big Game

Uranerz (2007) conducted a formal big game winter survey in February 2007, which included the proposed project area and land within a 1.6-km (2-mi) radius. The survey was completed in accordance with WDEQ and Wyoming Game and Fish Department (WGFD) guidelines, and wildlife biologists recorded the number of individuals, sex, age composition, and habitat type for each group of big game observed within this area. Additionally, Uranerz (2007) conducted opportunistic big game surveys in conjunction with other wildlife surveys in 2006 and 2007.

Table 3-7. Wildlife Species Observed Near the Nichols Ranch ISR Project

Scientific Name	Common Name
Mammals	
Antilocapra americana	pronghorn antelope
Canis latrans	coyote
Cynomys ludovicianus	black-tailed prairie dog
Erethizon dorsatum	porcupine
Lepus townsendii	White-tailed jackrabbit
Lynx rufus	bobcat
Odocoileus hemionus	mule deer
Spermophilus tridecemlineatus	thirteen-lined ground squirrel
*Sylvilagus audubon*i	desert cottontail
Sylvilagus nutallil	mountain cottontail
Taxidea taxus	badger
Vulpes velox	swift fox
Birds	
Anas platyrhynchos	mallard
Aquila chrysaetos	golden eagle
Asio otus	long-eared owl
Bubo virginianus	great horned owl
Buteo jamacensis	red-tailed hawk
Buteo lagopus	rough-legged hawk
Centrocercus urophasianus	greater sage-grouse
Eremophila alpestris	horned lark
Falco mexicanus	prairie falcon
Falco sparverius	American kestrel
Haliaeetus leucocephalus	bald eagle
Perdix perdix	gray partridge
Pica pica	black-billed magpie
Spizella breweri	Brewer's sparrow
Reptiles	
Coluber constricter flaviventris	Eastern yellowbelly racer
Crotalus viridis viridis	Prairie rattlesnake
Pituophis melanoleucas sayi	Bullsnake
Source: Uranerz, 2007	

Two species of big game, pronghorn antelope and mule deer, were observed during the survey; a total of 460 and 322 individuals were recorded, respectively. Pronghorn antelope were mainly observed in mixed grassland and sagebrush shrubland vegetation types. The proposed project area lies within habitat designated by the WGFD as winter/yearlong and yearlong range for pronghorn antelope. The pronghorn antelope herd in this area is identified by the WGFD as the Pumpkin Buttes Antelope Herd Unit, which occupies a total of 2,485 km^2 (1,544 mi^2) and has been above the objective population size (18,000 individuals) since 1999 (WGFD, 2005a in Uranerz, 2007). There are no crucial pronghorn ranges within the project area. The nearest crucial range for pronghorn occurs approximately 63 km (39 mi) south of the proposed project area (University of Wyoming, 2008).

Mule deer were generally observed in mixed sagebrush grassland and juniper outcrop vegetation types. The mule deer population in this area is indentified by the WGFD as the Pumpkin Buttes Mule Deer Herd Unit, and it occupies 4,355 km^2 (2,706 mi^2) (WGFD, 2005a in Uranerz, 2007). This population was slightly below the objective population size of 11,000 individuals in 2005 and 2006 (WGFD, 2005a in Uranerz, 2007). The proposed project area lies within habitat designated as winter/yearlong and yearlong range for mule deer. There are no crucial mule deer ranges within the proposed project area. The nearest mule deer crucial winter range occurs approximately 77 km (48 mi) southwest of the proposed project area (University of Wyoming, 2008).

3.6.1.2.2 Upland Game Birds

During the wildlife inventories conducted by Uranerz, two species of upland game birds, the greater sage-grouse and gray partridge, were recorded on the proposed Nichols Ranch ISR Project site. No sage-grouse mating grounds, referred to as leks, are within the proposed project area. However, ten greater sage-grouse leks exist within a 3.2-km (2-mi) radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). Sage-grouse is a State of Wyoming species of concern and BLM-designated sensitive species and is discussed in more detail in Section 3.6.3. Uranerz conducted a formal survey for greater sage-grouse lek activity in April 2006, which is also discussed in Section 3.6.3. Uranerz did not complete any other formal surveys for upland game birds.

University of Wyoming (2006), Wyoming Natural Diversity Database (WYNDD) reports requested by Uranerz did not indicate the potential presence of any other species of upland game birds in the vicinity of the site.

3.6.1.2.3 Raptors

Uranerz (2007) conducted raptor nesting activities in April and May 2006 as part of the wildlife inventories. Follow-up productivity surveys for nests determined to be active were conducted in June 2006 (Uranerz, 2007). A winter bald eagle winter roost survey was conducted in January and February 2007, which is discussed in more detail in Section 3.6.3. Additionally, incidental sightings of raptor species was recorded during other portions of the 2006 and 2007 wildlife inventories.

Six raptor species were observed during the wildlife inventories: the red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), long-eared owl (*Asio otus*), great horned owl (*Bubo virginianus*), and the rough-legged hawk (*Buteo lagopus*) (Uranerz, 2007). All but the rough-legged hawk were determined to have active nests in the area. A total of 40 raptor nests were identified within the 3.2-km (2.0-mi) radius. Ten of these nests were determined to be active, and the remaining 30 nests were inactive or abandoned by an undetermined species. Nine of the active nests (3 red-tailed hawks, 3 long-eared owls, and 3 great horned owls) are located in the Hank Unit, and the remaining active nest (golden eagle) is located in the Nichols Ranch Unit. The red-tailed hawks nests were located in isolated cottonwood trees within drainages. The long-eared owls' nests were in juniper trees. The great horned owl nest was located in a cliff/bank of an incised drainage. The active golden eagle nest was observed in a cottonwood tree. Uranerz (2007) will not remove the trees with identified active nests during project activities.

3.6.1.2.4 Waterfowl and Shorebirds

Limited habitat exists on or in the vicinity of the proposed Nichols Ranch ISR Project site for waterfowl and shorebirds. Four wetlands (totaling 0.5 ha [1.2 ac] in size) occur within the southeast portion of the Nichols Ranch Unit, three of which are linear, palustrine depressions found within the Cottonwood Creek floodplain, and the fourth of which is also in the Cottonwood Creek floodplain and occurs downstream of an overflowing stock tank associated with ranching operations (Uranerz, 2007). These wetlands are discussed in more detail in Section 3.5.1.5. A small pond on the Nichols Ranch Unit and small man-made stock ponds within the vicinity of the site provide seasonal sources of water (Uranerz, 2007). No open-water systems occur on the Hank Unit that could be utilized by waterfowl or shorebirds. Because such limited habitat occurs on or in the vicinity of the site, Uranerz did not conduct formal surveys for waterfowl or shorebirds; however, incidental sightings were recorded during the course of the wildlife inventories conducted in 2006 and 2007. Only one mallard duck (*Anas platyrhynchos*) was observed in a stock pond on the Nichols Ranch Unit (Uranerz, 2007).

University of Wyoming (2006), WYNDD reports requested by Uranerz indicate that the following additional waterfowl and shorebird species or populations may be found in the vicinity of the site: the sandhill crane (*Grus canadensis*), American avocet (*Recurvirostra americana*), black tern (*Chlidonias niger*) breeding colonies, and American dipper (*Cinclus mexicanus*). None of these species were recorded during the wildlife inventories; however, this does not preclude their potential occurrence on or in the vicinity of the proposed site.

Sandhill cranes can be found throughout Wyoming in spring and summer months. Two distinct populations of sandhill cranes have been identified in Wyoming: the Rocky Mountain Population and the Mid-Continental Population (WGFD, 2005e). Any sandhill crane individuals seen on the proposed Nichols Ranch ISR Project site would most likely be from the Mid-Continental Population as this population occupies the eastern portion of the state. The WGFD issues one-year limited quota sandhill crane permits to hunters as an effort to regulate the State's population.

The American avocet is designated as a Level III, Local Interest, species by the *Wyoming Bird Conservation Plan* (Nicholoff, 2003). The species is found through Wyoming in marshes, ponds, and wet meadows and feeds on aquatic invertebrates, small fish, insects, and seeds (Nicholoff, 2003). Because the wetland and open water areas on the proposed Nichols Ranch ISR Project site and surrounding vicinity are small in size and seasonal, they do not support aquatic life, and would, therefore, not provide the diet necessary for this species. Though the American avocet is unlikely to inhabit the proposed Nichols Ranch ISR Project site, this species may migrate through the area.

The black tern is listed as a Level I, Conservation Action, also referred to as migratory bird species of management concern, by the *Wyoming Bird Conservation Plan* (Nicholoff, 2003). The black tern occurs across Wyoming in small, loose colonies and most commonly nests in emergent wetlands with cattail (*Typha* spp.) or bulrush (*Scirpus* spp.). The species prefers marshes or series of marshes greater than 20 ha (50 ac) in size (Nicholoff, 2003); therefore, the proposed Nichols Ranch ISR Project site is unlikely to provide sufficient habitat for this species, though some individuals may migrate through the site.

The American dipper is listed as a Level II, Monitoring, species by the *Wyoming Bird Conservation Plan* (Nicholoff, 2003). This species requires rapidly flowing mountain streams near coniferous forest and is unlikely to inhabit the proposed Nichols Ranch ISR Project site.

3.6.1.2.5 Nongame/Migratory Birds

Uranerz (2007) recorded incidental sightings of nongame/migratory birds during 2006 and 2007 wildlife inventories but did not conduct any formal surveys specifically for these species. Three species were observed during the wildlife inventories: the horned lark (*Eremophila alpestris*), black-billed magpie (*Pica pica*), and Brewer's sparrow (*Spizella pusilla*). The Brewer's sparrow is a State of Wyoming species of concern and a BLM-designated sensitive species and is discussed in more detail in Section 3.6.3.

University of Wyoming (2006), WYNDD reports requested by Uranerz indicate that the following additional nongame/migratory bird species may be found in the vicinity of the site: the Williamson's sapsucker (*Sphyrapicus thyroideus*), canyon wren (*Catherpes mexicanus*), and chimney swift (*Chaetura pelagica*). The Williamson's sapsucker is designated as a Level II, Monitoring, species by the *Wyoming Bird Conservation Plan* (Nicholoff, 2003). This species inhabits coniferous forests and aspen stands and is unlikely to occur within the vicinity of the Nichols Ranch ISR Project site. The canyon wren is designated as a Level III, Local Interest, species by the *Wyoming Bird Conservation Plan* (Nicholoff, 2003). The species generally inhabits cliffs, canyons, and rock outcrops in pine-juniper and woodland-chaparral habitat (Nicholoff, 2003). The chimney swift has no designation within the State of Wyoming.

Additional nongame/migratory birds with a protected status that have the potential to occur on or in the vicinity of the site are listed in Section 3.6.3.

3.6.1.2.6 Other Mammals

Uranerz (2007) recorded incidental sightings of mammals during 2006 and 2007 wildlife inventories but did not conduct any specific formal surveys. Three species of mammalian predators were observed within a 3.2-km (2.0-mi) radius of the proposed Nichols Ranch ISR Project site: bobcat (*Lynx rufus*), badger (*Taxidea taxus*), and coyote (*Canis latrans*). In addition, a swift fox (*Vulpes velox*) was observed approximately 8 km (5 mi) east of the proposed site.

Desert cottontails (*Sylvilagus audubonii*) and white-tailed jackrabbits (*Lepus townsendii*) were observed in all types of vegetative communities; however, both species were observed in highest concentration near disturbed areas, which included existing CBM well pads, a CBM compression station, and along existing roads. During the wildlife inventories, an outbreak of Tularemia, an infectious bacterial disease, was confirmed by a Wyoming State Lab biologist to be present within the rabbit population. Outbreaks of this disease, caused by the bacterium *Francisella tularensis*, are found primarily in rodent populations, and documented cases occur in Wyoming nearly every year (WGFD, 2006b).

Additional mammal species observed within the vicinity of the site include ground squirrels (*Spermophilus tridecemlineatus*) and black-tailed prairie dogs (*Cynomys ludovicianus*) (Uranerz, 2007). A total of 381.1 ha (941.8 ac) of black-tailed prairie dog colonies occur on or within a 3.2-km (2-mi) radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). Black-tailed prairie dogs are a State of Wyoming species of concern and are discussed in more detail below in Section 3.6.3.

3.6.1.2.7 Reptiles and Amphibians

Uranerz (2007) recorded incidental sightings of reptiles and amphibians during 2006 and 2007 wildlife inventories but did not conduct any specific formal surveys. Two species of reptiles were observed: the prairie rattlesnake (*Crotalus viridis*) and bullsnake (*Pituophis melanoleucas sayi*). Prairie rattlesnakes were observed in juniper outcrop and bottomland vegetation. One bullsnake was observed along a road in the northern portion of the Hank Unit.

Additional protected reptile and amphibian species that may occur in the vicinity of the proposed site are listed in Section 3.6.3.

3.6.2 Aquatic Ecology

The majority of the surface water features on the proposed project area are ephemeral streams and washes that maintain flow during snow melt or major summer storms. Four small wetlands with man-made ponds are located within one of the channels in the southeast corner of the Nichols Ranch Unit. These wetlands and ponds are seasonal in nature, and thus do not provided a year-round source of surface water sufficient to maintain a population of aquatic species. The wetlands, specifically, are discussed in more detail in Section 3.5.1.

3.6.3 Protected Species

Table 3-8 presents species that are Federally-listed under the *Endangered Species Act of 1973* (ESA), State-listed under the Final Comprehensive Wildlife Conservation Strategy for Wyoming, and/or BLM-listed as sensitive species[5] and occur in Campbell and Johnson Counties. No Federally-listed species are known to occur on or in the vicinity of the proposed Nichols Ranch ISR Project site; however, potential habitat for the black-footed ferret (*Mustela nigripes*) exists on the Nichols Ranch Unit and in the vicinity of the Hank Unit. Of the State-listed species, black-tailed prairie dog (*Cynomys ludovicianus*), greater sage-grouse (*Centrocercus urophasianus*), and swift fox (*Vulpes velox*) are known to occur on or in the vicinity of the site and were observed during the wildlife inventories conducted by Uranerz (2007). These species are discussed in more detail below.

Table 3-8. Federally and State-Listed Species at the Nichols Ranch ISR Project

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County of Occurrence[c]
Amphibians				
Ambystoma tigrinum	tiger salamander	–	SGCN	CAM; JOH
Bufo cognatus	Great Plains toad	–	SGCN	CAM
Rana pipiens	northern leopard frog	–	SGCN; BLM-SS	CAM; JOH
Rana pretiosa	spotted frog	–	BLM-SS	CAM; JOH
Rana sylvatica	wood frog	–	SGCN	JOH
Birds				
Accipiter gentilis	northern goshawk	–	SGCN; BLM-SS	JOH
Aegolius funereus	boreal owl	–	SGCN	JOH
Ammodramus bairdii	Baird's sparrow	–	BLM-SS	CAM; JOH
Ammondramus savannarum	grasshopper sparrow	–	SGCN	CAM; JOH

[5] BLM Wyoming has enacted the Sensitive Species Policy and List to focus species management efforts within BLM lands and ensure that actions authorized, funded, or carried out by BLM do not contribute to the need for any species to become listed under the *Endangered Species Act*.

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County of Occurrence[c]
Amphispiza belli	sage sparrow	–	SGCN; BLM-SS	CAM; JOH
Asio flammeus	short-eared owl	–	SGCN	CAM; JOH
Athene cunicularia	burrowing owl	–	SGCN; BLM-SS	CAM; JOH
Buteo regalis	ferruginous hawk	–	SGCN; BLM-SS	CAM; JOH
Calcarius mccownii	McCown's longspur	–	SGCN	CAM; JOH
Calcarius ornatus	chestnut-collared longspur	–	SGCN	CAM
Centrocercus urophasianus	greater sage-grouse	–	SGCN; BLM-SS	CAM; JOH
Charadrius montanus	mountain plover	–	SGCN	CAM; JOH
Coccyzus americanus	yellow-billed cuckoo	–	SGCN; BLM-SS	JOH
Cygnus buccinator	trumpeter swan	–	BLM-SS	CAM; JOH
Dolichonyx oryzivorus	boblink	–	SGCN	CAM
Egretta thalus	snowy egret	–	SGCN	JOH
Falco peregrinus anatum	American peregrine falcon	DL	SGCN; BLM-SS	CAM; JOH
Gaviea immer	common loon	–	SGCN	JOH
Haliaeetus leucocephalus	bald eagle	DL	SGCN	CAM; JOH
Lanius ludovicianus	loggerhead shrike	–	BML-SS	CAM; JOH
Numenius americanus	long-billed curlew	–	SGCN; BLM-SS	CAM
Nycticorax nycticorax	black-crowned night-heron	–	SGCN	CAM; JOH
Oreoscoptes montanus	sage thrasher	–	BLM-SS; SGCN	CAM; JOH
Plegadis chihi	white-faced ibis	–	BLM-SS	CAM; JOH
Rallus limicola	Virginia rail	–	SGCN	JOH
Sitta pygmaea	pygmy nuthatch	–	SGCN	CAM; JOH
Spizella breweri	Brewer's sparrow	–	BLM-SS; SGCN	CAM; JOH
Fish				
Hiodon alosoides	goldeye	–	SGCN	JOH
Hybognathus argyritis	western silvery minnow	–	SGCN	CAM; JOH
Macrhybopsis gelida	sturgeon chub	–	SGCN	CAM; JOH
Oncorhynchus clarki bouvieri	Yellowstone cutthroat trout	–	BLM-SS	CAM; JOH
Scaphirhynchus platorynchus	shovelnose sturgeon	–	SGCN	CAM; JOH
Stizostedion canadense	sauger	–	SGCN	CAM; JOH

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County of Occurrence[c]
Mammals				
Corynorhinus townsendii	Townsend's big-eared bat	–	BLM-SS; SGCN	CAM; JOH
Cynomys leucurus	white-tailed prairie dog	–	SGCN	JOH
Cynomys ludovicianus	black-tailed prairie dog	–	SGCN	JOH
Euderma maculatum	spotted bat	–	BLM-SS	CAM; JOH
Lasionycteris noctivagans	silver-haired bat	–	SGCN	CAM; JOH
Lasiurus cinereus	hoary bat	–	SGCN	CAM; JOH
Lontra canadensis	river otter	–	SGCN	JOH
Martes pennanti	fisher	–	SGCN	JOH
Microtus richardsoni	water vole	–	SGCN	JOH
Mustela nigripes	black-footed ferret	E	SGCN	CAM; JOH
Mustela nivalis	least weasel	–	SGCN	JOH
Myotis ciliolabrum	western small-footed myotis	–	SGCN	JOH
Myotis evotis	long-eared myotis	–	BLM-SS; SGCN	CAM; JOH
Myotis thysanodes	fringed myotis	–	BLM-SS; SGCN	JOH
Myotis volans	long-legged myotis	–	SGCN	JOH
Perognathus fasciatus	olive-backed pocket mouse	–	SGCN	CAM; JOH
Sorex haydeni	Hayden's shrew	–	SGCN	JOH
Sorex nanus	dwarf shrew	–	SGCN	CAM; JOH
Vulpes velox	swift fox	–	BLM-SS; SGCN	CAM; JOH
Reptiles				
Coluber constrictor flaviventris	eastern yellowbelly racer	–	SGCN	CAM; JOH
Plants				
Anemone narcissiflora ssp. zephyra	zephyr windflower		PSC	JOH
Arnica lonchophylla	northern arnica	–	PSC	JOH
Cymopterus williamsii	Williams' waferparsnip	–	BLM-SS; PSC	JOH
Cypripedium montanum	mountain lady-slipper	–	PSC	JOH
Draba fladnizensis var. pattersonii	white artiv whitlow grass	–	PSC	JOH
Festuca hallii	Hall's fescue	–	PSC	JOH
Juncus triglumis var. triglumis	three-flower rush	–	PSC	JOH

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County of Occurrence[c]
Papaver kluanense	alpine poppy	–	PSC	JOH
Parnassia kotzebuei	Kotzebuei's grass-of-parnassus	–		JOH
Pedicularis contorta var. ctenophore	coil-breaked lousewort	–	PSC	JOH
Penstemon haydenii	blowout penstemon	E	–	CAM; JOH
Physaria lanata	woolly twinpod	–	PSC	CAM; JOH
Polygala verticillata	whorled milkwort	–	PSC	CAM
Polygonum spergulariiforme	fall knotweed	–	PSC	JOH
Potamogeton amplifolius	large-leaved pondweed	–	PSC	JOH
Psilocarphus brevissimus	dwarf woolly-heads	–	PSC	CAM
Puccinellia cusickii	Cusick's alkali-grass	–	PSC	JOH
Pyrrocoma clementis var. villosa	hairy tranquil goldenweed	–	HCP	JOH
Rubus acaulis	northern blackberry	–	PSC	JOH
Schoenoplectus heterochaetus	slender bulrush	–	PSC	CAM
Sesuvium verrucosum	sea purslane	–	PSC	CAM
Spiranthes diluvialis	ute ladies'-tresses	T	–	CAM; JOH
Sporobolus compositus	longleaf dropseed	–	PSC	CAM
Triodanis leptocarpa	slim-pod Venus' looking-glass	–	PSC	CAM

[a] DL = delisted; E = endangered; T = threatened; – = not listed.
[b] BLM-SS = BLM Wyoming-designated Sensitive Species; PSC = plant species of concern, as designated by the WYNDD; SGCN = species of greatest conservation need, as designated by the WGFD
[c] CAM = Campbell County, Wyoming; JOH = Johnson County, Wyoming

Sources: BLM, 2002; FWS, 2008b; USDA, 2009; WGFD, 2005b; WYNDD, 2003; WYNDD, 2007

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*), which was delisted from the Federal List of Endangered and Threatened Wildlife in July 2007 (72 FR 37346), is known to occur within the vicinity of the project. Numerous bald eagles were observed during the wildlife inventories conducted by Uranerz (2007). A raptor nest inventory was conducted in April and May of 2006 to determine the presence of raptor nests onsite. Additionally, in January and February of 2007, three specific bald eagle winter roost site surveys were conducted that included land within a 0.6-km (1-mi) radius of the proposed Nichols Ranch ISR Project site. No roosts exist within the surveyed area; however one winter roost was identified from available BLM data and is located 7.2 km (4.5 mi) southwest of the Nichols Ranch Unit (Uranerz, 2007). The closest known nest is about 16 km (10 mi) west of the site along the Powder River (Uranerz, 2007). The species continues to be protected at the national level by the *Bald and Golden Eagle Protection Act*, as well as the *Migratory Bird Treaty Act*, and at the State level as a species of concern. The bald eagle is a large raptor species with a white head and tail, brown body feathers and is generally associated with lakes and other large, open bodies of water. Bald eagles prey on fish, small mammals, birds, and occasionally carrion.

Black-Footed Ferret

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

The black-footed ferret is a small mammal in the weasel family with a natural to buff-colored body and black face, feet, and tail. Adults are 46 to 61 cm (18 to 24 in) long and weigh 0.7 to 1.1 kg (1.5 to 2.5 lbs), with males generally larger than females (FWS, 2009). Generally, black-footed ferret occurrence coincides with prairie dog habitat (black-tailed [*Cynomys ludovicianus*], Gunnison's [*C. gunnisoni*], and white-tailed [*C. leucurus*]) because prairie dog is the main prey of the ferret, and the ferret also uses prairie dog burrows for shelter (FWS, 2008a). Black-footed ferrets are more likely to occur in black-tailed prairie dog habitat than in other prairie dog species' habitat; historically, it is estimated that 85 percent of all black-tailed ferrets occurred in black-tailed prairie dog habitat, 8 percent in Gunnison's prairie dog habitat, and 7 percent in white-tailed prairie dog habitat (FWS, 2008a).

Within and in the vicinity of the proposed Nichols Ranch ISR Project site, 11 black-tailed prairie dog colonies totaling 381.1 ha (941.8 ac) (discussed in more detail below) were identified by Uranerz (2007) during wildlife inventories conducted in 2006 and 2007. In a 2004 letter (FWS, 2004a), the FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations. Incidental takes of individual ferrets in black-tailed prairie dog habitat, which is "block cleared," is considered by the FWS to not be an issue and would not result in an effect on any wild population. However, this block clearance does not relieve federal agencies of the need to assess a proposed action's effect on the species' survival and recovery. Further, the FWS directs federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2004a).

No black-footed ferrets have been identified on the proposed Nichols Ranch ISR Project site (Uranerz, 2007). The FWS has not designated any critical habitat for the species (FWS, 2009). However, due to the presence of black-tailed prairie dog habitat, the NRC initiated informal consultation with the FWS to ensure that the provisions of the ESA are upheld regarding the black-footed ferret. This informal consultation is discussed in more detail in Section 4.6.1.1.3.

Black-Tailed Prairie Dog

The black-tailed prairie dog (*Cynomys ludovicianus*) is a State of Wyoming species of concern. The species is a small, diurnal ground squirrel that is endemic to North America and occurs throughout the Great Plains region. In Wyoming, the black-tailed prairie dog inhabits dry, flat, open, short and mixed-grass prairie within the eastern third of the state (WGFD, 2005d). Adults weigh 0.5 to 1.4 kg (1 to 3 lbs) and are 36 to 43 cm (14 to 17 in) in length. Coloring can vary from a mixture of brown, black, grey, and white, though the black-tipped tail is characteristic of the species. Black-tailed prairie dogs live in family groups within large colonies (FWS, 2000). The black-tailed prairie dog is preyed upon by a number of species including the black-footed ferret, swift fox, mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*), all of which are Federally- or State-listed species.

Black-tailed prairie dog colony mapping completed as part of the wildlife inventory conducted by Uranerz (2007) indicates that a total of 381.1 ha (941.8 ac) of prairie dog colonies occur on or within a 3.2-km (2-mi) radius of the proposed Nichols Ranch ISR Project site, 144.3 ha (356.5 ac) of which are on the site, itself. Eleven colonies were identified, the largest of which occurs within the Nichols Ranch Unit. One colony borders the western boundary of the Hank Unit and the rest of the colonies lie between the two units as well as to the west of the Nichols Ranch Unit. Within the state of Wyoming, the major threat to this species are habitat degradation, habitat loss, human conflict/disturbance, and unregulated take/mortality (WGFD, 2005d).

Blowout Penstemon

The blowout penstemon (*Penstemon haydenii*) is Federally-listed as endangered. The species is a perennial herb that is endemic to the Nebraska Sandhills in north-central Nebraska and to the northeastern region of the Great Divide Basin in Carbon County, Wyoming (Fertig, 2008). The species is found exclusively in sparsely vegetated, early successional, sand dunes or blowout areas at elevations of 1,790 to 2,270 m (5,860 to 7,440 ft) (Fertig, 2008). The proposed Nichols Ranch ISR Project does not have sand dune habitat and is outside of the elevation range in which this species is typically found. This species was not identified during vegetation inventories conducted by Uranerz (2007) and is not known to occur on or in the vicinity of the site.

Brewer's Sparrow

The Brewer's sparrow (*Spizella breweri*) is a State of Wyoming species of concern and a BLM-designated sensitive species. During the wildlife inventories conducted by Uranerz (2007), Brewer's sparrow was observed within a 3.2-km (2-mi) radius of the proposed Nichols Ranch ISR Project site. The species inhabits open sagebrush shrubland across Wyoming and migrates to southern California and south to central Mexico in winter months (Nicholoff, 2003). This species is the smallest of the North American sparrows and is brown to grey in color with a white eye ring (CDNR, 2005). The Brewer's sparrow builds its nest about 1.2 m (4 ft) off the ground at the base of live sagebrush and is commonly parasitized by the common cowbird (*Molothrus ater*) (Nicholoff, 2003). The species is territorial and individual territories range from 0.1 to 2.36 ha (0.25 to 5.8 ac) in size (CDNR, 2005). Habitat fragmentation and sagebrush spraying or removal are the primary threats to this species (Nicholoff, 2003).

Greater Sage-Grouse

The greater sage-grouse (*Centrocercus urophasianus*) is a State of Wyoming species of concern and a BLM-designated sensitive species. The species inhabits open sagebrush plains in the western United States and is found at elevations of 1,200 to 2,700 m (4,000 to 9,000 ft), corresponding with the occurrence of sagebrush habitat (FWS, 2004b). The greater sage-grouse is a mottled brown, black, and white ground-dwelling bird that can be up to 0.6 m (2 ft) tall and 76 cm (30 in) in length (FWS, 2004b). Breeding habitat, referred to as leks, and stands of sagebrush surrounding leks are used in early spring and are particularly important habitat because birds often return to the same leks and nesting areas each year. Leks are generally more sparsely vegetated areas such as ridgelines or disturbed areas adjacent to stands of sagebrush habitat. Threats to this species' survival include loss of habitat, agricultural practices, livestock grazing, hunting, and land disturbances from energy/mineral development and the oil and gas industry (Sage-grouse Working Group, 2006).

The Northeast Wyoming Sage-grouse Working Group oversees the Conservation Plan that includes the proposed Nichols Ranch ISR Project site and the Powder River Basin. The Northeast Wyoming Sage-grouse Working Group estimates that Campbell and Johnson Counties contain 175 and 128 leks, respectively (Sage-grouse Working Group, 2006). According to information gathered from the BLM Buffalo Field Office and WGFD, eight greater sage-grouse leks are located within a 3.2-km (2.0-mi) radius of the proposed Nichols Ranch ISR Project site (Uranerz, 2007). Two additional active leks were identified during formal surveys conducted in April 2006[6], bringing the total number of active leks in the vicinity of the proposed site to ten in 2006 (Uranerz, 2007). Four of the leks averaged less than 15 birds, four of the leks averaged in the range of 15 to 25 birds, and two of the leks averaged over 60 birds (Uranerz, 2007). None of these leks occur on the proposed project site. In July 2006, several females with young were observed in the Dry Willow Drainage north of the Hank Unit (Uranerz, 2007). No greater sage-grouse were observed during the winter survey in February 2007, which indicates that the population of sage-grouse in the vicinity of the proposed project site may be migratory, and therefore, only present near the site during the spring and summer months.

Swift Fox

The swift fox (*Vulpes velox*) is a State of Wyoming species of concern and a BLM-designated sensitive species. The species was removed from the *Endangered Species Act* Candidate List in 2002 due to successful conservation measures and reintroduction efforts in western states. The species is native to the Great Plains region, and in Wyoming, the swift fox inhabits flat terrain east of the Continental Divide with shortgrass or mixed-grass prairie and is often associated with prairie dog colonies (WGFD, 2005f). Individuals are orange to tan in color with pale yellow to white on the throat, chest, and belly, and black on the tail, muzzle, and ears. Adults are 2.3 to 3.2 kg (5 to 7 lbs) in size with males generally larger than females. Its diet includes rabbit, prairie dog, and other small mammals, as well as some small reptiles, berries, and seeds (Defenders of Wildlife, 2009). Swift foxes are nocturnal and use underground dens year-round. Threats to the species' continued survival include loss of prairie habitat, trapping and hunting, and predator control campaigns (WGFD, 2005f). During the wildlife inventories conducted by Uranerz (2007), one swift fox was observed approximately 8 km (5 mi) east of the proposed Nichols Ranch ISR Project site. No swift foxes were observed on the proposed site; however, based on the observation of one individual near the proposed site and the presence of suitable short mixed grassland habitat and prairie dog colonies on and in the vicinity of the proposed project site, the swift fox is likely to inhabit the proposed project site and surrounding area.

Ute Ladies'-Tresses Orchid

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

[6] Formal surveys consisted of visiting each lek three times at sunrise during April 2006 and recording the number of male and female birds at each location (Uranerz, 2007).

areas with ample sunlight (FWS, 2008b). It is characterized by 12- to 50-cm (4.7- to 20-in) stems with linear basal leaves up to 28 cm (11 in) long and spikes of small white to ivory flowers that bloom between early August and early September (Fertig, 2000). Urbanization, livestock grazing, pesticide use, competition with noxious weeds, and loss of pollinators threaten this species survival (Fertig, 2000). This species was not identified during vegetation inventories conducted by Uranerz (2007) and is not known to occur on or in the vicinity of the proposed site.

Additional Species

The following BLM-designated sensitive species and Wyoming species of concern have been recorded as occurring in the vicinity of the site; however, none of these species were observed during the wildlife inventories conducted by Uranerz (2007):

- Burrowing owl (Athene cunicularia)
- Ferruginous hawk (Buteo regalis)
- Loggerhead shrike (Lanius ludovicianus)
- Mountain plover (Charadrius montanus)
- Sage sparrow (Amphispiza belli)
- Sage thrasher (Oreoscoptes montanus)
- Northern leopard frog (Rana pipiens)

3.7 Meteorology, Climatology, and Air Quality

The following sections discuss the meteorology, climatology, and air quality at the proposed project site. See Chapter 5 for a discussion of climate change at the proposed site.

3.7.1 Meteorology and Climatology

The majority of Wyoming is dominated by mountain ranges and rangelands of the Rocky Mountains and high plains, which occupy the westernmost portion of the state and are generally oriented in a north-south direction. Wyoming's mountain ranges generally provide effective barriers to pacific-generated weather systems because they are perpendicular to the prevailing westerly winds, as discussed in Section 3.3.6.1 of the GEIS. Much of the moisture that moves in from the west is dropped along the western slopes, which creates semiarid conditions in the eastern portion of the state. Wyoming's mean elevation is 2,042 m (6,700 ft) AMSL with the highest point, Gannett Peak, at 4,201 m (13,785 ft) and the lowest point at 952 m (3,125 ft) in the northeastern corner of the state near the South Dakota state line. Generally, Wyoming's elevation results in cool temperatures. The fall, winter, and spring months experience frequent variations with rapid change from cold to mild temperatures, and freezes in early fall and late spring create a short growing season (NRC, 2009b).

The proposed Nichols Ranch ISR Project is located at an elevation of 1,653 m (4,750 ft) AMSL and approximately 90 km (56 mi) southeast of the Big Horn Mountains within the Powder River Basin. This basin is characterized by semi-arid plains with low hills and buttes, little vegetation, and few substantial topographical features. The Powder River Basin experiences diverse weather patterns that fluctuate throughout the year, due in large part to its proximity to the Rocky Mountain system and its relatively high elevation. Generally, weather patterns follow those described for the Wyoming East Uranium Milling Region in Section 3.3.6.1 of the GEIS. The majority of precipitation occurs in the spring and summer months with occasional heavy rains or thunderstorms, which can create flash flooding. Table 3-9, below, is taken from the

GEIS (Table 3.3-6) and includes mean temperatures at National Climate Data Centers (NCDCs) in Glenrock, about 120 km (75 mi) south of the proposed Nichols Ranch ISR Project, and Midwest, about 40 km (25 mi) southwest of the proposed Nichols Ranch ISR Project.

3.7.1.1 *Temperature*

As discussed in Section 3.3.6.1 of the GEIS, Wyoming's elevation results in relatively cool temperatures (NRC, 2009b). The Powder River Basin's climate is cold continental with long, dry winters and warm summers. Summer is characterized by high daytime temperatures with cooler night temperatures. The mean temperature in the proposed project area ranges from -5.7 °C (21.7 °F) in January to 21 °C (70.7 °F) in July based on data collected from 1971 to 2000 in Midwest (NOAA, 2004). The average annual maximum temperature is 15.6 °C (60.1 °F) and the average minimum temperature is -0.4 °C (31.2 °F) (Curtis and Grimes, 2004).

Table 3-9. Climate Data for Stations in the Wyoming East Uranium Milling Region

		Glenrock 5 ESE	Midwest
Temperature (°C)[a]	Mean – Annual	8.8	7.5
	Low – Monthly Mean	-3.1	-5.7
	High – Monthly Mean	22.4	21.5
Precipitation (cm)[b]	Mean – Annual	31.0	35.0
	Low – Monthly Mean	0.90	1.4
	High – Monthly Mean	6.1	6.5
Snowfall (cm)	Mean – Annual	58.4	135
	Low – Monthly Mean	0	0
	High – Monthly Mean	13.5	22.6

[a] To convert Celsius (°C) to Fahrenheit (°F), multiply by 1.8 and add 32.
[b] To convert centimeters (cm) to inches (in), multiply by 0.3937.
Source: NCDC, 2004; NRC, 2009b Table 3.3-6

3.7.1.2 *Wind*

As discussed in Section 3.3.6.1 of the GEIS, winter winds in Wyoming may reach 48 to 64 kph (30 to 40 mph) with gusts to 80 to 97 kph (50 to 60 mph) (Uranerz, 2007). Prevailing wind directions vary from west-southwest, west, and northwest. In many localities, winds are so strong and constant that trees (when present) show a definite lean towards the east or southeast. Many wind farms have been established over southern Wyoming in places such as Arlington, Medicine Bow, Rock River and just south of Cheyenne to take advantage of this renewable energy source.

The high plains area near the proposed Nichols Ranch ISR Project site experiences moderate westerly winds throughout the year. These prevailing winds are generated by high pressure systems that originate in the north Pacific and Canadian Rocky Mountains. These systems move east across the mountainous western United States and Canada, where most of the precipitation is released, leaving fairly dry, steady winds that empty into the eastern foothills and plain regions such as the Powder River Basin. Wind data for the proposed project area were obtained from Casper/Natrona County International Airport, approximately 100 km (60 mi) south-southwest of the proposed project area. The spring months exhibit the highest monthly mean wind speeds, with May having a monthly mean high of 16 kph (10 mph), and August having a mean monthly low of 8 kph (5 mph) (Uranerz, 2007).

3.7.1.3 *Precipitation*

As discussed in Section 3.3.6.1 of the GEIS, the precipitation in Wyoming varies with spring and summer being the wettest for the State. The proposed Nichols Ranch ISR Project area receives relatively little rainfall due in large part to the Rocky Mountain range system that effectively blocks moisture from regional weather systems that approach from the west, northwest, and the southwest. Its unique location has helped to shape the desert climate in the area. The mean annual precipitation within the area is approximately 35 cm (14 in) based on data collected in Midwest from 1971 to 2000 (Curtis and Grimes, 2004). Precipitation is generally experienced as intense events with large flow volumes.

3.7.1.4 *Evaporation*

As discussed in Section 3.3.6.1 of the GEIS, the annual evaporation rates in the Wyoming East Uranium Milling Region range from about 102 to 127 cm (40 to 50 in) (NWS, 1982). The low humidity, sunshine, and high winds contribute to a high rate of evaporation. At the proposed Nichols Ranch ISR Project, the annual evaporation rate is likely to be 102 to 114 cm (40 to 45 in) (Uranerz, 2007).

3.7.2 Air Quality

As discussed in Section 3.3.6.2 of the GEIS, the EPA has established air quality standards to promote and sustain healthy living conditions. These standards, known as the National Ambient Air Quality Standards (NAAQS) address carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), ozone, (O_3), and sulfur dioxide (SO_2). Every state is required by EPA to evaluate baseline conditions by conducting an air quality monitoring program. Based upon the results of the monitoring, counties are placed into one of two categories: attainment and nonattainment. Attainment means that the pollutant levels measured do not exceed the NAAQS. All of the areas in the Wyoming East Uranium Milling Region are in attainment (NRC, 2009b). Specific to the proposed Nichols Ranch ISR Project, both Johnson and Campbell Counties where the proposed site is located are classified as attainment areas for all the primary pollutants.

As discussed in Section 3.3.6.2 of the GEIS, Prevention of Significant Deterioration (PSD) requirements identify maximum allowable increases in concentrations for particulate matter, sulfur dioxide, and nitrogen dioxide for areas designated as attainment. There are several different classes of PSD areas with Class I areas having the most stringent requirements. No Class I areas are present in the Wyoming East Uranium Milling Region (NRC, 2009b). Thus, the proposed Nichols Ranch ISR Project is not located in a Class I area and not subject to PSD requirements.

3.8 Noise

According to the GEIS, the estimated ambient noise levels in undeveloped rural and more urban areas of the Wyoming East Uranium Milling Region are 22 to 38 decibels (dBA) (NRC, 2009b). Noise in and around the proposed site is mostly from light automobile and truck traffic related to CBM operations. Uranerz did not take any ambient noise measurements as part of its application. However, Uranerz estimates the ambient noise levels at the proposed site are in the range reported for "farm in valley" sites by Wyle Laboratories (Wyle, 1971) where median noise levels are approximately 29 to 39 dBA, which is similar to the range of that stated in the GEIS. On occasion, high winds and high truck traffic conditions may exist at the project site and Uranerz estimates the noise levels in that situation to range from 50 to 60 dBA. When there is use of agricultural equipment and oil and gas drilling and completion operations in the project area, Uranerz estimates the temporary noise levels to range from 70 dBA to more than 100 dBA (Uranerz, 2007).

The nearest recreational area, the Powder River, is located approximately 14 km (9 mi) to the west of the project area. The nearest residential receptor (Pfister Ranch) is located approximately 0.95 km (0.6 mi) north of the Hank Unit. The Dry Fork Ranch is located approximately 1.4 km (0.9 mi) west of the Nichols Ranch Unit.

3.9 Historical, Cultural, and Paleontological Resources

The historical and cultural resources investigations for the proposed Nichols Ranch ISR Project included archaeological surveys, a paleontological survey, ethnographic review, and tribal consultation. No standing structures were evaluated for the proposed project area; the only structures in the proposed project area are features associated with ranch operations including wells, stock ponds, reservoirs, existing two-track roads, and recently introduced energy development infrastructure.

3.9.1 Cultural History

The archeological cultural sequence for the project is unevenly divided between the prehistoric periods (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The prehistoric periods encompasses about 11,000 years between 12,000 B.P. (before present; A.D. 1950) and 250 B.P. (about A.D. 1700). The protohistoric/historic era extends from about A.D. 1700 to A.D. 1959, which is the 50-year cutoff date for possible inclusion onto the *National Register of Historic Places* (NRHP).

3.9.1.1 *Prehistoric Era*

As mentioned above, the prehistoric periods are divided into Paleoindian, Archaic, and Late Prehistoric. The hallmark artifact forms for Paleoindian period (12,000 to 8,500 B.P.) in the region include, from oldest to youngest, Clovis, Folsom/Goshen, Agate Basin, Hell Gap, Eden, Scottsbluff, and Cody. Paleoindian sites in the region, yielding both Pleistocene megafauna and Paleoindian artifacts, include the James Allen site in southwestern Wyoming; Hell Gap and Agate Basin in eastern Wyoming, located east and southeast of the proposed project area; and Medicine Lodge Creek in central Wyoming. The Paleoindian period comes to a close in the terminal Pleistocene/early Holocene era. The Pleistocene megafauna (e.g., mammoth, muskox) are replaced by modern antelope, bison, deer, and elk. These smaller grazers were better adapted to the change from savannah to grassland communities that resulted from the onset of warmer and drier conditions in the Holocene era. The Archaic period (8,500 to 1,800 B.P.) in eastern and northeastern Wyoming is broken into three subperiods: Early (8,500 to 5,000 B.P.), Middle (5,000 to 3,000 B.P.), and Late (3,000 to 1,500 B.P).

In general, the regional Early Archaic sites are marked by the presence of various side- and corner-notched projectile points and side-notched knives. The subperiod is known for semi-subterranean houses that are usually marked by the presence of one or more hearths, firepits, storage pits, and milling basins. The latter is of particular interest as such features clearly indicate that floral species played an important role in subsistence strategies. Middle Archaic site assemblages reflect a relatively broad spectrum of gathering and hunting responses, with an emphasis on bison procurement. By Late Archaic times, communal bison kills occur and recorded examples contain diagnostic Yonkee points (large corner-notched projectile points), which are the preferred method of felling the bison through the subperiod. Late Archaic faunal assemblages demonstrate the presence of smaller game animals and mid-size ungulates (deer and antelope).

The Late Prehistoric period (1,500 to 300 B.P.) heralds the acceptance of new technologies such as smaller projectile points adapted to use with arrows. Prior to the Late Prehistoric period, the points were hafted on spears. Also introduced at this time is earthenware technology, which improves food preparation techniques. Stewing, braising, and boiling were now possible, which significantly broadened the number of floral and faunal species that could be utilized. Sometime between 1,000 and 600 B.P., there is considerable movement of people into Wyoming from several directions. The Kiowa-Apache and Shoshone-Comanche move into the region first, probably in response to several factors including population pressures from eastern sedentary groups who have partially adapted to horticultural regimes. Between about 600 B.P. (A.D. 1300) and A.D. 1700, the Crow, Cheyenne, and Arapaho all move into Wyoming to pursue their bison-oriented lifestyles.

3.9.1.2 *Protohistoric/Historic Era*

The Protohistoric period dates between about A.D. 1700 and 1840. This period includes the time when European goods and the domesticated horse are introduced into the region. There is no appreciable European presence in the region, with the exception of French fur traders moving up and down the Missouri River. Across the northern High Plains, there was active trading in European material goods, including metal knives, pots, and glass beads. However, Native American goods in similar styles also continued to be produced. The Native American tribes continued to pursue Native traditions into the 1900s in the region though the majority of the tribal members were relocated to the Wind River Reservation.

The Historic era is subdivided into seven periods: Early Historic (A.D. 1801 to 1842), Pre-territorial (A.D. 1843 to 1867), Territorial (A.D. 1868 to 1889), Expansion (A.D. 1890 to 1919), Depression (A.D. 1920 to 1939), World War II (A.D. 1940 to 1946), and Post-World War II (A.D. 1947 to 1959). Various themes have been identified which crosscut the periods. The proposed project area was historically used for cattle ranching with limited oil and gas exploration in the nearby vicinity. There is no indication from the sites identified to date in the proposed project area that there were earlier historic occupations of the area. Thus, at best, historic occupations are limited to the Expansion and post-Expansion periods.

3.9.2 Historic and Cultural Resources Identified and Places of Cultural Significance

Section 106 of the *National Historic Preservation Act of 1966* as amended (NHPA) requires federal agencies to take into account the effects of their undertakings on cultural resources (i.e., archaeological, historical, and traditional properties eligible for or listed in the NRHP). NRC staff reviewed documentation related to past archaeological surveys conducted on behalf of Uranerz for the proposed Nichols Ranch ISR Project and those conducted for CBM companies whose project areas overlap with the proposed Nichols Ranch ISR Project boundaries. These documents included survey reports with determinations of the potential for effects or adverse effects to properties listed on or eligible for listing on the NRHP. The following sections discuss the occurrence of cultural resources at each unit.

3.9.2.1 *Nichols Ranch Unit*

Within the Nichols Ranch Unit, one Class III archaeological survey was conducted by Western Land Services (WLS) for the Tex Draw CBM POD project, which identified 13 archaeological sites. These included 7 prehistoric, 3 historic, and 3 prehistoric/historic sites. Based on the available data, the sites are dominated by artifact scatters though historic building remains are present at Site 48JO2953, which is not eligible for listing on the NRHP. Only 1 of the 13 sites is eligible for listing on the NRHP and is identified in Table 3-10.

Table 3-10. Nichols Ranch Unit Archaeological Sites

Site ID	Site Type	NRHP Finding
48JO2944	Prehistoric: lithic scatter Historic: debris scatter	Not eligible
48JO2946	Prehistoric: open camp	Not eligible
48JO2948	Prehistoric: lithic scatter	Not eligible
48JO2949	Historic: debris scatter	Not eligible
48JO2950	Historic: debris scatter	Not eligible
48JO2953	Prehistoric: lithic scatter Historic: building remains (razed Nichols Ranch)	Not eligible
48JO2957	Prehistoric: lithic scatter	Not eligible
48CA5386	Prehistoric: lithic scatter Historic: hunting blinds and wind breaks	Not eligible
48CA5390	Prehistoric: lithic scatter Historic: debris scatter	Not eligible
48CA5391	Prehistoric: lithic scatter with feature Historic: debris scatter	Eligible
48CA5392	Prehistoric: lithic scatter	Not eligible
48CA5393	Prehistoric: lithic scatter	Not eligible
48CA5406	Prehistoric: lithic scatter	Not eligible
Sources: Brunette, 2007; Uranerz, 2007		

3.9.2.2 *Hank Unit*

Within the Hank Unit, four archaeological Class III surveys have been completed, which identified 23 archaeological sites (Table 3-11). Of the 23 sites, 8 are eligible for listing on the NRHP and are identified in Table 3-11. The past Class III surveys include two conducted by Frontier Archaeology and TRC Environmental Corporation for the proposed Nichols Ranch ISR Project on behalf of Uranerz, one for the Dry Willow I POD project, and one by Arcadis for the Dry Willow 4 POD project. Except for Site 48CA6146/6147, all of the cultural resources identified in the Hank Unit are prehistoric or protohistoric. The single historic component, at Site 38CA6147, is a very small debris scatter consisting of a fragmented clear glass bottle, two cans, and a handful of nails. The debris may have resulted during fence mending or other ranch activities.

The prehistoric sites are marked by the presence of fire-cracked rock (FCR), chipped stone tested cobbles, debris and occasional tools; groundstone; and, at one site, minor amounts of bone. None of the prehistoric sites indicated the presence of temporally diagnostic items such as ceramics or projectile points. The reason for this absence of such sites is unclear, but the artifact assemblages from the sites are suggestive of seasonal processing locations. The presence of stone circles does not preclude seasonal use and the stone circles, possible tepee loci, does hint at Late Prehistoric or Protohistoric occupations. The absence of EuroAmerican goods at any of the sites argues against early Historic occupations by Native American peoples though it is documented that the Pumpkin Buttes have been utilized by Native Americans into the Historic period.

Table 3-11. Hank Unit Archaeological Sites

Site ID	Site Type	NRHP Finding
48CA379	Prehistoric: lithic scatter	Not eligible
48CA6146/ 48CA6147	Prehistoric: lithic, groundstone, and FCR scatter with stone circles. Historic: debris scatter	Eligible
48CA6148	Prehistoric: lithic scatter with stone circles	Eligible
48CA6149	Prehistoric: lithic scatter	Not eligible
48CA6151	Prehistoric: lithic scatter	Not eligible
48CA6342	Prehistoric: lithic scatter with hearth	Not eligible
48CA6343	Prehistoric: lithic scatter with features	Not eligible
48CA6344	Prehistoric: lithic scatter with FCR	Not eligible
48CA6345	Prehistoric: lithic scatter with FCR	Not eligible
48CA6475	Prehistoric: open camp	Eligible
48CA6490	Prehistoric: open camp	Eligible
48CA6491	Prehistoric: lithic scatter	Not eligible
48CA6498	Prehistoric: lithic scatter	Not eligible
48CA6499	Prehistoric: lithic scatter	Not eligible
48CA6748	Prehistoric: lithic scatter with FCR and activity areas	Eligible
48CA6749	Prehistoric: lithic scatter	Not eligible
48CA6750	Prehistoric: lithic scatter with groundstone.	Not eligible
48CA6751	Prehistoric: lithic scatter with activity areas and possible stone circle feature	Eligible
48CA6752	Prehistoric: lithic and FCR scatter	Not eligible
48CA6753	Prehistoric: lithic and FCR scatter	Eligible
48CA6754	Prehistoric: lithic and FCR scatter with FCR concentration	Not eligible
48CA6926	Prehistoric: lithic scatter	Not eligible
48CA6927	Prehistoric: lithic scatter with features	Eligible
Sources: Brunette, 2007; Uranerz, 2007; Brunette, 2006		

3.9.2.3 *Places of Cultural Significance*

The Pumpkin Buttes (Site 48CA268), an NRHP-eligible TCP, is the only documented place of cultural significance near or within the proposed Nichols Ranch ISR Project area, as shown in Figures 1-1 and 2-3. The Pumpkin Buttes are comprised of five individual buttes (North, North

Middle, South Middle, Indian, and South). The western boundary of the North Middle Butte is located within the proposed Hank Unit permit boundary. The TCP boundary for the North Middle Butte is the area between 1,676 m (5,500 ft) AMSL and the top of the butte. Sites 48CA6748 and 48CA6753 are within the TCP boundary and Site 38CA6751 is adjacent to it, all of which are recommended eligible to the NRHP.

The Pumpkin Buttes were identified as eligible to the NRHP (Uranerz, 2007) during investigations not related to the proposed Nichols Ranch ISR Project. The Pumpkin Buttes were determined eligible for the NRHP under Criteria A, B, and C and its conditions of integrity were considered intact (BLM, 2009b). Subsequent to the determination of eligibility, the BLM entered into Memoranda of Agreement (MOA) with the proponents of the Savageton 3/Savageton 4 project (Lance Oil and Gas/Anadarko Petroleum Corporation) and Dry Willow Phase I and II projects (Anadarko Petroleum Corporation). Because of anticipated development within the viewshed of the Pumpkin Buttes, BLM entered into a Programmatic Agreement (PA) with the Wyoming State Historic Preservation Office (SHPO) focused on mitigation of adverse effects for the Pumpkin Buttes TCP from anticipated Federal minerals development (BLM, 2009b). Prior to entering into the agreement, the BLM invited the Blackfeet, Cheyenne River Sioux, Crow, Eastern Shoshone, Fort Peck, Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nation), Northern Arapaho, Northern Cheyenne and Oglala to participate in consultation and to be consulting parties for the resolution of adverse effects to the Pumpkin Buttes. Although the Northern Cheyenne participated in the consultation process for the Savageton 3/Savageton 4 MOA, they and the other tribes chose not to formally comment on the PA. In the PA, the signatory parties noted that "BLM has determined that the development of oil, gas and in-situ uranium well, infrastructure corridors, access roads and other facilities are assumed to have an adverse effect to the contributing integrity of the setting, feeling and association for the Pumpkin Buttes Traditional Cultural Property..." (BLM, 2009b). The PA outlines various measures that must be taken by the proponent to mitigate the adverse effect of their proposed actions on the TCP, which are discussed in Chapter 4.

3.9.3 Tribal Consultation

Consultation with Native American tribes that have heritage interest in the proposed project area is ongoing. As mentioned in Chapter 1, NRC sent Section 106 tribal consultation letters were sent to the following tribes on December 24, 2008: Blackfeet, Cheyenne River Sioux, Crow, Eastern Shoshone, Ft. Peck Assiniboine/Sioux, Northern Arapaho, Northern Cheyenne, Oglala Sioux, and Three Affiliated Tribes (the Mandan, Hidatsa, and Arikara Nation). By email dated February 12, 2009, Mr. Conrad Fisher of the Northern Cheyenne Tribal Historic Preservation Office (NCTHPO) responded to the December 24 request. Fisher noted that the Pumpkin Buttes are considered spiritual and ceremonial areas and that contaminants related to uranium extraction, traffic, noise, and dust pollution may affect the overall condition of the area (NCTHPO, 2009). To date, no other responses have been received.

3.9.4 Paleontological Resources

A paleontological survey was conducted for the proposed project area on behalf of Uranerz. The survey identified Quaternary sediments and exposed Eocene deposits of the Wasatch Formation. These deposits are fossil bearing and vertebrate, invertebrate, and petrified wood specimens were identified in the Nichols Ranch Unit and Hank Unit areas. The survey results summarized the identification of unidentified mammal, gar, turtle, and petrified wood in the Nichols Ranch Unit. In the Hank Unit, fossil materials were recovered from the slope of the North Middle Butte and included unidentified bone, turtle, and petrified wood.

3.10 Visual and Scenic Resources

In general, this region of the Powder River Basin in which the proposed Nichols Ranch ISR Project is located is characterized as basin and range country with prominent buttes and ridges interspersed by rolling grasslands. The Pumpkin Buttes, which flank the northern and southeastern boundaries of the Hank Unit are recognized by the BLM as a TCP, which is discussed in more detail in Section 3.10.3. Semi-permanent streams are fed by intermittent and ephemeral drainages which seasonally drain the adjacent uplands. Past changes to land surfaces include those associated with human habitation, the development of stock ponds and reservoirs; access roads; and the introduction of gas, oil, and other energy development infrastructure.

The BLM evaluates the scenic quality of the land it administers through a Visual Resource Inventory to ensure that the scenic (visual) value is preserved. As part of this inventory, the BLM completes a scenic quality evaluation, a sensitivity level analysis, and a delineation of distance zones in order to group areas into one of four visual resource management (VRM) classes. Class I is the most protected of visual and scenic resources and Class IV is the least restrictive.

The BLM has established VRM classifications and has resource management plans for all of the Wyoming East Uranium Milling Region, which includes the entire Nichols Ranch and Hank Units (NRC, 2009b). The VRM classifications for the region are shown in Figure 3.3-17 of the GEIS (NRC, 2009b). In the past, the landscape has been extensively modified in urban areas and in several rural areas by oil, natural gas, and coal production. The bulk of the Wyoming East Uranium Milling Region is categorized as VRM Class III (along highways) and Class IV (open grassland, oil and natural gas, urban areas). The BLM resource management plans for this region do not identify any VRM Class I resources.

The area considered for visual resources associated with the proposed Nichols Ranch ISR Project includes the project site, access roads, and a 3.2-km (2-mi) buffer area outside of the proposed project site. Beyond this distance, any changes to the landscape would be in the background distance zone, and either unobtrusive or imperceptible to viewers. Areas and associated viewer types considered to be potentially sensitive to visual changes include park, recreation, and wilderness areas; major travel routes; and residential areas.

3.10.1 Nichols Ranch Unit

The Nichols Ranch Unit is located approximately 10 km (6 mi) southwest of the Hank Unit on the border between Johnson and Campbell Counties. Topography in this area is relatively flat with gently rolling hills and low ridges that drain south toward Cottonwood Creek (an intermittent stream) that is located in the southern portion of the unit. Elevations in the Nichols Ranch Unit range from 1,425 to 1,495 m (4,670 to 4,900 ft) AMSL. (Uranerz, 2007)

The Nichols Ranch Unit is about 9.6 km (6 mi) west of the TCP and separated from it by hills and pronounced drainages, though the TCP is visible from this unit. The mid to upper slopes and the tops of North Middle and South Middle Buttes can be seen from Nichols Ranch Unit, but the butte bases are not visible.

As described in Section 3.2, livestock grazing, oil and gas extraction, CBM extraction, and uranium recovery activities are all currently taking place on or near the proposed project area. The immediate future land use for the proposed project area and adjacent areas would be continued livestock grazing, ISR, CBM extraction, and oil and gas extraction. There are no parks, recreation areas, wilderness areas, or residential areas within the proposed project area. The historic Bozeman Trail, located approximately 3.2 km (2 mi) west of the proposed Nichols

Ranch ISR Project area was a route used first by Native Americans and then later by traders and homesteaders moving west during the nineteenth century. This trail is at the margin of the area considered for visual resources.

3.10.2 Hank Unit

The Hank Unit is located on the western flank of the North Middle Butte within the Pumpkin Buttes. Topography of the Hank Unit includes gently rolling hills and low ridges, as well as steep terrain near North Middle Butte. There are steeply eroded areas in the southern part of the Unit that have resulted from Dry Willow Creek (an ephemeral stream). Elevations in the Hank Unit range from 1,540 to 1,588 m (5,055 to 5,209 ft) AMSL and the area is dissected by a series of unnamed and ephemeral drainages that generally drain west and southwest toward Dry Willow Creek (Uranerz, 2007).

The five buttes which collectively are called the Pumpkin Buttes are located north, west, and southwest of the Hank Unit. North Butte is located about 2.4 km (1.5 mi) northwest of the Hank Unit and 3.0 km (1.9 mi) from the existing T-Chair Ranch Road, which would serve as the primary access to both the Nichols Ranch and Hank Units. Each of the buttes is a free-standing residual feature which clearly dominates its location. The buttes rise to elevations in excess of 1,830 m (6,000 ft) AMSL and their bases lie at about 1,525 m (5,000 ft) AMSL. The flanks of the buttes are cut by intermittent drainages which are effectively headwaters for local intermittent drainages. At present, water tanks are located within the Hank Unit on the base of North Middle Butte. South Middle Butte, outside of the Hank Unit but within view of it, hosts four signal transmission towers on the butte top. These towers are visible from the Hank Unit and from North Middle Butte. The northeastern quadrant of the Hank Unit subsumes part of the western slope of North Middle Butte, which is an element of the Pumpkin Buttes TCP.

The Pumpkin Buttes have been recognized as a TCP by the BLM. Visual concerns from CBM development in general were addressed in past Environmental Assessments (EAs) for Anadarko Petroleum Corporation Dry Willow Phase I and Dry Willow Phase II (BLM, 2007). The Dry Willow Phase II EA (BLM, 2007) noted that oil and gas facilities and related visual distractions, including gas and oil wells, well pads, pump jacks, pipeline scars, storage buildings, and vehicular traffic were visible from base of the Pumpkin Buttes to approximately 24 km (15 mi) westward. A Pumpkin Buttes Visual Assessment completed in 2006 noted that roads and trails, CBM-associated structures, reservoirs, and power lines were readily visible from the base of the buttes (Uranerz, 2007). Because of the anticipated development within the viewshed of Pumpkin Buttes, BLM entered into a PA with the Wyoming SHPO focused on mitigation of adverse effects for the Pumpkin Buttes TCP from anticipated Federal minerals development (BLM, 2009b).

3.11 Socioeconomics

In 2008, Wyoming experienced a 3.4 percent growth in jobs with the largest increases by percentage in government, educational and health services, and natural resource and mining sectors (WDOE, 2009). However, job growth began to flatten in 2009 in response to the global recession. January saw a 2.1 percent increase in jobs, and February saw only a 1.5 percent increase in jobs (WDOE, 2009). The reduction in natural gas prices, which has affected gas exploration and production, is cited as one cause for decreased growth in the area (Wyoming Economic Analysis Division, 2009a). Additionally, the lowered demand for electricity is likely affecting the coal market, and thus, state employment and revenue. In a June 2009 monthly report published by the Wyoming Business Council (WBC, 2009), Wyoming's unemployment rate was reported to have increased from 5.0 percent to 5.9 percent between May and June, though this remains well below the national average unemployment rate of 9.5 percent.

The proposed Nichols Ranch ISR Project is located in a rural, resource-rich area of northeastern Wyoming that bisects Campbell and Johnson Counties in the Powder River Basin. Gillette, the largest town in the area with a population of approximately 25,000 people, is the center for mining and energy activity in this portion of Wyoming. Following the oil boycott in 1973, Gillette experienced numerous problems associated with rapid population growth, including inadequate public services, social disruption, and inadequate funding for public services. Since then, the State of Wyoming, Campbell County, and the City of Gillette have developed tax systems that take into account natural fluctuations associated with the oil and gas industry and are therefore, much better prepared to manage change associated with new projects.

Gillette is located 74 km (46 mi) from the proposed project site. The closest town to the proposed Nichols Ranch ISR Project is Wright, located approximately 32 km (20 mi) to the east with 1,604 residents. The towns of Edgerton and Midwest are located approximately 40 km (25 mi) to the southwest of the proposed Nichols Ranch ISR Project, and have populations of 170 and 408 people, respectively (USCB, 2009).

The GEIS demographic, income, housing, and other socioeconomic data are based on 2000 U.S. Census data. The socioeconomic information presented in this SEIS for the proposed Nichols Ranch ISR Project region of influence (ROI) is based on a combination of 2000 U.S. Census Bureau data, U.S. Census Bureau 2005-2007 American Community Survey 3-Year Estimates, and U.S. Census Bureau 2009 State and County QuickFacts. Though specific numbers may differ, the characterization of socioeconomics presented in 3.3.10 of the GEIS remains valid for the proposed Nichols Ranch ISR Project.

3.11.1 Demographics

Campbell County has 40,433 residents, the majority of which lie in the 35 to 54 age group. The population of Campbell County is mostly comprised of White non-Hispanics, with Hispanic, American Indian, and other races each comprising less than 5 percent of the population. Population demographics for Campbell County can be found in Table 3-12. The city of Gillette is the urban center of Campbell County, and is home to over half of the counties' population (USCB, 2009).

Table 3-12. Demographics of Campbell County

Race	Percent of the Population
White Non-Hispanic	94.1
Hispanic	3.5
American Indian	1.7
Two or More Races	1.3
Other Races	1.1
Source: USCB, 2009	

The population of Johnson County is roughly 8,142 with a median resident age of 43. The population of Johnson County is mostly composed of White non-Hispanics, with Hispanic, American Indian, and other races each comprising less than 5 percent of the population. Population demographics for Johnson County can be found in Table 3-13. The city of Buffalo comprises the largest urban population in the county at approximately 4,000 and holds the Johnson County seat (USCB, 2009).

Table 3-13. Demographics of Johnson County

Race	Percent of the Population
White Non-Hispanic	95.7
Hispanic	2.1
Two or More Races	1.6
American Indian	1.5
Other Races	0.6
Source: USCB, 2009	

3.11.2 Income

The estimated median household income in Campbell County is $67,627, and the unemployment rate (2.1 percent) is quite low compared to the national average. Mining is the major industrial activity and accounts for over 40 percent of all earnings in Campbell County (DOC, 2007). Campbell County is the third most expensive county in the state in which to live (Wyoming Economic Analysis Division, 2009b). However, the 2008 cost of living index gives Campbell County an index score of 82.9, which is below the national cost of living average of 100 (USCB, 2009). Unemployment remained low in 2008 and ranged from 2 to 3 percent throughout 2008 (WDOE, 2009a). However, unemployment rates doubled by the first quarter of 2009 as a result of the global recession, reducing demand and prices for energy.

The estimated median household income is $46,433 in Johnson County, and the unemployment rate is roughly 3.5 percent. Johnson County is less dependent on the extractive industries than Campbell County and government employment accounts for 14.8 percent of county earnings followed by mining at 10.1 percent (DOC, 2007). The cost of living index score for Campbell County is 89.7, which is also below the national average (USCB, 2009).

3.11.3 Housing

From 2002 to 2007, the average cost of homes increased nearly 70 percent (Wyoming Economic Analysis Division, 2009b).

In general, workers locate in the largest towns nearest their work. The population centers in the area are Gillette, Casper, and Buffalo. The City of Gillette Planning Department reported a 0.1 percent rental vacancy rate for apartments and other buildings in 2008 (City of Gillette, 2009). Kaycee, which is approximately 50 km (30 mi) from the proposed project site with a population of 285, has few vacancies for temporary or permanent housing (NRC, 2009a). Buffalo, which is approximately 90 km (55 mi) from the proposed project site with a population of 4,500, has new residential apartments under construction (NRC, 2009a).

The average household size in Campbell County is 2.9 (compared to 2.4 for the state), and the higher number is likely to reflect group living arrangements. The average household size in Johnson County is 2.4.

3.11.4 Employment Structure

3.11.4.1 *State Data*

As mentioned earlier, the State of Wyoming has been experiencing a boom over the last several years because of the increased demand for energy and minerals. This boom has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. With the global recession affecting the demand for energy, the demand for natural gas, oil and coal, exploration/extractive activities has decreased. This decrease has led to an increase in unemployment from 2.9 percent in May 2008 to 5.9 percent by June 2009 (WDOE, 2009).

State-wide, the largest sector of employment is sales and office occupations. The largest industry is educational, health, and social services. The largest class of worker is private wage and salary workers (USCB, 2009). Wyoming was ranked first in the U.S. year after year for employment growth, with a 2.9 percent growth for 2008. Natural resources and mining were the leading industries for job growth, which added 2,100 jobs in 2008. Wyoming does not collect corporate or personal state income taxes or inventory taxes. However, there are a variety of taxes levied on commercial enterprises that are discussed below.

3.11.4.2 *County Data*

The largest source of employment in Campbell County is the mining industry, which accounts for 27 percent of all jobs and 40 percent of all earnings in the county. Government-related jobs are the second largest employers in Campbell County, providing 13 percent of the total job force. Retail trade accounts for 10 percent of the employment. Unemployment, however, is on the rise due to the decrease in demand for energy. The unemployment rate in May 2009 was 4.1 percent, which is double the rate of 2.0 percent from a year earlier. The state unemployment rate in May 2009 was 5.0 percent and increased to 5.9 percent by June 2009 (WDOE, 2009).

The federal government is the largest employer in Johnson County, holding 17 percent of the county work force, while the health care and social assistance sector follows with 11 percent of the work force (WBC, 2009). Unemployment is increasing in Johnson County with an unemployment rate in May 2009 of 6.2 percent, which is almost double the rate of 3.4 percent from a year earlier (WDOE, 2009).

3.11.5 Local Finance

The state of Wyoming maintains a 5 percent sales tax and allows counties to increase sales tax up to 4 percent above the state rate. Campbell County has an additional 0.25 percent sales tax, which is returned directly to the county in addition to the 5 percent state sales tax (Liu, 2008). Johnson County has a 5 percent sales tax. The average property tax rate in Campbell County is 6.25 percent. The average property tax rate in Johnson County is 7.13 percent (WDOR, 2007).

A lodging tax, which cities, towns, and counties may impose up to 4 percent on all sleeping accommodations for guests staying less than thirty days, also provides additional income from workers and visitors living in local motels. Campbell County does not impose a lodging tax. Johnson County imposes a 2 percent lodging tax (WDOR, 2007).

Campbell County imposes taxes on commercial personal property. All tangible personal property used in business is taxable and must be listed once a year with the County tax assessor (W.S. 39-13-103). In addition to industrial enterprise, contractors and subcontractors must pay a use tax to the Wyoming Department of Revenue on all purchases of materials, fixtures, or other supplies purchased in other states, if those purchases were made tax free or at a lesser tax rate than the applicable Wyoming sales tax rate for the county where the materials are stored, used, or consumed (WDOR, 2001).

Finally, the state imposes an "ad valorem tax" on mineral extraction. In 2007 for uranium alone, the state collected $1.2 million from this tax (NRC, 2009b).

3.11.6 Education

The Campbell County School district, which is the third largest school district in Wyoming, is composed of a total of 24 school facilities and currently enrolls approximately 7,500 students. Campbell County School District #1, including the Gillette area, had a student to teacher ratio of 12.98 in 2007 (WDE, 2007). By 2009, the student to teacher ratio had increased to 19.2 to 1, which is higher than the state-wide ratio of 12.4 to 1 (CCESC, 2009; WDE, 2007).

Johnson County has one school district that is composed of 5 school facilities and currently enrolls 1,261 students. In the town of Kaycee, the district is represented by Kaycee School, which offers a kindergarten though twelfth grade program (JCSD, 2009). Approximately 83 percent of Johnson County residents that are 25 years or older have a high school degree or higher and 15.7 percent of the residents that are 25 years of age or older have a bachelor's degree or higher. Johnson County, which is part of the Northern Wyoming College District and contains Sheridan Community College and University of Wyoming in Laramie, has approximately 1,160 college students (WBC, 2009).

3.11.7 Health and Social Services

The primary health care facility in Campbell County is the Campbell County Memorial Hospital located in Gillette, which provides emergency care, a cancer care center, and clinical outpatient operations. The hospital also has two branch clinics located in Gillette and Wright. The closest medical center offering full service emergency services is the Wyoming Medical Center in Casper. The primary health care facility in Johnson County is the Johnson County Health Center, located in Buffalo, which is a fully-equipped hospital with an outpatient medical clinic. Emergency response services would also likely come from Buffalo (NRC, 2009a).

The closest police stations to the project area are the Midwest Police Station in Midwest and the Campbell County Police Station #9 in Wright. The Campbell County Fire Station #9 is collocated with the Campbell County Police Station #9 and is the closest station to the project area.

3.12 Public and Occupational Health and Safety

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

Radiation dose is a measure of the amount of ionizing energy that is deposited in the body. Ionizing radiation is a natural component of the environment and ecosystem and members of the public are exposed to natural radiation continuously. Radiation doses to the general public occur from radioactive materials found in the earth's soils, rocks, and minerals. Radon-222 is a radioactive gas that escapes into ambient air from the decay of uranium (and its progeny radium-226) found in most soils and rocks. Naturally-occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from outer space is another natural source of exposure and ionizing radiation dose. In addition to natural sources of radiation, there are also artificial or manmade sources that contribute to the dose received by the general public. Medical diagnostic procedures using radioisotopes and x-rays are a primary manmade radiation source. The National Council for Radiation Protection (NCRP) in its Report No. 160, estimates the annual average dose to the public from all natural background radiation sources (terrestrial and cosmic) is 3.1 millisieverts (mSv; 310 millirem [mrem]). Due to the increase in medical imaging and nuclear medicine procedures, the annual average dose to the public from all sources (natural and manmade) is 6.2 mSv (620 mrem) (NCRP, 2009).

3.12.1 Background Radiological Conditions

In accordance with NRC regulations contained in Title 10, "Energy," of the *U.S. Code of Federal Regulations* (10 CFR) Part 40, Appendix A, Criterion 7, Uranerz developed and implemented a pre-operational monitoring program to establish site baseline conditions at the proposed site. Following the guidance found in NRC Regulatory Guide 4.14 (NRC, 1980), Uranerz included the following sampling methods included in their baseline radiological environmental monitoring program (Uranerz, 2007):

- Integrated gamma scan survey to map the ambient gamma radiation levels across the site;
- Surface soil samples (to a depth of 15 cm [6 in]) in well fields analyzed for radium-226. A large percentage were also analyzed for uranium, thorium-230, and lead-210;
- Eighteen subsurface samples (to a depth of 0.9 m [3 ft]) analyzed for radium-226, uranium, thorium-230, and lead-210;
- Twenty-six sediment samples analyzed for radium-226, uranium, thorium-230, and lead-210;
- Quarterly radon-222 sampling and ambient gamma measurements consistent with NRC Regulatory Guide 4.14;
- Groundwater and surface water samples analyzed for radium-226, uranium, thorium-230 and lead-210; and
- Vegetation samples analyzed for radium-226, uranium, thorium-230, lead-210, arsenic, and selenium.

Direct gamma surveys were conducted throughout the proposed production and processing areas as well as in drainages, at the nearest residence, and near the proposed license boundary. Gamma measurements ranged between 11 and 18 microroentgen (μR) per hour. The Nichols Ranch Unit measurements ranged between 11 and 15 μR per hour and averaged 13 μR per hour. Measurements at the Hank Unit ranged from 11 to 18 μR per hour and also averaged 13 μR per hour. The results show that background within the survey areas are either within or somewhat higher than the average background range of 15 μR per hour typical for Wyoming (Uranerz, 2007). The elevated gamma levels correlate in some locations with the elevated radium concentrations in soil.

Surface and subsurface soil samples were analyzed for radium-226 and, in most cases, uranium, thorium-230, and lead-210. Sampling locations were focused in the areas most likely to be affected by potential pipe leaks and spills. Results for the majority of the Nichols Ranch Unit and Hank Unit surface soil samples were consistent with the average background radium range for Wyoming, which is approximately 0.5 to 2 pCi/g (Uranerz, 2007). However, one surface soil sample (LAS-5) from the Nichols Ranch Unit had an elevated radium-226 concentration of 26.4 pCi/g, which would be well above the acceptable surface activity level of 5 pCi/g. Uranerz excluded this sample result from statistical analyses and indicates that the elevated concentration may be due to previous exploration activities, which may have resulted in ore zone cuttings being left on the soil surface. At the Hank Unit, radionuclide concentrations measured at the LAS-2 surface sample site (8.4 mg/kg uranium, 1.2 pCi/g lead-210, 3.8 pCi/g radium-226, and 2.5 pCi/g thorium-230) were higher than concentrations for the other samples, though not abnormal for this region. All subsurface soil samples for both the Nichols Ranch and Hank Units exhibited typical background radiological characteristics (Uranerz, 2007).

Sediment samples were analyzed for radium-226, uranium, thorium-230, and lead-210. Approximately 40 percent of the Nichols Ranch Unit sediment samples were greater than background values for radium-226 (i.e., greater than approximately ~1 pCi/g). The average concentration for radium was 9.6 pCi/g. Sample SD-8 had the maximum radium concentration measured of 32.2 pCi/g. At the Nichols Ranch Unit, of the uranium, thorium-230, and lead-210 samples collected, two lead-210 samples (2.0 pCi/g and 1.8 pCi/g) were higher than the typical background range. Uranerz indicates that these elevated concentrations may be due to previous exploration activities. At the Hank Unit, of the uranium, thorium-230, and lead-210 samples collected, two lead-210 samples (2.5 pCi/g and 1.8 pCi/g) were higher than the typical background range and the average and maximum radium concentrations measured were 1.2 pCi/g and 2.2 pCi/g, respectively.

Following the monitoring procedure outlined in NRC Regulatory Guide 4.14, four radon detectors were placed at the location of the nearest residences, locations at or near the proposed license boundary, and at control points upwind of the site. Uranerz documented four quarters of sampling results from October 2006 to October 2007. Reported quarterly site average radon-222 results for all sampling locations range between 0.6 to 1.9 pCi/L in air and are somewhat consistent with typical background levels (approximately 0.8 pCi/L) in this region of Wyoming (based on historic data from the PRI North Butte ISR Project), though higher than the U.S. average of 0.4 pCi/L (EPA, 2009). Gamma measurements for the same sampling locations range between 0.34 and 0.55 mSv (34 and 55 mrem) per quarter, which is consistent with typical background levels for the region (Uranerz, 2007).

Groundwater samples were taken from various wells located within the proposed Nichols Ranch ISR Project area. As expected, the concentrations of radionuclides in groundwater are strongly correlated with the location of the uranium mineralization. Excluding outliers, the concentration of uranium ranged from below detection levels to 5.25 mg/L, while the EPA drinking water MCL is 0.03 mg/L. Radium concentrations ranged from below detection levels to 562 pCi/L. The MCL for radium-226 is 5 pCi/L.

Baseline surface water samples were collected by Uranerz in June 2008 and analyzed for numerous chemical and radiological constituents, including natural uranium and radium-226. The highest uranium concentration measured was 0.137 mg/L. The 2008 data show radium-226 concentrations are less than 0.5 pCi/L. These values are consistent with typical background levels.

Given that Uranerz asserts there is a lack of crop-growing areas or permanent surface water and, therefore, fish at or immediately adjacent to the proposed site, no crop samples or fish were collected or analyzed. Vegetation samples were analyzed for radium-226, uranium, thorium-230, lead-210, arsenic, and selenium. All results are consistent with typical background levels for vegetation. Due to the fact that baseline vegetation results are within background, Uranerz chose not to sacrifice livestock (grazing cattle) to obtain samples.

3.12.2 Public Health and Safety

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

A review of the surrounding area indicated that there are several nuclear facilities within 80 km (50 mi) of the proposed Nichols Ranch ISR Project area (NRC, 2009b):

- Smith Ranch-Highland – This operational ISR facility is located approximately 72 km (45 mi) southeast of the proposed Nichols Ranch ISR Project;
- Irigaray/Christensen Ranch – This ISR facility is located 6.4 km (4 mi) northwest of the Hank Unit. The NRC recently granted a license amendment authorizing a restart of operations at the Irigaray/Christensen Ranch ISR facility;
- Moore Ranch – This proposed ISR facility would be located approximately 32 km (20 mi) to the southeast of the proposed Nichols Ranch ISR Project. The NRC is currently reviewing the license application for the proposed Moore Ranch ISR Project; and
- Several inactive and decommissioned conventional uranium mills in the 80 km (50 mi) radius.

However, because of their relative distances, none of these projects are considered to represent an appreciable source of radiation exposure in and around the proposed Nichols Ranch ISR Project area. Therefore, the natural background represents the only radiation exposure to individuals in the area surrounding the proposed Nichols Ranch ISR Project area.

Other than CBM activities, there are no major sources of non-radioactive, chemical releases to the atmosphere or water receiving bodies in the immediate area surrounding the proposed project area.

3.12.3 Occupational Health and Safety

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

Also of concern with respect to occupational health and safety are industrial hazards and exposure to non-radioactive pollutants, which for an ISR operation can include normal industrial airborne pollutants associated with service equipment (e.g., vehicles), fugitive dust from access roads and well field activities, and various chemicals used in the ISR process. Industrial safety aspects associated with the use of hazardous chemicals at the proposed Nichols Ranch ISR Project would be regulated under the State of Wyoming regulations and the Wyoming Division of Mine Inspection and Safety (Wyoming, Title 30-Mines and Minerals, Chapter 2-Mining Operations, Article 2-Inspector of Mines). The type of chemicals and impacts are discussed in Section 4.13.

3.13 Waste Management

As discussed in Chapter 2, the proposed Nichols Ranch ISR Project operations would generate both liquid and solid wastes, which would require proper disposal. The main waste disposal options for these wastes are a landfill for non-radioactive municipal solid wastes, a licensed waste disposal site or mill tailings facility for 11e.(2) byproduct material, deep disposal wells for the liquid effluent wastes, and onsite septic systems for sanitary wastes.

3.13.1 Solid Waste

Uranerz would dispose of non-radioactive municipal solid wastes, including construction and demolition waste, in a sanitary landfill located near the city of Gillette. The Campbell County Landfill located in Gillette is not currently at or near capacity (CCPW, 2009). Construction and demolition waste generated during the construction and decommissioning phases of the project would be disposed of in the landfill or in an adjacent construction and demolition pit specifically used for such wastes. The existing construction and demolition pit is also not currently at or near capacity (CCPW, 2009). The Campbell County Landfill is not permitted to take hazardous wastes such as used oils, spent bulbs, and used batteries from industrial operations. Uranerz would have to contract with a WDEQ-approved hazardous waste treatment, storage, or disposal facility for their hazardous waste disposal and transportation.

3.13.2 Liquid Waste

Sanitary wastes would be disposed of in onsite septic systems. The septic systems would be designed to accommodate the estimated number of employees for the proposed Nichols Ranch ISR Project. Uranerz would have to obtain a permit to construct the onsite septic systems from the county in which they are located.

3.13.3 Radioactive Waste

Uranerz plans to dispose of liquid effluent wastes generated during uranium recovery operations in Class I deep disposal wells, as described in detail in Chapter 2 of this SEIS. As discussed in Section 2.7.2 of the GEIS, Uranerz would have to obtain approval from the NRC as an acceptable method to dispose of liquid effluent wastes and obtain a UIC permit from the WDEQ, who has primacy for the program as delegated by the EPA. The reviews conducted by NRC and WDEQ ensure that the disposal of wastes into deep disposal wells complies with the dose limits set in 10 CFR Part 20 and with the appropriate National Pollutant Discharge Elimination System (NPDES) permit conditions.

Uranerz would dispose of solid 11e.(2) byproduct material in a licensed waste disposal site or mill tailings facility. Options considered by Uranerz include the low-level waste disposal site at EnergySolutions in Clive, Utah, and uranium mill tailings site at Pathfinder-Shirley Basin in Mills, Wyoming; and White Mesa in Blanding, Utah. Prior to operation, Uranerz would need to enter into a written agreement with such a site, which would ensure that there was available capacity at the site for 11e.(2) byproduct waste disposal.

3.14 References

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4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION, OPERATION, AQUIFER RESTORATION, AND DECOMMISSIONING ACTIVITIES AND MITIGATIVE ACTIONS

4.1 Introduction

This chapter describes the environmental consequences associated with the alternatives presented in Chapter 2 and is based on the baseline conditions established in Chapter 3. The potential impacts for each resource are described and evaluated separately for each stage in the process: construction, operation, aquifer restoration, and decommissioning/reclamation. Impact significance is evaluated and reported based on the following categories as described in the U.S. Nuclear Regulatory Commission's (NRC's) guidance in NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NRC, 2003):

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

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

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

4.2 Land Use Impacts

Potential environmental impacts to land use at the proposed Nichols Ranch In-Situ Recovery (ISR) Project site may occur during all phases of the facility's lifecycle. Impacts could include land disturbance as part of construction and decommissioning; grazing and access restrictions; and competing access for mineral rights. Potential impacts to land use may be greater in areas with higher percentages of private land ownership and Native American land ownership or in areas with a complex patchwork of land ownership. Ecological, historical, and cultural resources may be impacted as well. Detailed discussion of the potential environmental impacts to land use from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.2.1 Proposed Action (Alternative 1)

4.2.1.1 *Construction Impacts*

In Section 4.3.1.1 of NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS) (NRC, 2009a), land use impacts during construction may occur from land disturbances (including alterations of ecological cultural or historical resources) and access restrictions (including limitations on other mineral extraction activities, grazing activities, or recreational activities). It was expected that land disturbances during construction would be temporary and limited to small areas within permitted boundaries, and that well sites, staging areas, and trenches would be reseeded and restored. Changes to land use access including grazing restrictions and impacts on recreational activities would be limited due to the small size of restricted areas, temporary nature of restrictions, and availability of other land for these activities. Ecological, historical, and cultural resources could be affected, but would be protected by careful planning and surveying to help identify resources and avoid or mitigate impacts. For all land use aspects except ecological, historical, and cultural resources, the GEIS determined that potential impacts would be SMALL. However, due to the potential for unidentified resources to be altered or destroyed during excavation, drilling, and grading, the potential impacts to ecological, historical, and cultural resources would be SMALL to LARGE, depending on local conditions. In situations involving grazing restrictions and competing access to mineral rights on the site, it was expected that agreements between the parties would serve to mitigate impacts.

Disturbance from construction-related activities related to the proposed Nichols Ranch ISR Project (drilling, trenching, excavating, grading, construction of the central processing plant and satellite facility and auxiliary structures) would affect approximately 121 ha (300 ac) of the proposed project area. Topsoil would be stripped and stockpiled and land would be graded for the construction of access roads and processing facilities. As stated in Chapter 2, approximately 24 to 32 ha (60 to 80 ac) would be fenced off to grazing activities at any given time during the project life. The local ecology, historical and cultural resources, and setting of Pumpkin Buttes Traditional Cultural Property (TCP) could be adversely impacted by construction equipment and activities, as discussed along with mitigation measures later in Chapter 4. Open spaces for hunting and off-road vehicle access would be minimally impacted by the fencing associated with the ISR facilities. Many construction impacts would be temporary in nature, occur on small areas of land at a time, and land would be restored to its original condition; therefore, construction impacts to land use would be SMALL.

Additionally, after its independent review of the Uranerz's Environmental Report (ER; Uranerz, 2007); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to land use during construction would be SMALL to LARGE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.2.1.2 *Operations Impacts*

As discussed in Section 4.3.1.2 of the GEIS, the types of land use impacts from operational activities would be expected to be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not be expected to occur from conducting operational activities. Because access restriction and land disturbance-related impacts would be similar to, or less than, those for construction, the GEIS determined that overall potential impacts to land use from operational activities would be SMALL.

Operations at the proposed Nichols Ranch ISR Project would take an estimated 1.25 to 2.5 years to extract the uranium from the production areas in both units, as shown in Figure 2-1. During this time, the day to day operations would affect the surrounding environment similarly to the impacts seen in the construction phase. As stated earlier, approximately 24 to 32 ha (60 to 80 ac) would be fenced off to grazing activities at any given time during the project life. During the operational period of the ISR facility, the primary changes to land use would be the development or sequencing of well fields from one area to another. Sequentially moving active operations from one well field to the next would shift potential impacts. Because access restriction and land disturbance impacts would be similar to, or less than those expected for construction, the potential impacts to land use from operational activities would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for land use and incorporates by reference the GEIS's conclusions that the impacts to land use during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.2.1.3 *Aquifer Restoration Impacts*

In Section 4.3.1.3 of the GEIS, aquifer restoration impacts to land use are discussed. Due to the use of the same infrastructure as during operations, land use impacts from aquifer restoration would be similar to, or less than, those from operations. It is expected that as aquifer restoration proceeds and well fields are closed, some operational activities would diminish. Therefore, aquifer restoration impacts to land use were expected to be SMALL.

Land use impacts from aquifer restoration at the proposed Nichols Ranch ISR Project would decrease as fewer wells and pump houses are used and overall equipment traffic and use diminish. There would be no additional land disturbances during the restoration phase as the main impacts occurred during the construction phase of the project. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, the aquifer restoration impacts to land use as a result of the proposed Nichols Ranch ISR Project are anticipated to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for land use and incorporates by reference the GEIS's conclusions that the impacts to land use during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.2.1.4 *Decommissioning Impacts*

Decommissioning impacts to land use are discussed in Section 4.3.1.4 of the GEIS. It was expected that land use impacts from decommissioning would be similar to those described for construction, with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Access restrictions may remain until decommissioning and reclamation are completed; although it is possible that a licensee could decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses would help mitigate long-term potential impacts. For lands administered by the U.S. Bureau of Land Management (BLM) or other surface management agencies, other reclamation standards may also be applicable. The GEIS determined that impacts to land use during decommissioning would be SMALL to MODERATE, and SMALL once decommissioning and reclamation are completed.

The dismantling of the proposed Nichols Ranch ISR Project facilities and roads and reseeding and placement of soil would have impacts similar in scale to the construction phase. Upon completion of well abandonment, seeded soil would be returned to the areas where it was stripped. This would occur primarily where the header houses and roads are removed, as well as in the Nichols Ranch Unit central processing plant and Hank Unit satellite facility areas. As decommissioning and reclamation proceed, the amount of disturbed land would decrease and the structures that could alter the setting of the Pumpkin Buttes TCP would be removed. For the proposed Nichols Ranch ISR Project, decommissioning impacts are anticipated to be similar in scale to the impacts anticipated during the construction phase and therefore, are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to land use during decommissioning would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.2.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no impacts to current land uses through added traffic, noise, or land disturbances associated with the proposed project. The current land uses on and near the project area, including grazing lands, natural resource extraction, and recreational activities, would continue.

4.2.3 Modified Action - No Hank Unit (Alternative 3)

4.2.3.1 *Construction Impacts*

Construction impacts under this alternative would be less than those resulting from proposed action because ground disturbing activities such as trenching and digging would be confined to approximately 60 ha (150 ac) for the Nichols Ranch Unit as opposed to twice the land area if the Hank Unit were involved. Open spaces for hunting and off-road vehicle access would be minimally impacted by any fencing associated with the ISR facilities. Livestock grazing would be minimally impacted by any fencing associated with the ISR facilities. Many construction impacts would be temporary and thus, the construction impacts related to this alternative would be SMALL.

Approximately 12 to 16 ha (30 to 40 ac) would be fenced off to grazing activities at any given time during the life of this alternative. The local ecology and historical and cultural resources could be adversely impacted by construction equipment and activities. Open spaces for hunting and off-road vehicle access would be minimally impacted by the fencing associated with the ISR facilities. Many construction impacts would be temporary and less than that of the proposed action. Thus, the construction impacts for this alternative would be SMALL.

4.2.3.2 *Operations Impacts*

The type of land use impacts for operational activities is expected to be similar to the construction impacts regarding access restrictions because the infrastructure would be in place. Operations would take an estimated 1.25 to 2.5 years to extract the uranium from both production areas in the Nichols Ranch Unit. As stated earlier, approximately 12 to 16 ha (30 to 40 ac) would be fenced off to grazing activities at any given time during the project life. During the operational period of the ISR facility, the primary changes to land use would be the development or sequencing of well fields from one area to another on the Nichols Ranch Unit. Sequentially moving active operations from one well field to the next would shift potential impacts. Because access restriction and land disturbance impacts would be similar to, or less than those expected for construction and less than that of the proposed action, the site-specific overall potential impacts to land use from operational activities would be SMALL.

4.2.3.3 *Aquifer Restoration Impacts*

During aquifer restoration, the land use impacts would be similar to those seen in the operations phase. In terms of specific activities, aquifer restoration uses the same infrastructure as the operations phase and maintenance would be at a similar level. Land use impacts from aquifer restoration would decrease as fewer wells and pump houses are used and overall equipment traffic and use diminish. Impacts would be less for this alternative than for the proposed action because land associated with the Hank Unit would not be involved. Therefore, the impacts to land use from aquifer restoration for this alternative would be SMALL.

4.2.3.4 *Decommissioning Impacts*

Dismantling of project facilities and roads, as well as the reseeding and placement of soil would have impacts similar in scale to the construction phase. As with the proposed action, seeded soil would be returned to areas where stripped upon completion of well abandonment. Impacts would be less for this alternative because land associated with the Hank Unit would not be involved. As decommissioning and reclamation proceed, the amount of disturbed land would decrease, and the overall impacts to land use during the decommissioning phase would be SMALL.

4.3 Transportation Impacts

Potential environmental impacts to transportation at the proposed Nichols Ranch ISR Project site may occur during all phases of the facility's lifecycle. Impacts would be due to the movement of workers to and from the site and to the shipment of materials and chemicals on and off the site. Impacts may be experienced in the form of dust, noise, and incidental wildlife or livestock kills, increased traffic on local roads, and from the consequences of accidents. Detailed discussion of the potential environmental impacts to transportation from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.3.1 Proposed Action (Alternative 1)

4.3.1.1 *Construction Impacts*

In Section 4.3.2.1 of the GEIS, it was expected that low levels of traffic generated by ISR construction activities (relative to local traffic counts) would not significantly increase traffic or accidents on many of the roads in the region. Roads that currently experience low traffic counts could be moderately impacted by the additional worker commuting traffic during periods of peak employment. Additionally, moderate dust, noise, and incidental wildlife or livestock kill impacts would be possible on, or near, site access roads (dust in particular for unpaved access roads). For these reasons, the GEIS determined that construction impacts to transportation would be SMALL to MODERATE.

The existing T-Chair ranch roads at the proposed Nichols Ranch ISR Project area have been constructed to accommodate tractor trailer traffic related to coal bed methane (CBM) activities and are four-season roads. Impacts related to the development of new access roads are addressed in Section 4.2.1.1. All roads except for those roads specifically requested by the landowner to remain would be reclaimed.

At all stages, the trip frequency to the project area from offsite locations is approximately eight passenger vehicles per day (standard light duty and ¾-ton trucks, passenger vans, or personal cars) and six tractor trailers per week (Uranerz, 2007). Traffic volumes would be highest Monday through Friday during the beginning and end of regular working hours (8:00 am and 4:00 pm). The projected traffic volumes should not be conspicuous on either the gravel roads nearest the project area or the regional road network; however, no traffic count data are available for Van Buggenum Road or the T-Chair ranch roads. Using the annual average daily traffic (AADT) counts presented in Chapter 3 for State Route (SR) 50, project-related traffic would result in an increase in AADT counts on SR 50 of roughly 3 percent. For SR 387, AADT counts would increase an estimated 0.6 percent to 2 percent, depending on the location between Interstate (I)-25 and SR 59.

Considering this minimal increase in traffic volumes, the degree to which an existing road network would be utilized, the brief construction period, and the limited footprint of new road construction relative to the total project area, transportation impacts related to the construction phase are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to transportation during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.1.2 *Operation Impacts*

As discussed in Section 4.3.2.2 of the GEIS, during operations, the low levels of facility-related traffic would not noticeably increase traffic or accidents on most roads, although local, less travelled roads could be moderately impacted during periods of peak employment. Dust, noise, and possible incidental wildlife or livestock kill impacts on or near site access roads would continue to be experienced.

The GEIS also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. While the GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area, the probability of such accidents occurring was determined to be low owing to the small number of shipments, comprehensive regulatory controls, and use of best management practices. For radioactive material shipments (yellowcake product, ion exchange resins, waste materials), compliance with transportation regulations was expected to limit radiological risk for normal operations. Additionally, the GEIS estimated that there is a low radiological risk for accident conditions. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium. The GEIS determined that potential impacts to transportation from operations would be SMALL to MODERATE.

Potential transportation impacts related to the proposed Nichols Ranch ISR Project operations can be broken down into three categories: incoming shipments, onsite traffic between the Nichols Ranch and Hank Units, and outgoing shipments. Incoming shipments would consist of the process chemicals required to support resource extraction. These chemicals are commonly used in industrial applications and their transport is regulated by U.S. Department of Transportation (USDOT). Onsite traffic would include routine inspections of the well heads and pipelines by light duty pickup trucks as well as regular shipments of ion exchange resins from the Hank Unit satellite facility to the Nichols Ranch Unit central processing plant. These shipments would be typically carried out using dedicated tanker trucks that are modified, three-compartment cement trailers. These trucks are generally designated as sole-purpose vehicles and labeled as such in accordance with USDOT requirements. Outgoing shipments consist of the refined yellowcake uranium produced at the Nichols Ranch Unit central processing plant. Packaging consists of 205-L (55-gal), 18-gauge drums holding an average of 430 kg (950 lb) and classified by the USDOT as Type A packaging. An average truck shipment consists of 40 drums or 17 t (19 T) of product. Yellowcake is transformed to uranium hexafluoride at just one facility in the United States, the Honeywell Uranium Conversion Facility in Metropolis, Illinois. The approximate distance from the proposed Nichols Ranch ISR Project to the conversion facility is 1,932 km (1,200 mi). Uranerz Energy Corporation (Uranerz) would maintain shipping records (bills of lading) to identify the nature and quantity of shipped materials. In addition, Uranerz would conduct surveys of the truck exterior and cab prior to each shipment of yellowcake/resin and use check-in/check-out or global positioning satellite technology to track shipments.

Transportation risks associated with incoming, onsite, and outgoing shipments have been evaluated, including accidents involving collisions, non-collisions (e.g., rollovers), and other events (e.g., theft, fires on standing trucks) (Uranerz, 2007). As the vast majority of incoming process chemicals are commonly used in a variety of industrial applications, accidental spillage presents no abnormal risk or requirement for specialized response. Spilled material can be recovered or removed and the affected areas reclaimed, resulting in no significant long-term environmental impact (public health impacts are discussed in Section 4.13). Anhydrous ammonia, a compound which may be used in the precipitation circuit, presents one exception. The accidental release of an ammonia "cloud" could be particularly hazardous should it occur near a populated area. However, the likelihood of such an accident occurring has been calculated at 3.0×10^{-7} accidents per km (4.8×10^{-7} accidents per mi) using NUREG-0706 data (NRC, 1980) provided in the GEIS (NRC, 2009a). This number is likely an overestimate since the proposed Nichols Ranch ISR Project site has a low population density.

The onsite transportation of ion exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would occur over roughly 13.4 km (8.3 mi) of private road. Should an accident occur and the trailer tank were to rupture, resin loaded with uranium could spill onto the ground; however, uranium loaded onto the resin would remain attached to the resin as it can only be removed by using a strong brine solution. No airborne releases would result and spilled resin would collect in low areas or depressions in the road, which would trap the resin for proper cleanup. Because the risk of spilling loaded resin is low and any spill would be properly removed and disposed of and the area would be reclaimed in accordance with applicable NRC and State regulations, the resulting environmental impact would be SMALL.

Based on data presented in NUREG-0706 (NRC, 1980), the overall probability of a truck accident associated with the proposed Nichols Ranch ISR Project has been calculated as 1.4×10^{-6} accidents per km (8.69×10^{-7} accidents per mi). This includes outgoing yellowcake shipments. In the unlikely event of a yellowcake spill, contaminated materials would be processed and reclamation would proceed as described above for onsite spills. Uranerz would ensure that shipments of outgoing yellowcake would not be combined with other shipments or include multiple destinations and that drivers would maintain appropriate licenses. Environmental impacts would be also be minimized by compliance with existing NRC transportation regulations in Title 10, "Energy," of the *U.S. Code of Federal Regulations* (10 CFR) Part 71 and adherence to the Uranerz Energy Corporation Incident Response Guide, which would be included with every shipment leaving the Nichols Ranch Unit central processing plant. These same accident minimization and cleanup protocols would also apply to shipments of 11e.(2) byproduct material for disposal. Additional best management practices (BMPs) to be used by Uranerz to reduce the risk of accidents include enforcing safe driving and emergency response training for personnel and truck drivers, installing communication systems to connect trucks to shipper/receiver/emergency responders, and posting of speed limits on the proposed project site to increase driver safety and reduce conflicts with big game and other vehicles.

Shipments of process chemicals to the site and shipments of product from the site would contribute to minimal transportation risks on the roads in the region of the proposed project. Those using the T-Chair ranch roads and the county roads to which they lead are likely accustomed to encountering heavy vehicles going to and from CBM and oil/gas production areas. The width of existing roads is sufficient to allow two tractor trailers to pass one another and have been constructed for year round travel. All vehicles would be expected to adhere to local, state, and federal laws of the road, including posted speed limits and right-of-way. Uranerz would assist in the maintenance of existing gravel ranch roads from the limits of county maintenance to the area during the life of the proposed Nichols Ranch ISR Project.

As for all phases of the project, the overall volume of traffic during the operation phase is low. The approximate trip frequency and resulting approximate increase in AADT counts on local highways remains per Section 4.3.1.1. As most of this traffic is related to commuting, there is some risk to employees, including fatigue, collisions with animals, and adverse weather. These risks are estimated at 1.4×10^{-6} accidents per km (8.69×10^{-7} accidents per mi) per NUREG-0706 (NRC, 1980). The volume of traffic relative to published traffic counts for SR 387 suggests commuting would not significantly change traffic conditions or accident rates.

Based on this volume of traffic, the low risk of vehicular-related accidents, and the fact that ranch road maintenance would be carried out by Uranerz in conjunction with the landowners, transportation impacts during the operations phase are considered to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to transportation during operations would be SMALL to MODERATE. The staff concludes that site-specific impacts for the Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.1.3 *Aquifer Restoration Impacts*

Section 4.3.2.3 of the GEIS estimated that the magnitude of transportation activities during aquifer restoration would be lower than for construction and operations. Aquifer restoration-related transportation activities would be expected to be primarily limited to supplies (including chemicals from reverse osmosis), chemical waste shipments, onsite transportation, and employee commuting. The GEIS considered transportation impacts from aquifer restoration to be SMALL to MODERATE, for the same reasons discussed under the operations phase.

For the proposed Nichols Ranch ISR Project, the rate of uranium extraction would gradually decrease through the course of aquifer restoration and incoming supplies of process chemicals would likely be reduced. Similarly, the number of onsite resin transfer trips between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would likely decrease, diminishing the risk of an accident. Fewer employees (approximately 20 people) would be employed during this phase, which is less than the construction and operation phases. Accordingly, transportation impacts are expected to be less than during construction and operations and thus, would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to transportation during aquifer restoration would be SMALL to MODERATE. The staff concludes that site-specific impacts for the Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.1.4 *Decommissioning Impacts*

As discussed in Section 4.3.2.4 of the GEIS, the types of transportation activities during decommissioning, and therefore the types of potential impacts, would be similar to those discussed for construction and operations, except that the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) from decommissioning could be lower than for operations. Accident risks from transportation during decommissioning would be bounded by the estimates of yellowcake transportation risk during operations. The GEIS determined that potential impacts during decommissioning would be SMALL due to the lower levels of transportation activities expected.

Onsite traffic at the proposed Nichols Ranch ISR Project may increase slightly relative to the aquifer restoration phase, due to the need for radiological surveys, infrastructure inspection and decontamination, extraction of buried pipelines, well abandonment, re-grading and reclaiming disturbed areas, the removal of contaminated materials, and follow-up monitoring of the restored site. Waste materials generated during decommissioning would be segregated by type and transported to approved disposal facilities. These range from ordinary municipal solid waste streams to those licensed facilities capable of receiving 11e.(2) byproduct material waste. Roughly 90 percent of the byproduct waste materials would be suitable for disposal in a local, unrestricted landfill (NRC, 2009a). The remaining 11e.(2) byproduct material waste would be transported to a licensed facility such as the Pathfinder-Shirley Basin uranium mill site in Mills, Wyoming; EnergySolutions low-level radioactive waste disposal site in Clive, Utah; or White Mesa uranium mill site in Blanding, Utah. As the trip distance is less than that of transporting yellowcake to the conversion facility in Metropolis, Illinois, the inherent risks of an accident involving the release of uranium are lower than those stated in Section 4.3.1.3.

The eventual fate of the access roads built to connect existing T-Chair ranch roads with both the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant as well as to the well fields would rest with the landowner, though it is anticipated that these roads would remain in use for some period after decommissioning in order to facilitate site monitoring. Should the landowner so request, these access roads would be reclaimed at Uranerz's expense. Such reclamation activities would include removing road bed materials, scarifying, or ripping the surface, and redressing with stockpiled topsoil and establishing native vegetation by seed.

Traffic estimates would be similar during the decommissioning phase as those during the construction phase, at eight passenger vehicles per day and six tractor trailers per week (Uranerz, 2007). Fewer employees (approximately 20 people) would be employed during this phase, which is less than the construction and operation phases. Because of the low traffic counts, fewer employees during this phase, and reduced risk of transportation accidents in comparison to the construction and operation phases (i.e., no interstate transport of yellowcake product), transportation impacts related to the decommissioning phase are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for transportation and incorporates by reference the GEIS's conclusions that the impacts to transportation during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in traffic flows and routings, service levels, or the integrity of the road surfaces and profiles associated with this project. Traffic volumes associated with current land activities such as CBM extraction, oil and gas extraction, and cattle ranching would persist in the future. This alternative would have no additional impacts to transportation.

4.3.3 Modified Action – No Hank Unit (Alternative 3)

4.3.3.1 *Construction Impacts*

Construction impacts related to this alternative would be the same as for the proposed action, though restricted to the location of the Nichols Ranch Unit. It should be noted that while no permanent facility would be located in the Hank Unit, improvements to the T-Chair Livestock ranch roads north of the Nichols Ranch Unit would likely be needed as project access via SR 50 would persist even without the satellite facility being present.

The volume of construction-related traffic for this alternative would be less than those cited for the proposed action, which would be very low. The number of required workers would be somewhat less than that for the proposed action. Considering the lower traffic volumes, the degree to which an existing road network would be utilized, the brief construction period, and the smaller footprint of road construction, transportation impacts related to the construction phase for this alternative are expected to be SMALL.

4.3.3.2 *Operation Impacts*

Operation impacts related to this alternative would be somewhat diminished as compared to the proposed action due to the fact that internal shipments of ion exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would not occur. Furthermore, because only one ore body would be developed, there would be fewer incoming shipments of process chemicals and other supplies and fewer outgoing shipments of yellowcake and non-regulated and 11e.(2) byproduct waste. The number of required workers would also be somewhat less than for the proposed action.

The volume of operation-related traffic would be less than those cited previously for the proposed action. Based on the lower traffic volume, the lower risk of vehicular-related accidents, and the fact that ranch road maintenance would be carried out by Uranerz in conjunction with the landowners, transportation impacts during the operational phase for this alternative are considered to be SMALL.

4.3.3.3 *Aquifer Restoration Impacts*

Aquifer restoration impacts related to transportation for this alternative would be diminished appreciably as compared to the proposed action because one ore body would be developed. There would accordingly be fewer incoming shipments of process chemicals and other supplies and fewer outgoing shipments of late-stage yellowcake product and non-regulated and 11e.(2) byproduct waste. The number of required workers would also be somewhat less than for the proposed action, resulting in less commuter traffic. Transportation impacts for aquifer restoration are expected to be less than during construction and operations and thus, would be SMALL.

4.3.3.4 *Decommissioning Impacts*

Decommissioning impacts related to this alternative would be diminished appreciably as compared to the proposed action by the fact that only one ore body would be developed. There would accordingly be fewer outgoing shipments of non-regulated and 11e.(2) byproduct material and less overall internal traffic associated with the reclamation of the site. The number of required workers would also be somewhat less than for the proposed action, resulting in less commuter traffic. Because of the lower traffic counts and the reduced risk of transportation accidents in comparison to the operation and aquifer restoration phases (i.e., no interstate transport of yellowcake product), transportation impacts during the decommissioning phase for this alternative are expected to be SMALL.

4.4 Geology and Soils Impacts

Potential environmental impacts to geology and soils can occur during all phases of the proposed Nichols Ranch ISR Project lifecycle. However, these impacts are largely concentrated during the construction phase of the project.

4.4.1 Proposed Action (Alternative 1)

4.4.1.1 *Construction Impacts*

As indicated in Section 4.3.3.1 of the GEIS during construction of ISR facilities, the principal impacts on geology and soils would result from earth-moving activities associated with constructing surface facilities, access roads, well fields, and pipelines. Earth-moving activities that might impact soils include the clearing of ground or topsoil and preparing surfaces for the central processing plant, satellite facility, header houses, access roads, drilling sites, and associated structures. Similarly, excavating and backfilling trenches for pipelines and cables may impact soils in the project area.

The GEIS indicates that the impact of construction activities on geology and soils will depend on local topography, surface bedrock geology, and soil characteristics. The earth-moving activities are normally limited to only a small portion of the project. Consequently, earth-moving activities would result in only SMALL and temporary (months) disturbance of soils, impacts that are commonly mitigated using accepted BMPs. Construction activities would also increase the potential for erosion from both wind and water due to the removal of vegetation and the physical disturbance from vehicle and heavy equipment traffic. However, these activities would result in SMALL impacts if equipment operators adopt construction BMPs that prevent or substantially reduce erosion.

The GEIS further indicates that ISR activities would not result in the removal of any rock matrix or structure. No subsidence would result at the site from the collapse of overlying rock strata in the ore zone which would happen in underground mining operations. No other geologic impacts are anticipated to occur with the ISR method.

Due to the depth of the ore zone (91 to 213 m [300 to 700 ft] for the Nichols Ranch Unit, 61 to 183 m [200 to 600 ft] for the Hank Unit), no subsidence would result at the site from the collapse of overlying rock strata in the ore zone. The impacts to the soils of the area would be limited to approximately 40 ha (100 ac) during the life of the project for the construction of plant facilities, well fields, and access roads (Uranerz, 2007). These disturbances would be temporary as any disturbance affected by the project would be restored and reclaimed after the project has reached the end of its life. All of the topsoil in the area of central processing plant, satellite facility, and well field header houses would be stripped prior to the construction of these facilities. Uranerz would take salvaged topsoil during construction and store it in designated topsoil stockpiles that are in accordance with Wyoming Department of Environmental Quality (WDEQ) requirements. Uranerz would remove topsoil removed to construct well field access roads and adhere to the landowner's preferred road construction practices. Uranerz would locate stockpiles onsite such that they would best minimize topsoil losses from wind erosion. Uranerz would not locate topsoil stockpiles in any drainage channels or other locations that could lead a loss of material. Uranerz would construct berms around the base of the stockpiles and seed them with wheatgrass to reduce the risk of sediment runoff and wind erosion.

During construction of the well fields, drilling activities and the installation of piping may also impact soils. These drilling activities would include the construction of mud pits. During the excavation of mud pits, Uranerz would first remove the topsoil and place it in a separate location. Uranerz would then remove and deposit the subsoil next to the mud pit. When the use of the mud pit is complete (usually within 30 days of initial excavation), Uranerz would re-deposit the subsoil in the mud pit and followed by replacement of the topsoil. Uranerz would follow a similar approach for pipeline ditch construction. Process-related liquid effluent waste would be disposed of in deep disposal wells. Uranerz would have to obtain approval from NRC and construct and operate the wells in accordance with WDEQ requirements.

Based on the limited construction area and implementation of the BMPs discussed above, the potential environmental impacts of construction activities on geology and soils at the proposed Nichols Ranch ISR Project would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.1.2 *Operation Impacts*

As discussed in Section 4.3.3.2 of the GEIS during ISR operations, a non-uranium-bearing (barren) solution or lixiviant is injected through wells into the ore zone. The lixiviant moves through the pores in the host rock, dissolving uranium and other metals. Production wells withdraw the resulting "pregnant" lixiviant, which now contains uranium and other dissolved metals, and pump it to a central processing plant or to a satellite facility for further uranium recovery and purification.

The removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure and, therefore, no significant matrix compression or ground subsidence is expected. Therefore, impacts on geology from ground subsidence at ISR projects are expected to be SMALL.

Section 4.3.3.2 of the GEIS further indicates that a potential impact to soils from ISR operations arises from the necessity to move barren and pregnant uranium-bearing lixiviant to and from the central processing plant in aboveground and underground pipelines. If a pipe ruptures or fails, lixiviant can be released and (1) pond on the surface, (2) run off into surface water bodies, (3) infiltrate and adsorb in overlying-soil and rock, or (4) infiltrate and percolate to groundwater. In the case of spills from pipeline leaks and ruptures, licensees are expected to establish immediate spill responses through onsite standard operation procedures (Section 5.7 of NRC, 2003). As part of the monitoring requirements at ISR facilities, licensees must report certain spills to the NRC within 24 hours. Licensees in the state of Wyoming must also comply with applicable WDEQ requirements for spill response and reporting.

Based on these considerations, Section 4.3.3.2 of the GEIS concludes that short-term impacts to soils from spills during operation could range from SMALL to LARGE depending on the volume of soil affected by the spill, but that required immediate response to spills at ISR facilities, spill recovery actions, and routine monitoring programs would reduce the overall impacts from spills to SMALL.

The proposed Nichols Ranch ISR Project would not result in the removal of any rock matrix or structure. No significant matrix compression or ground subsidence is expected, as the net withdrawal of fluid (bleed) would be typically one percent or less. Due to the depth of the ore zone (91 to 213 m [300 to 700 ft] for the Nichols Ranch Unit, 61 to 183 m [200 to 600 ft] for the Hank Unit), no subsidence would result at the site from the collapse of overlying rock strata in the ore zone. Uranerz would be expected to construct and monitor these deep disposal wells in accordance with WDEQ requirements and obtain the necessary NRC and WDEQ approvals and permits for operation.

If soil were contaminated by a spill, Uranerz would remove the contaminated soil and dispose of it at a licensed disposal facility. All decontamination procedures would be confirmed with radiation surveys and would be required to meet NRC's regulations addressing radioactive materials in soils in areas released for unrestricted use (Uranerz, 2007). In addition, during operations, Uranerz would have a program in place to monitor well field and pipeline flow and pressure. This program, discussed in Section 6.3.2, would ensure the timely detection of any releases from leaks from pipeline breaks or ruptures and minimize the volume of such releases.

Because the operation phase involves no soil removal of rock matrix or structure and spills would be mitigated using the BMPs discussed above, the potential environmental impacts to geology from operations are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.1.3 *Aquifer Restoration Impacts*

As indicated in Section 4.3.3.3 of the GEIS, aquifer restoration programs typically use a combination of (1) groundwater transfer, (2) groundwater sweep, (3) reverse osmosis, permeate injection, and recirculation, (4) stabilization, and (5) water treatment and surface conveyance. The groundwater sweep and recirculation process does not result in the removal of rock matrix or structure and, therefore, no significant matrix compression or ground subsidence is expected. The water pressure in the aquifer is decreased during restoration because a negative water balance is maintained in the well field being restored to ensure water flows into the well field from its edges, reducing the spread of contamination. However, the change in pressure is limited by recirculation of treated groundwater and, therefore, it is very unlikely that ISR operations would reactivate any local faults and extremely unlikely that any earthquakes would be generated. Therefore, in the Wyoming East Uranium Milling Region, the potential environmental impacts to geology from aquifer restoration are expected to be SMALL.

Based on the same considerations as used when evaluating the potential impact to soils from spills and leaks, Section 4.3.3.3 of the GEIS has concluded that impacts to soils from spills during operation could range from SMALL to LARGE depending on the volume of soil affected by the spill. Because of the required immediate responses at ISR facilities, spill recovery actions, and routine monitoring programs, impacts from spills are temporary and the overall long-term impact to soils would be expected to be SMALL.

ISR activities during aquifer restoration at the proposed Nichols Ranch ISR Project site would not result in the removal of any rock matrix or structure. Due to the depth of the ore zone (91 to 213 m [300 to 700 ft] for the Nichols Ranch Unit, 61 to 183 m [200 to 600 ft] for the Hank Unit), no significant matrix compression or ground subsidence is expected and no subsidence would result at the site from the collapse of overlying rock strata in the ore zone during the restoration phase. Therefore, the potential environmental impacts during aquifer restoration on geology are expected to be SMALL.

Uranerz would conduct the same spill and leak detection program as planned during operations. Consequently, the impact to soils from spills and pipeline leaks should be similar to that identified during the operation phase. Thus, the potential environmental impacts to soils from spills during aquifer restoration at the proposed Nichols Ranch ISR Project site are expected to be SMALL. The required immediate response, the spill recovery actions, and the routine monitoring programs, impacts from spills would be temporary, and the overall long-term impact to soils would be expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.1.4 *Decommissioning Impacts*

As indicated by Section 4.3.3.4 of the GEIS, decommissioning of ISR facilities includes: (1) dismantling process facilities and associated structures, (2) removing buried piping, and (3) plugging and abandoning wells using accepted practices. The main impacts to geology and soils at the project site during decommissioning would be from activities associated with land reclamation and cleanup of contaminated soils.

As further indicated in the GEIS, before decommissioning and reclamation activities begin, the licensee is required to submit a decommissioning plan to NRC for review and approval. Any areas potentially impacted by operations would be included in surveys to ensure all areas of elevated soil concentrations are identified and properly cleaned up to comply with NRC regulations at 10 CFR Part 40 Appendix A, Criterion 6(6). Additionally, a goal of reclamation is to return the site to pre-production conditions through return of topsoil and re-establishment of vegetative communities.

The GEIS has concluded that most of the impacts to geology and soils associated with decommissioning would be detectable but SMALL. Disruption and/or displacement of existing soils would be relatively small. Changes in amounts and locations of impervious surfaces would be measurable but would not be at a great enough scale to noticeably alter existing natural conditions. Mitigation may be needed to offset adverse impacts but would be relatively simple to implement and likely be successful.

Uranerz would restore all lands disturbed by the proposed Nichols Ranch ISR Project to their prior land use of livestock grazing and wildlife habitat. Any buildings or structures would be decontaminated to regulatory standards and either demolished and trucked to a disposal facility or turned over to the landowner if desired. Baseline soils, vegetation, and radiological data would be used as a guide in evaluating final reclamation. Uranerz would submit a final decommissioning plan to the NRC for review and approval at least 12 months prior to the planned decommissioning of a well field or project area. During the reclamation process, WDEQ guidelines would be followed, and the WDEQ would determine the success of final re-vegetation by comparing the area to a reference area (Uranerz, 2007).

While there may be some short-term impacts as reclamation is in progress, the outcome of these activities should be to return the project area to its prior use. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, the potential environmental impacts to geology and soils associated with decommissioning at the proposed Nichols Ranch ISR Project site would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.2 No-Action (Alternative 2)

The No-Action Alternative would result in no change to existing soil and/or topographic and geologic conditions at the proposed project area or in the region. Land disturbance would be avoided and the area would retain its soil and/or topographic and geologic characteristics for the region. The current land uses on and near the proposed project area, including grazing lands, natural resource extraction, and recreational activities, would continue.

4.4.3 Modified Action – No Hank Unit (Alternative 3)

This alternative would result in a similar but slightly less environmental impact than identified for the proposed action. Approximately 20 ha (50 ac) of soils during the life of the project for the disturbance of soil to construct a central processing plant, auxiliary facilities, and well fields on the Nichols Ranch Unit and an access road. These impacts would be temporary as any disturbance affected by the project would be restored and reclaimed after the project has reached the end of its life. Similar to the proposed action, Uranerz would strip the topsoil in the area of the central processing plant and well field header houses prior to construction. That topsoil would be salvaged during construction activities and stored in designated topsoil stockpiles that are in accordance with WDEQ requirements. During construction of the Nichols Ranch Unit well fields, deep disposal well for process-related effluent, drilling activities and the installation of piping may also impact soils. Similar to the proposed action, the drilling activities would include the construction of mud pits. Uranerz would use the same procedure of excavating mud pits as outlined in the proposed action. During the operation and aquifer restoration phases, Uranerz would use the same monitoring program and spill procedures outlined in the proposed action. Similar to the proposed action, Uranerz would submit a decommissioning plan prior to the planned decommissioning of a well field or Nichols Ranch Unit project area. Due to the smaller area affected by this alternative than the proposed action and the same monitoring and spill procedures as the proposed action, the potential environmental impacts to geology and soils for all stages of the project for this alternative are SMALL.

4.5 Water Resources Impacts

4.5.1 Surface Waters and Wetlands Impacts

Potential environmental impacts to surface water at the proposed Nichols Ranch ISR Project site may occur during all phases of the ISR facility's lifecycle. Impacts can result from road construction and crossings, erosion runoff, spills or leaks of fuel and lubricants, discharges of stormwater and potentially process-related fluids, and discharge of well field fluids as a result of pipeline or well head leaks.

Detailed discussion of the potential environmental impacts to surface water from construction, operation, aquifer restoration, and decommissioning are provided in the following sections. Four wetlands occur in the southeast portion of Nichols Ranch Unit, which are the result of man-made activities. Because these wetlands lie outside of the proposed construction area and would be avoided by all phases of the proposed Nichols Ranch ISR Project, wetlands are not expected to impacted. Therefore, the discussion in this section focuses on the ephemeral channels and washes on and in the vicinity of the site.

4.5.1.1 *Proposed Action (Alternative 1)*

4.5.1.1.1 Construction Impacts

As discussed in the Section 4.3.4.1.1 of the GEIS, impacts to surface waters and related habitats from construction could involve road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment. These would be mitigated through proper planning, design, construction methods, and best management practices. U.S. Army Corps of Engineers (USACE) permits may be required when filling and crossing of wetlands. The GEIS considered that temporary changes to spring and stream flow from grading and changes in topography and natural drainage patterns could be mitigated or restored after the construction phase. Additionally, while impacts from incidental spills of drilling fluids into local streams could occur, they would be expected to be temporary due to the use of mitigation measures. The GEIS also estimated that impacts from roads, parking areas, and buildings on recharge to shallow aquifers would be SMALL, owing to the limited area of impervious surfaces proposed by license applicants. Overall, the GEIS determined that construction impacts to surface water would be SMALL in most cases.

During construction of the proposed Nichols Ranch ISR Project, two new 0.32-km (0.2-mi)-long access roads would be created. These roads would be constructed entirely in uplands and therefore, only minimal impacts to surface waters from loose soil would be expected. Sedimentation and erosion control devices would be implemented during construction to minimize sediment transfer to surface waters. Additional temporary access roads would be constructed to provide access to well fields for equipment and trucks required to install injection and production wells. Ephemeral channels would be crossed at two locations on the Nichols Ranch Unit and at three locations on the Hank Unit. These crossings would occur at the natural streambed elevation and at shallow-water locations perpendicular to flow. No fill material would be expected to be needed for these trails. If needed, Uranerz would grade steep and incised channel banks to create gently sloping approaches to these channel crossings. Uranerz would also use proper sedimentation and erosion control to minimize sedimentation into the channels and disturbed soil would be re-seeded. Uranerz would also use riprap and/or hay bales to armor areas prone to erosion.

Uranerz would route electric lines through both the Nichols Ranch and Hank Units as overhead lines on utility poles. However, any lines within 0.6 km (1.0 mi) of the base of the Pumpkin Buttes TCP would be buried accordance with the BLM/Wyoming State Historic Preservation

Office (SHPO) Programmatic Agreement (PA) (BLM, 2009) regarding mitigation of adverse effects to this cultural resource, which is discussed in more detail in Section 4.9.1.1. No poles would be installed in any ephemeral streams, washes, or wetlands, and therefore, construction activities associated with these lines are not expected to affect surface waters.

Uranerz would construct wells to avoid channels and washes when possible; however, avoidance is not always possible due to the nature of the land surface immediately above the ore bodies. Uranerz would place approximately 15 wells (5 production and 10 injection) in ephemeral channels during the dry season within the Nichols Ranch Unit and 22 wells in ephemeral channels on the Hank Unit (11 production and 11 injection). Uranerz would minimize impacts through the implementation of erosion and sedimentation control measures. For wells occurring in ephemeral channels, pumped water would be released directly into ephemeral channels where the water is expected to quickly be absorbed into the soil. Once the installation of each well is completed, measures would be taken to stabilize loose soil such as re-seeding and mulching using standard erosion control techniques.

Uranerz would use plastic polyvinyl chloride (PVC) pipelines to connect the injection and production wells with the Nichols Ranch Unit central processing plant and the Hank Unit satellite facility, which would require that pipes bisect ephemeral channels at numerous locations. Uranerz would bury pipelines and crossings would be perpendicular to flow. Uranerz would perform the work when the channels are dry using small-scale excavation equipment that would create a narrow, shallow trench. Excavated native soil would be immediately returned to the trench at the pre-existing grade after the pipes have been installed so as to restore the channel to the original condition. Bare soil would be re-seeded and mulched for stability.

Uranerz would construct the Nichols Ranch Unit central processing plant and Hank Unit satellite facility in the center of the respective properties away from all ephemeral channels and above the peak flow elevation. Uranerz would utilize proper erosion and sedimentation measures pursuant to WDEQ requirements throughout the construction process to prevent sedimentation into any channels.

Temporary disturbances to the soil from vehicular passes during construction may cause some sediment transport during periods of surface flow. However, the amount of sediment transport would be expected to have a negligible effect on the stability of the channel and water quality. Uranerz would mitigate accidental spills of petrochemicals such as oil and gasoline by conducting routine vehicle maintenance and inspection and Uranerz would develop and implement an emergency response plan (ERP) tailored for such occurrences. Uranerz would train personnel in the proper handling and transport of hazardous materials to minimize the occurrence of spills. Uranerz would handle waste disposal via properly installed septic systems, deep disposal wells, or offsite transport to appropriate disposal sites to mitigate the effects of potential chemical spills onsite.

Based on the limited construction area, limited number of surface water and wetlands features onsite, and the implementation of BMPs as discussed above, the impacts associated with construction, including road construction, installation of electric lines, well construction, pipe routing, building construction, and related vehicular traffic are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for surface water and incorporates by reference the GEIS's conclusions that the impacts to surface water during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.1.2 Operation Impacts

Section 4.3.4.1.2 of the GEIS states that through permitting processes, federal and state agencies regulate the discharge of storm water runoff and the discharge of process-related water. Impacts from these discharges would be mitigated as licensees would be expected to operate within the conditions of their permits. Expansion of facilities or pipelines during operations would be expected to generate impacts similar to those experienced during construction. Additionally, the potential impact of spills to surficial aquifers would depend on the size of the spill, the success of remediation, the use of the surface water, the proximity of the spill to surface water, and the relative contribution of the aquifer discharge to the surface water. For these reasons, overall, the GEIS determined that impacts to surface waters during operations would be SMALL.

Uranerz would develop a storm water management plan for the proposed Nichols Ranch ISR Project that would be implemented in accordance with WDEQ. The plan would cover how storm water runoff would be diverted away from the Nichols Ranch Unit central processing plant and Hank Unit satellite facility and absorbed into soils, rather than to any surface waters channels.

During routine maintenance of wells, vehicles would need to cross ephemeral channels to access portions of the well fields. Some channel crossings would occur at unimproved, streambed elevations. Uranerz would conduct such crossings mostly during dry periods of no flow, though scheduled well field observations may require a low flow crossing. Temporary disturbances to soil from such vehicular passes may cause limited sediment to downstream areas. Uranerz would avoid crossing drainage and wash areas that could loosen soil, damage channel banks, or disturb vegetation to reduce impacts to surface waters. Therefore, impacts related to routine maintenance would be SMALL.

Uranerz would construct the Nichols Ranch Unit central processing plant and Hank Unit satellite facility on concrete slabs with a protective berm erected around the perimeter to prohibit any chemical spills from escaping the area. While most of the operational facilities occur on land relatively distant from surface water features, spills, leaks and other inadvertent discharges into surface waters may occur during operations. These events are expected to have relatively low risk of occurring and would be detected early for stoppage and cleanup in accordance with NRC requirements. Uranerz would train personnel in proper handling and transport of hazardous materials would avoid spills as well. Waste disposal via properly installed septic systems, deep disposal wells, or offsite transport to an appropriate disposal site(s) would mitigate the effects of potential onsite chemical spills. Therefore, impacts to surface water from these operational activities are expected to be SMALL

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for surface water and incorporates by reference the GEIS's conclusions that the impacts to surface water during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.1.3 Aquifer Restoration Impacts

In Section 4.3.4.1.3 of the GEIS, aquifer restoration activities that could impact surface water include management of produced water, storm water runoff and accidental spills, and management of brine reject from the reverse osmosis system. It is expected that the impacts from these activities would be similar to impacts from operations, due to use of the same (in-place) infrastructure and similar activities conducted (e.g., well field operation, transfer of fluids, water treatment, storm water runoff). For these reasons, the GEIS determined aquifer restoration impacts to surface water to be SMALL.

The restoration of groundwater aquifers at the proposed Nichols Ranch ISR Project would result in the production of wastewater, primarily as a result of groundwater sweep, the first phase of aquifer restoration. The second source of wastewater would be brine from the reverse osmosis unit. All wastewater would be contained in a wastewater disposal system for eventual injection via deep disposal wells. Uranerz would use automated sensors to monitor the injection process to detect leaks or pipe/well ruptures as during operational monitoring. No wastewater would be released into surface waters. Impacts to surface waters from storm water runoff and accidental spills, as discussed in Section 4.5.1.1.2 are possible; however, impacts to surface water from aquifer restoration are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for surface water and incorporates by reference the GEIS's conclusions that the impacts to surface water during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.1.4 <u>Decommissioning Impacts</u>

As discussed in Section 4.3.4.1.4 of the GEIS, impacts from decommissioning are expected to be similar to impacts from construction. Activities to clean up, re-contour, and reclaim disturbed lands during decommissioning would be expected to mitigate long-term impacts to surface waters. Potential impacts to surface water from decommissioning would be expected to be SMALL.

Decommissioning of the proposed Nichols Ranch ISR Project would require all buildings and pipelines to be removed, and all wells to be plugged and abandoned (Uranerz, 2007). The impacts of removing project improvements would be similar to construction impacts discussed in Section 4.5.1.1.1. Temporary soil disturbances would result in some soil erosion and translocation. Topsoil that was stockpiled during the construction phase would be returned to the disturbed areas, graded to pre-disturbance contours, and seeded/mulched as part of an erosion and sedimentation control plan to be approved by the WDEQ. Uranerz would ensure that proper measures would be in place to limit sedimentation into surface waters during the decommissioning of buildings, thereby minimizing impacts.

Wells and pipeline removal would require temporary disturbances within surface waters where pipes bisect these systems. Work would be performed during the dry season so as to minimize sedimentation in surface waters. Excavated surface soil would be returned to the wellheads and trenches once the pipes are removed. Restored trenches would be graded to pre-construction contours and seeded with a native seed mix in accordance with a restoration plan approved by the WDEQ. Any access roads that the landowner would prefer to be reclaimed would be restored in a similar manner.

Based on the temporary nature of these activities and the BMPs discussed above, impacts to surface water features associated with decommissioning activities are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for surface water and incorporates by reference the GEIS's conclusions that the impacts to surface water during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.2 *No-Action (Alternative 2)*

Under the No-Action Alternative, there would be no change in the surface water quality at or in the vicinity of this site. This alternative would result in no impacts to surface water quality. the current land uses on and near the proposed project area, including grazing lands, natural resource extraction, and recreational activities, would continue.

4.5.1.3 *Modified Action – No Hank Unit (Alternative 3)*

Under this alternative, the Hank Unit would not be considered and all proposed facilities would be confined to the Nichols Ranch Unit. Similar to the proposed action, the primary disturbances that could cause impacts to surface water during construction would occur with well drilling, road and facility construction, and pipeline installations. Spills, leaks and other inadvertent discharges into surface waters may occur during operations, but the potential would be reduced because only the Nichols Ranch Unit would be operating. The BMPs discussed in the proposed action for all phases would still be implemented under this alternative. Under all phases, impacts of this alternative are expected to be similar in nature, but less than under the proposed action and thus would be SMALL.

4.5.2 Groundwater Impacts

Potential environmental impacts to groundwater at the proposed Nichols Ranch ISR Project site may occur during all phases of the ISR facility's lifecycle, but primarily during operations and aquifer restoration.

ISR activities can impact aquifers at varying depths (separated by aquitards) above and below the uranium-bearing aquifer as well as adjacent surrounding aquifers in the vicinity of the uranium-bearing aquifer. Surface or near-surface activities that can introduce contaminants into soils are more likely to impact shallow aquifers while ISR operations and aquifer restoration will likely impact the deeper uranium-bearing aquifer and potentially impact any aquifers above and below and adjacent surrounding aquifers.

ISR facility impacts to groundwater resources can occur from surface spills and leaks, releases from shallow surface piping, consumptive water use, horizontal and vertical excursions of leaching solutions from production aquifers, degradation of water quality from changes in the production aquifer's chemistry, and waste management practices involving deep well injection. Detailed discussion of the potential impacts to groundwater resources from construction, operations, aquifer restoration, and decommissioning are provided in the following sections.

4.5.2.1 *Proposed Action (Alternative 1)*

4.5.2.1.1 <u>Construction Impacts</u>

Section 4.3.4.2.1 of the GEIS (NRC, 2009a) indicates that during construction of ISR facilities, the potential for groundwater impacts are primarily from consumptive groundwater use, introduction of drilling fluids and mud from well drilling, and spills of fuels and lubricants from construction equipment. The GEIS further stated that groundwater use during the construction phase would be limited and would be expected to be protected by implementing BMPs such as spill prevention and cleanup. The volume of drilling fluids and muds introduced into the environment during well installation would be limited. Thus, the construction impacts to groundwater would be SMALL based on the limited nature of construction activities and the implementation of BMPs to protect shallow groundwater (NRC, 2009a).

The consumptive water use during construction would be generally limited to dust control, drilling support, and cement mixing. Most water used for construction at the proposed Nichols Ranch ISR Project would be extracted from wells completed in surficial aquifers. The consumptive water use during construction is expected to be SMALL and temporary relative to the water supply available in these aquifers.

The volume of drilling fluids and muds used during well installation is expected to be limited and BMPs would be applied to prevent, identify, and correct impacts to soils and the surficial aquifer at the proposed Nichols Ranch ISR Project. Drilling fluids and muds would be placed into mud pits to control the spread of the fluids, to minimize the area of soil contamination, and to enhance evaporation. Therefore, any small amount of leakage from the mud pits or spills from drilling activities should result in only a small amount of infiltration and not cause any changes in the surficial aquifer water quality. The introduction of drilling fluids to the surficial aquifers may occur during drilling of production and monitoring wells, but is expected to be small, since drilling muds are designed to seal the hole so the casing may be set.

As wells are installed, some water may be pumped from aquifers for hydrologic tests such as pumping tests. This water should be discharged to the surface in accordance with approved permits from the State of Wyoming that Uranerz would obtain prior to any release. The surface discharge permits would protect near surface aquifers by limiting the discharge volume and prescribing concentration limits to waters that can be discharged.

During all construction operations at the proposed Nichols Ranch ISR Project, the groundwater quality of near surface aquifers would be protected by BMPs during facility construction and well field installation including implementation of a spill prevention and cleanup program to prevent soil contamination from fuels and lubricants from construction equipment. The volume of fuels and lubricants to be kept in the proposed project area is expected to be small and any leaks or spills would result in an immediate cleanup response to prevent soil contamination or infiltration to groundwater.

Based on this analysis, consumptive groundwater use during the construction phase would be limited and would be expected to have a SMALL and temporary impact. The impacts to soil and groundwater resources during well field and facility construction would be SMALL based on the limited nature of construction activities and implementation of BMPs to protect soils and shallow groundwater consistent with the GEIS conclusions (NRC, 2009a).

In conclusion, groundwater use during construction is expected to be limited to routine activities such as dust suppression, mixing cements, and drilling support. The amounts of groundwater used in these activities are small relative to available water and potentially could have a SMALL adverse and temporary impact to groundwater supplies within the proposed Nichols Ranch ISR Project. Even in instances where the water-table aquifer is shallow (e.g., See Section 4.5.2.1.2.1), groundwater quality of near-surface aquifers during construction would be protected by BMPs such as implementation of a spill prevention and cleanup plan to minimize soil contamination. Uranerz has committed to an aggressive program to clean up spills (Uranerz, 2007). Additionally, the amount of drilling fluids and mud introduced into aquifers during well construction would be limited and have a SMALL adverse impact to the water quality of those aquifers. Thus, construction impacts to groundwater resources would be SMALL based on the limited nature of construction activities and implementation of BMPs to protect shallow groundwater.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for groundwater and incorporates by reference the GEIS's conclusions that the impacts to groundwater during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.2 Operation Impacts

As indicated in Section 4.3.4.2.2 of the GEIS, during ISR operations, potential environmental impacts to shallow (near-surface) aquifers are related to leaks of lixiviant from pipelines, wells, or header houses. Potential environmental impacts to groundwater resources in the production and surrounding aquifers also include consumptive water use and changes to water quality. Water quality changes would result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations also can potentially impact groundwater resources (NRC, 2009a).

4.5.2.1.2.1 *Shallow (Near-Surface) Aquifers*

Section 4.3.4.2.2.1 of the GEIS (NRC, 2009a) discusses the potential impacts to shallow aquifers during ISR operations. A network of buried pipelines is used during ISR operations for transporting lixiviant between the pump house and the satellite facility or central processing plant and also to connect injection and extraction wells to manifolds inside the header houses. The failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers could result in leaks and spills of pregnant and barren lixiviant which could impact water quality in shallow aquifers. The potential environmental impact of such pipeline, valve, well integrity failure, or pond leakage depends on a number of factors, including the depth to shallow groundwater, the use of shallow groundwater, and the degree of hydraulic connection of shallow aquifers to regionally important aquifers. As indicated in the GEIS, potential environmental impacts could be MODERATE to LARGE if:

1) The groundwater in shallow aquifers is close to the ground surface;
2) The shallow aquifers are important sources for local domestic or agricultural water supplies; or
3) Shallow aquifers are hydraulically connected to other locally or regionally important aquifers.

As indicated in the GEIS, potential environmental impacts could be SMALL if shallow aquifers have poor water quality or yields not economically suitable for production, and if they are hydraulically separated from other locally and regionally important aquifers.

As previously discussed in Section 3.4.1 and 3.5.2 of this SEIS, the Wasatch Formation outcrops in the proposed project area and is characterized by a series of sand layers separated by mudstones and siltstones. The more permeable sand layers serve as aquifers in this area. Uranerz identified a series of sand layers in the upper portion of Wasatch Formation present in the proposed project area and have labeled these layers from the shallowest to the deepest as the H, G, F, C, B, A, and 1 Sands. In addition, the depth and expression of these sands at the ground surface is influenced by the topographical relief of the proposed project area.

The depth at which groundwater is first encountered in aquifers across the Nichols Ranch Unit varies and depends on surface topography. The specific sand that acts as the surficial aquifer similarly varies across the proposed project area depending on the outcropping of these sands and the surface topography. Limited groundwater level data are available to define depth to shallow groundwater across the Nichols Ranch Unit, and additional wells are planned to better define shallow groundwater levels in this area (Uranerz, 2007). In the southern portion of the Nichols Ranch Unit, shallow groundwater is first encountered in the Cottonwood alluvium and is within 3 m (10 ft) of the ground surface (Uranerz, 2007). Moving north from the Cottonwood alluvium, shallow groundwater is first encountered in the F Sand aquifer at depths ranging from 15 to 30 m (50 to 100 ft). However, in the northernmost portion of the Nichols Ranch Unit, the G Sand is likely to be the shallow aquifer, with depth to groundwater ranging between 30 to 60 m (100 to 200 ft). Groundwater flow in the F and G Sands is projected to be in a westerly direction (Uranerz, 2007).

Thus, the depth to shallow groundwater in the southern portion of the Nichols Ranch Unit is limited. Data indicate that the depth to groundwater in the general area of the proposed central processing plant is approximately 15 m (50 ft) and portions of the projected production zone extend to the area adjacent to the Cottonwood Creek alluvium, where groundwater may be as shallow as 3 m (10 ft). This limited unsaturated zone offers a limited buffer to absorb and attenuate any releases at the ground surface. Moreover, the shallow groundwater likely flows to Cottonwood Creek alluvium, and if left unchecked, shallow groundwater contamination could migrate into and along this alluvial material to the west. The groundwater quality data for the F Sand indicate that groundwater in this unit has relatively high total dissolved solids (TDS), but appears suitable for stock watering in many areas (Wyoming Class III groundwater). The well survey provided by Uranerz indicates that there are a number of stock watering wells within a 0.8-km (0.5-mi) radius of the proposed project area. Only one of these wells (N1, 11849) is screened in the F Sand shallow aquifer and could be potentially impacted by releases at the ground surface that migrate downgradient to the west.

Depth to shallow groundwater at the Hank Unit is similarly uncertain and the installation of additional wells are planned to identify shallow water levels in the Hank Unit (Uranerz, 2007). However, Uranerz indicated that the H Sand should be the surficial aquifer in this area, with depth to groundwater ranging between 15 m (50 ft) in the low lying areas to the west of the Hank Unit to 61 m (200 ft) along the eastern border of the Hank Unit. Groundwater flow in the H Sand at the Hank Unit is expected to flow in a westerly direction. The Willow and Dry Willow Creek alluvial materials in the Hank Unit are not expected to contain water except during short periods of time after runoff events.

The depth to shallow groundwater appears somewhat greater at the Hank Unit than at the Nichols Ranch Unit. There is generally a 30 m (100 ft) or more separation from the ground surface to shallow water beneath most of the production zone and planned processing facility. However, the southern portion of the ore body extends into an area where shallow water is projected to be within 15 m (50 ft) of the surface. Water quality data from the H Sand indicate that this unit is suitable for livestock use (Wyoming Class III groundwater). The well survey provided by Uranerz indicates that there are six of stock watering wells within a 0.8-km (0.5-mi) radius of the proposed project area. None of these wells are screened in the shallow aquifer. Monitoring wells, however, are screened in the surficial H Sand aquifer (e.g., BR-I, BR-K, URZHH-7) (Uranerz, 2007).

As indicated by the GEIS, any potential impact of releases at or near the ground surface on shallow groundwater can be greatly reduced by leak detection programs required by the NRC. Uranerz has planned an aggressive leak detection and spill cleanup program (Uranerz, 2007). In addition, preventative measures such as well mechanical integrity testing (Uranerz, 2007) would limit the likelihood of well integrity failure during operations.

As discussed previously for the Nichols Ranch Unit, the surficial aquifer is close to the ground surface in several areas, but these shallow aquifers do not appear hydraulically connected with more significant supplies of water from other local and regional aquifers. In one case though, the water is used by ranchers to water their stock. Therefore, the resultant impact to the shallow aquifer could potentially be MODERATE. However, the implementation of the leak detection program and mechanical integrity testing should mitigate the potential impact (i.e., early detection and cleanup) and result in SMALL potential operational impacts to shallow (near surface) aquifers for the Nichols Ranch and Hank Units.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to shallow aquifers during operations would be SMALL to LARGE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.2.2 *Production and Surrounding Aquifers*

The potential environmental impacts to groundwater supplies in the production and other surrounding aquifers are related to consumptive water use and groundwater quality.

<u>Water Consumptive Use</u>

As discussed in the Section 4.3.4.2.2.2 of the GEIS, groundwater is withdrawn and re-injected into the production zone during ISR operations. Most of the water withdrawn from the aquifer is returned to the aquifer. The portion that is not returned to the aquifer is referred to as consumptive use. The consumptive use is due primarily to production bleed and also includes other smaller losses. The production bleed is the net withdrawal maintained to ensure groundwater gradients toward the production network. This net withdrawal ensures there is an inflow of groundwater into the well field to minimize the potential movement of lixiviant and its associated contaminants out of the well field.

The portion of an aquifer where the production occurs must be designated as an exempt aquifer by the U.S. Environmental Protection Agency (EPA) pursuant to the Federal underground injection control (UIC) regulations before any production begins. An exempt aquifer designation means the aquifer is not, nor would it ever be, a source of drinking water in the location covered by the exemption. At the proposed Nichols Ranch ISR Project, portions of the A Sand at the Nichols Ranch Unit and F Sand at the Hank Unit in which production operations would occur and typically a buffer zone would be sought to be declared as exempt by EPA. Groundwater in the aquifer outside the designated exempt zone would still be considered a possible source of drinking water.

Consumptive water use during ISR operations could potentially impact a local water user who uses water from the production aquifer outside the exempted zone. This potential impact would result from lowering the water levels in nearby wells, thereby reducing the yield of these wells. In addition, if the production zone is hydraulically connected to other aquifers above and/or below the water zone, consumptive use may potentially impact the water levels in these overlying and underlying aquifers and reduce the yield in any nearby wells withdrawing water from these aquifers. Water consumptive use is discussed in more detail in Section 4.3.4.2.2.2 of the GEIS.

Uranerz provided predicted drawdowns created by production bleed during operations (Uranerz, 2007). These predictions were based on a simple analytical model and relied on aquifer properties determined during aquifer testing or assumed based on local conditions. Based on an assumed production rate of 13,250 liters per minute (Lpm) (3,500 gallons per minute [gpm]) and a 1 percent bleed rate, a groundwater withdrawal rate of 133 Lpm (35 gpm) was used to predict drawdowns at the Nichols Ranch Unit. The drawdowns resulting from this pumping rate were predicted using the aquifer properties of 4,350 L/day/m (350 gal/day/ft) for transmissivity and a storage coefficient of 1.8 x 10^{-4}. Simulations were conducted to evaluate the drawdowns resulting from concentrated drawdowns distributed at various locations in the projected well fields. These predictions show that 9 m (30 ft) of the drawdown will extend approximately 2,100 m (7,000 ft) outward from the center of the well fields. The 1.5 m (5 ft) contour is projected to extend out approximately 6,860 m (22,500 ft) or approximately 6.4 km (4 mi) from the proposed Nichols Ranch ISR Project area.

Uranerz indicated that the primary effect of the drawdowns caused by the Nichols Ranch Unit bleed should be limited to those wells that are located in the ore zone (A Sand) unit (Uranerz, 2007). This conclusion is based on the assumption that the A Sand is well confined and there would be little leakage from the underlying or overlying sands into the A Sand. Uranerz further indicated that the predicted drawdowns should not greatly impact production from pumping wells since in the confined A Sand, there is a large amount of potential drawdown available. As discussed in Section 3.5.2.3.5, inspection of Wyoming State Engineer's Office (WSEO) well data for wells within 4.8 km (3 mi) of the Nichols Ranch Unit indicates an average of about 136 m (446 ft) in available hydraulic head. Despite the significant amount of available head, flowing wells (i.e., those wells with a potentiometric surface above the ground surface) in the Nichols Ranch Unit area may cease flowing due to the predicted drawdowns. Uranerz indicated that flowing wells within the 3 m (10 ft) drawdown contour may be impacted and has identified a total of 10 wells within an 8 km (5 mi) radius that are flowing wells and screened within the A Sand (Uranerz, 2007). A pump or other supplement may have to be installed in a flowing well if the drawdowns cause it to cease flowing. Uranerz indicated that "confidential surface use agreements (are) in place with the landowners" detailing mitigation measures that will be implemented if a free flowing well is impacted by the proposed Nichols Ranch ISR Project (Uranerz, 2007).

In addition to the drawdown, pumping of the A Sand may induce leakage from the overlying and/or underlying aquifers. Such leakage may occur in areas where the intervening aquitards are not extensive or where they are compromised by wells screened over multiple aquifers or inadequately sealed wells or boreholes are present. The result of such leakage across confining beds would produce drawdowns in these adjacent beds; however, aquifer testing at the Nichols Ranch Unit has not indicated leakage from either the overlying B Sand or the underlying 1 Sand. Specifically, Uranerz presented the results of two multi-well pumping tests (MN-1 and MN-2 multi-well tests) that included pumping of the A Sand coupled with monitoring of the A Sand, the overlying B Sand aquifer, and the underlying 1 Sand aquifer (Uranerz, 2007). Neither test indicated a hydraulic connection (drawdown) between the A Sand and the B Sand or 1 Sand. Even if leakage from underlying or overlying units were to occur in offsite areas, these drawdowns are expected to be a fraction of the drawdowns experienced in the A Sand. Consequently, given the abundant hydraulic head in the A Sand, the in-place mitigation measures in the event of impact to free flowing wells, and the absence of the evidence indicating leakage from overlying and underlying aquifers, the potential short-term impact due to consumptive use at the Nichols Ranch Unit during the production phase is considered SMALL.

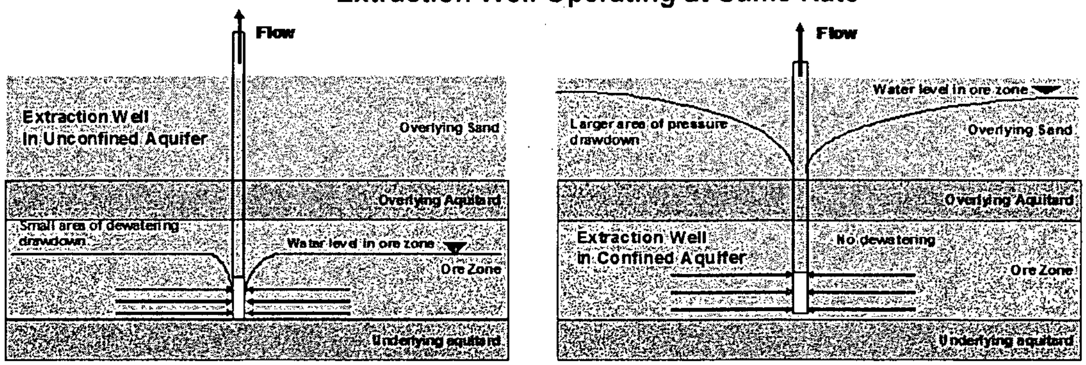
The net consumptive use of water at the Nichols Ranch Unit during the operational phase (production and restoration) is a small fraction of the water currently stored in the A Sand in the Powder River Basin. After production and restoration are complete and groundwater withdrawals are terminated at the Nichols Ranch Unit, groundwater levels will tend to recover with time. Thus, the potential long-term (approximately 10 years) environmental impact from consumptive use during the operational phase at Nichols Ranch Unit is considered SMALL.

As previously discussed in Section 3.5.2, the F Sand production zone at the Hank Unit is not completely saturated. Therefore, it is an unconfined aquifer. The unconfined conditions in the production zone help to reduce the potential impact of the consumptive use anticipated during

ISR operations. For a given net withdrawal, an unconfined aquifer exhibits substantially less drawdown in water level over a smaller area relative to that exhibited in a confined aquifer. As shown in Figure 4-1, the water produced from a well in an unconfined aquifer (water level below overlying aquitard) comes from dewatering of the aquifer pore space in the production zone. However, the water moving to a well in a confined aquifer (water level above overlying aquitard) comes from the compression of the sediments and expansion of water from the pressure drawdown in the production zone, but does not drain the pore spaces. Therefore, much more water is produced from dewatering drawdown over a small area of an unconfined aquifer to meet the well flow rate, whereas the pressure drawdown to produce water from a confined aquifer must occur over a larger area to meet the well flow rate.

Uranerz provided predictions of drawdowns created by production bleed in the F Sand at the Hank Unit. Based on an assumed production rate of 9,470 Lpm (2,500 gpm) and a 3 percent bleed rate, a groundwater withdrawal rate of 284 Lpm (75 gpm) was used to predict drawdowns at the Hank Unit. The drawdowns resulting from this pumping rate were predicted using the aquifer properties of 400 gal/day/ft for transmissivity and a storage value of 0.05 for the unconfined F Sand. Simulations were conducted by assuming 284 Lpm (75 gpm) distributed over 6 locations in the northern well field for 1.5 years followed by a second set of six withdrawals in the southern well field for the remaining 1.5 years. The predictions indicate that drawdowns of 3 m (10 ft) will extend out only to the area immediately adjacent to the southern well field, while the drawdowns of 1.5 m (5 ft) will extent out approximately 270 m (900 ft) from

Figure 4-1. Drawdowns in an Unconfined Aquifer and Confined Aquifer from an Extraction Well Operating at Same Rate



the well field. The reduced drawdowns observed in the F Sand at the Hank Unit are due to the unconfined nature of the aquifer. Aquifer testing at the Hank Unit has not indicated leakage from either the overlying G Sand or the underlying B Sand. Specifically, Uranerz presented the results of two multi-well pumping tests (URZHF-1 and URZHF-5 multi-well tests) that included pumping of the F Sand coupled with monitoring of the F Sand, the overlying G Sand aquifer, and the underlying B Sand aquifer (Uranerz, 2007). Neither test indicated a hydraulic connection (drawdown) between the F Sand and the G Sand or B Sand. No flowing wells have been identified in the F Sand in this area. In addition, Uranerz stated that any wells screened in the F Sand in the area immediately adjacent to the Hank Unit will need to be abandoned due to their close proximity to the production zone using acceptable WDEQ methods or will be used as monitoring wells if not completed in multiple sands (Uranerz, 2007). Thus, the potential environmental impact due to consumptive use of groundwater at the Hank Unit during the production phase is likely to be SMALL.

The net consumptive use of water at the Hank Unit during the operational phase (production and restoration) is a small fraction of the water currently stored in the F Sand in the Powder River Basin. After production and restoration are complete and groundwater withdrawals are terminated at the Hank Unit, groundwater levels will tend to recover with time. Thus, the potential long-term (approximately 10 years) environmental impact from consumptive use during the operational phase at Hank Unit is considered SMALL.

Excursions and Groundwater Quality

As discussed in Section 4.3.4.2.2.2 of the GEIS, groundwater quality in the production zone is degraded as part of ISR operations. The portion of the production aquifer used for production must be exempted as an underground source of drinking water by the U.S. Environmental Protection Agency. After production is completed, the licensee is required to initiate aquifer restoration activities to restore the production zone to baseline or pre-operational class-of-use conditions, if possible. If the aquifer cannot be returned to preoperational conditions, NRC requires that the production aquifer be returned to the maximum contaminant levels (MCLs) provided in Table 5C of 10 CFR Part 40 Appendix A or to Alternate Concentrations Limits (ACLs) approved by the NRC. For proposed ACLs to be approved, they must be shown to be protective of public health at the site.

In Section 2.11.4 of the GEIS, the NRC staff documented that based on historical information at operating ISR facilities, excursions have occurred at these facilities. Separately, the NRC staff analyzed the environmental impacts from both horizontal and vertical excursions at three NRC-licensed ISR facilities (NRC, 2009b). In that analysis, which involved 60 events at the three facilities, the NRC staff found that, for most of the events, the licensees were able to control and reverse the excursions through pumping and extraction at nearby wells. Most excursions were short-lived, although a few continued for several years. In all cases, none resulted in environmental impacts (NRC, 2009b).

Current groundwater compositions at the Nichols Ranch and Hank Units affect the use of the groundwater resource. In the Nichols Ranch Unit, the A, B, and C Sand aquifers contain water whose compositions (primarily for radium-226) exceed the Wyoming Ground Water Quality Class I (domestic use), Class II (agriculture use), and Class III (suitable for livestock) standards. In contrast, the deeper 1 Sand aquifer meets Wyoming's Class I standard. Based on cross-sections, Uranerz shows the 1 Sand to be very discontinuous and thin. Consequently, due to the significant depth, and limited extent of this aquifer, the 1 Sand is not expected to be used as source of drinking water. At the Hank Unit, the G and H Sands, which lie above the F Sand production zone, are considered the shallow (near-surface) aquifers and meet Wyoming's Class III standard (suitable for livestock), while both the F Sand and underlying B and C Sands exceed Wyoming's standards for drinking water, agriculture or livestock use. Based on the generally poor pre-existing water quality in both the Nichols Ranch and Hank Units, and the expected restoration of the production zones at both units, and due to the confinement of the Nichols Ranch Unit production aquifer, potential impacts to the water quality of the uranium-bearing production zone aquifer as a result of ISR operations would generally be expected to be SMALL and temporary.

To prevent horizontal excursions, inward hydraulic gradients are expected to be maintained in the production aquifer during ISR operations. These inward hydraulic gradients are created by the net groundwater withdrawals (production bleeds) maintained through continued pumping during ISR operations. Groundwater flows in response to these inward hydraulic gradients, thus ensuring that groundwater flow is toward the production zone. This inward groundwater flow toward the extraction wells prevents horizontal excursions of leaching solutions away from the production zone (Uranerz, 2007).

The NRC also requires the licensee to take preventive measures to reduce the likelihood and consequences of potential excursions. A ring of monitoring wells within and encircling the production zone is required for early detection of horizontal excursions. Uranerz's groundwater monitoring program is detailed in Chapter 6 of this SEIS. If excursions are detected, corrective actions are required outside of the exempted portion of the production aquifer. Chemical indicators of horizontal excursions will use conservative (nonreactive or unretarded) constituents of the lixiviant such as chloride. An elevated chloride concentration in a monitoring well could provide an early signal suggesting the approach of a plume of reactive contaminants. Corrective action can be implemented to stop or reverse the progress of the plume.

Vertical excursions may also potentially occur into aquifers overlying or underlying the production zone aquifer. As analysis presented in the GEIS indicates, the potential for migration of leaching solution into an overlying or underlying aquifer is small if the thickness of the aquitard separating the production zone from the overlying and underlying aquifers is sufficient and the permeability of the aquitard is low. Steep hydraulic gradients in which the hydraulic head of the production zone exceeds that of the overlying or underlying aquifers also can lead to vertical excursions. Vertical excursions can also occur due to improperly sealed boreholes, to poorly completed wells, or to a loss of mechanical integrity of ISR injection and extraction wells. To ensure the detection of vertical excursions, the NRC also requires monitoring in the overlying and underlying aquifers (Uranerz, 2007). A program of mechanical integrity testing of all ISR wells is also required (Uranerz, 2007). Corrective action is required if any vertical excursions are detected (Uranerz, 2007).

Groundwater in the A Sand (the production zone) at the Nichols Ranch Unit is confined and there is sufficient hydraulic conductivity for ISR operations. The drawdown created by pumping in the production zone should facilitate containment of the lixiviant in the ore zone and allow the recovery of any horizontal or vertical excursions, should they occur. The overlying BA Aquitard and underlying A1 Aquitard are thick and extensive and are expected to confine the lixiviant to the A Sand. Pumping tests conducted to date indicate no potential hydraulic connection between the A Sand and the overlying or underlying sands. Each production area will undergo further extensive testing required before initiating ISR operations. The results of this further testing will be provided in the data packages, which will be reviewed and approved by the NRC. Therefore, the potential environmental impact to groundwater quality is considered SMALL at the Nichols Ranch Unit.

The occurrence of unconfined conditions in the production zone at the Hank Unit presents special considerations when evaluating the maintenance of the necessary inward hydraulic gradient, the reliability of monitoring around the periphery of the well field, and the capability of reversing any potential horizontal excursion by drawing the lixiviant back into the producing well. Although the unconfined condition of the production zone at the Hank Unit does not necessarily indicate that leakage will occur from the overlying G Sand aquifer as the overlying aquifer could be perched and separated from the production zone by an aquitard, it does result in limited drawdown. However, as in ISR operations in confined aquifers, data packages containing the results of aquifer testing throughout the production zone will be required to verify that hydraulic control of the production zone can be maintained with the planned production bleed. These tests must also demonstrate that hydraulic control reaches out to the proposed monitoring ring and that sufficient drawdown is available to pull back any horizontal or vertical excursion that might occur. The unconfined conditions of the F Sand at the Hank Unit can affect the methods applied in the restoration stage of the ISR project (see Section 4.5.2.1.3). However, given the generally poor water quality and the evidence suggesting insignificant connections between the production zone and the overlying and underlying aquifers, the potential environmental impact to groundwater quality from excursions at the Hank Unit is considered SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to production and surrounding aquifers during operations would be SMALL to LARGE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.2.3 *Deep Aquifers Below the Production Aquifers*

Potential environmental impacts to confined deep aquifers below the production aquifers could be due to deep well injection of processing wastes into deep aquifers. Under different environmental laws such as the *Clean Water Act*, the *Safe Drinking Water Act*, and the *Clean Air Act*, EPA has statutory authority to regulate activities that may affect the environment. Underground injection of fluid requires a permit from EPA or from an authorized state UIC program. The WDEQ has been authorized to administer the UIC program in Wyoming and is responsible for issuing any permits for deep well disposal at the proposed Nichols Ranch ISR Project site.

The GEIS also indicates that the potential environmental impact of injecting a leaching solution into deep aquifers below ore-bearing aquifers would be expected to be SMALL, if water production from deep aquifers is not economically feasible or if the groundwater quality from these aquifers is not suitable for domestic or agricultural uses (e.g., high salinity) and they are confined above by sufficiently thick and continuous low permeability layers.

Section 4.3.4.2.2.3 of the GEIS indicates that in the Wyoming East Uranium Milling Region, where the proposed Nichols Ranch ISR Project is located, the Paleozoic aquifers are hydraulically separated from the aquifer sequence that includes, from the shallowest to the deepest, the Wasatch Formation, Fort Union Formation, Lance Formation, and Fox Hills Formation by thick low permeability confining layers that include the Pierre Shale, Lewis Shale, and Steele Shale (Whitehead, 1996). Hence, the nonkarstic Paleozoic aquifers (e.g., Tensleep Sandstone) can be investigated further for suitability of disposal of leaching solutions. The GEIS has concluded that in the Wyoming East Uranium Milling Region, considering the relatively low water quality in and the reduced water yields from the nonkarstic Paleozoic Aquifers and the presence of thick and regionally continuous aquitards confining them from above, the potential environmental impacts due to deep well injection of leaching solution into the nonkarstic Paleozoic aquifers could be SMALL.

Uranerz plans to dispose of waste fluids using deep well injection and is seeking a permit for Class I injection wells from the WDEQ. Each of the units would have a deep injection well. The WDEQ will evaluate the suitability of the proposed deep injection wells. The WDEQ will only grant such a permit if the waste fluids can be suitably isolated in a deep aquifer. Consequently, it is assumed that the potential environmental impact to deep aquifers below the production aquifers of deep well injection of waste will be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to deep aquifers during operations would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.3 Aquifer Restoration Impacts

As indicated in Section 4.3.4.2.3 of the GEIS, the potential environmental impacts to groundwater resources during aquifer restoration are related to groundwater consumptive use and waste management practices, including potential deep disposal of brine slurries resulting from reverse osmosis. In addition, aquifer restoration directly affects groundwater quality in the vicinity of the well field being restored.

Regardless of the process, hydraulic control of the former production zone must be maintained during restoration. This is accomplished by maintaining an inward hydraulic gradient through a production bleed (see Section 4.5.2.1.2.2). As discussed in the GEIS, the impacts of consumptive use during aquifer restoration are generally greater than during ISR operations. This is particularly true during the sweep phase when a greater amount of groundwater is generally withdrawn from the production aquifer. During the sweep phase, groundwater is not re-injected into the production aquifer and all withdrawals should be considered consumptive.

Uranerz is planning three phases of restoration: groundwater sweep, groundwater transfer, and groundwater treatment. The sequence of the restoration methods would be determined based on operating conditions (Uranerz, 2007). Uranerz indicated that restoration will be sequenced with production at the facility. Thus, initially only production will be occurring. However, as production moves from one well field to another, restoration and production will be occurring. Eventually, after production is complete, only restoration will be undertaken. Uranerz indicated that restoration will consume additional water, particularly during the groundwater sweep phase. Also, during restoration, approximately 20 to 25 percent of the groundwater treatment flow through the reverse osmosis unit is disposed of as brine that is sent to the deep disposal well. Based on liquid disposal rates predicted for the deep injection wells, net withdrawals may approach 380 Lpm (100 gpm) at both the Nichols Ranch and Hank Units during the combined production and restoration phase and during the restoration phase alone.

The analysis of the predictions of drawdown during production (see Section 4.5.2.1.2.2) has already indicated that at 133 Lpm (35 gpm), production drawdown from the Nichols Ranch Unit will likely reach a 8 km (5 mi) radius from the unit. The additional consumptive used of groundwater that will accompany aquifer restoration would accentuate these drawdown effects. Given the ample amount (136 m [446 ft] on average) of available hydraulic head in the Nichols Ranch Unit, the temporary environmental impact due to consumptive use during restoration at the Nichols Ranch Unit has the potential to be MODERATE, particularly for wells located just outside the Nichols Ranch Unit boundary. After production and restoration are complete and groundwater withdrawals are terminated at the Nichols Ranch Unit, groundwater levels will tend to recover with time. Thus, the potential long-term environmental impact from consumptive use during the restoration phase at the Nichols Ranch Unit will be SMALL.

For the Hank Unit, the analysis of the predictions of drawdown during production (see Section 4.5.2.1.2.2) has indicated that at 284 Lpm (75 gpm), production withdrawals should result in limited, localized drawdowns. The limited drawdowns are due to the unconfined nature of the production aquifer (F Sand) at the Hank Unit. The additional pumping amounts that may occur during restoration are not likely to increase these drawdowns significantly. Thus, the potential environmental impact due to consumptive use of groundwater during aquifer restoration at the Hank Unit is likely to be SMALL.

The unconfined condition of the F Sand at the Hank Unit will result in cones of depression around pumping wells. Consequently, portions of the aquifer will be drained by the pumping process. The restoration of the aquifer will require methods that return water to those drained portions of the aquifer to remove lixiviant and contaminants that are retained in the vadose zone.

A network of buried pipelines is used during this phase for transporting restoration fluids between the pump house and the satellite facility or central processing plant and also to connect injection and extraction wells to manifolds inside the header houses. However, the fluids transported in these pipes during restoration are generally less potent than during production. The failure of pipeline fittings or valves, or failures of well mechanical integrity in shallow aquifers, could result in leaks and spills of these fluids which could impact water quality in shallow aquifers. However, as discussed in Section 4.5.2.1.2.1, Uranerz has committed to an aggressive leak detection and spill cleanup program (Uranerz, 2007), as well as preventative measures such as well mechanical integrity testing. Consequently, the implementation of these measures should result in SMALL potential-related impacts to shallow (near surface) aquifers for the Nichols Ranch and Hank Units because these aquifers are close to the surface and are used for watering livestock.

The disposal of waste fluids via deep well injection of waste is planned during aquifer restoration in much the same manner as during the operational phase. As previously indicated in Section 4.5.2.1.2.3, it is assumed that the potential environmental impact to deep aquifers below the production aquifers of deep well injection of waste will be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to groundwater during aquifer restoration would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.4 Decommissioning Impacts

As indicated in Section 4.3.4.2.4 of the GEIS, the environmental impacts to groundwater during dismantling and decommissioning ISR facilities are primarily associated with consumptive use of groundwater, potential spills of fuels and lubricants, and well abandonment. The consumptive groundwater use could include water use for dust suppression, re-vegetation, and reclaiming disturbed areas. The potential environmental impacts during the decommissioning phase are expected to be similar to potential impacts during the construction phase. Groundwater consumptive use during the decommissioning activities would be less than groundwater consumptive use during ISR operation and groundwater restoration activities. Spills of fuels and lubricants during decommissioning activities could impact shallow aquifers. Implementation of BMPs during decommissioning can help to reduce the likelihood and magnitude of such spills and facilitate cleanup.

Furthermore, prior to NRC's termination of the ISR source material license, the licensee must demonstrate that there would be no long-term impacts to underground sources of drinking water. Earlier NRC approvals of the completion of well field restoration at the site would have determined that the restoration standards that had been met were protective of public health and safety.

After ISR operations are completed at the proposed Nichols Ranch ISR Project, improperly abandoned wells could impact aquifers above the production aquifer by providing hydrologic connections between aquifers. As part of the restoration and reclamation activities, all monitoring, injection, and production wells will be plugged and abandoned in accordance with the Wyoming UIC program requirements. The wells would be filled with cement and clay and then cut off below plough depth to ensure that groundwater does not flow through the abandoned wells (Uranerz, 2007). If this process is properly implemented and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts would be SMALL (NRC, 2009a).

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for groundwater and incorporates by reference the GEIS's conclusions that the impacts to groundwater during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.2 *No-Action (Alternative 2)*

The No-Action Alternative would result in no construction or operational activities onsite that might impact shallow groundwater. This alternative also would not require the injection of lixiviant into the production aquifer or the consumptive use of groundwater. The disposal of waste liquids and solids would no longer be necessary and therefore would pose no threat to groundwater quality. Wells that have already been constructed would be plugged to prevent the degradation of aquifers with better water by aquifers with poor water. With the plugging effort complete, Alternative 2 would result in no impacts to groundwater. Impacts on the groundwater from other activities in the area such as CBM extraction are possible but not as a result of the No-Action Alternative.

4.5.2.3 *Modified Action – No Hank Unit (Alternative 3)*

Alternative 3 would include issuing Uranerz a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing as proposed by Uranerz, but only for the Nichols Ranch Unit and not the Hank Unit. This would result in the same environmental impact as identified for the Nichols Ranch Unit for Alternative 1 (see Section 4.5.2.1), while removing those impacts identified for the Hank Unit.

4.5.2.3.1 Construction Impacts

As indicated during the evaluation of the potential environmental impacts at the Nichols Ranch Unit in Section 4.5.2.1.1, the potential environmental impacts to groundwater resources during construction of the Nichols Ranch Unit would be SMALL based on the limited nature of construction activities and implementation of BMPs to protect shallow groundwater.

4.5.2.3.2 Operation Impacts

As discussed previously in Section 4.5.2.1.2, during operation, the potential environmental impact to shallow groundwater quality at the Nichols Ranch Unit appears to be SMALL. Additionally, the potential short-term environmental impact due to consumptive use during operation at the Nichols Ranch Unit is SMALL. After production and restoration are complete and groundwater withdrawals are terminated at the Nichols Ranch Unit, groundwater levels will tend to recover with time. Thus, the potential long-term impact from consumptive use during the operational phase at Nichols Ranch Unit remains SMALL. The potential environmental impact to groundwater quality in the production zone during operations is likely to be SMALL at the Nichols Ranch Unit. During operations, the potential environmental impact to deep aquifers below the production aquifers of deep well injection of waste is assumed to be SMALL.

4.5.2.3.3 Aquifer Restoration Impacts

As discussed previously in Section 4.5.2.1.3, during aquifer restoration, the short-term environmental impact due to consumptive use during restoration at the Nichols Ranch Unit has the potential to be MODERATE. After production and restoration are complete and groundwater withdrawals are terminated at the Nichols Ranch Unit, groundwater levels will tend to recover with time. Thus, the potential long-term environmental impact from consumptive use during the restoration phase at Nichols Ranch Unit is likely to be SMALL. The potential impact to shallow groundwater during restoration at the Nichols Ranch Unit appears to be SMALL. During aquifer restoration, the potential environmental impact to deep aquifers below the production aquifers of deep well injection of waste will be SMALL.

4.5.2.3.4 Decommissioning Impacts

During decommissioning, the potential environmental impacts to the groundwater resources in shallow aquifers at the Nichols Ranch Unit would be expected to be SMALL. The potential environmental impacts due to well abandonment at the Nichols Ranch Unit would also be expected to be SMALL (NRC, 2009a). As described in 4.5.2.1.4, prior to NRC's termination of the ISR source material license, the licensee must demonstrate that there would be no long-term impacts to underground sources of drinking water. Earlier NRC approvals of the completion of well field restoration at the site would have determined that the restoration standards that had been met were protective of public health and safety.

4.6 Ecological Resources Impacts

Potential environmental impacts to ecological resources at the proposed Nichols Ranch ISR Project site may occur during all phases of the ISR facility's lifecycle. Impacts may include the removal of vegetation from the site (with the associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); the modification of existing vegetative communities as a result of site activities; the loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Concerning wildlife, impacts may involve loss, alteration, and/or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species may be affected by disturbance of stream channels, increases in suspended sediments, fuel spills, and habitat reduction.

Detailed discussion of the potential environmental impacts to ecological resources from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.6.1 Proposed Action (Alternative 1)

4.6.1.1 *Construction Impacts*

4.6.1.1.1 Terrestrial Ecology

4.6.1.1.1.1 *Vegetation*

As discussed in Section 4.3.5.1 of the GEIS, during construction, terrestrial vegetation may be affected through (1) the removal of vegetation from the milling site (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (2) the modification of existing vegetative communities; (3) the loss of sensitive plants and habitats as a result of clearing and grading; and (4) the potential spread of invasive species and noxious weed populations. As further indicated in the GEIS, the percent of vegetation removed and land disturbed by construction activities (from less than 1 percent up to 20 percent of the permit area) would be a SMALL impact in comparison to the total permit area and surrounding plant communities. Additionally, the clearing of herbaceous vegetation in an open grassland or shrub steppe community is expected to have a short-term, SMALL impact given the rapid colonization by annual and perennial species in the disturbed areas. The clearing of wooded areas may have a long-term impact given the pace of natural succession, and such impacts would be SMALL to MODERATE, depending on the amount of the surrounding wooded area. Noxious weeds are expected to be controlled with appropriate spraying techniques and therefore, impacts would be SMALL.

Sagebrush shrublands and mixed grasslands are the most likely communities to be affected at the proposed Nichols Ranch ISR Project as they constitute a combined total of 88 percent of the site (Uranerz, 2007). A total of 121 ha (300 ac) of land would be disturbed by the proposed Nichols Ranch ISR Project from construction of the central processing plant, main access roads, and well fields. This disturbance would occur over an anticipated 10-year life of the project and would consist of approximately 24 to 32 ha (60 to 80 ac) of affected land at any time. The majority of disturbance to vegetation would result from well field development, which would be reclaimed and reseeded as soon as practicable following project completion in accordance with a Reclamation Plan. Some recruitment from native populations bordering disturbed areas can also be expected, which would facilitate the re-vegetation process.

Existing access roads would be utilized and possibly upgraded to minimize new disturbance of sagebrush habitat following BLM and Wyoming Game and Fish Department (WGFD) recommendations to minimize road width, re-vegetate road shoulders, and limit vehicle speeds.

Surface disturbance associated with the construction activity of the proposed Nichols Ranch ISR Project could result in the spread of invasive and noxious weeds. One noxious weed species, Canada thistle (*Cirsium arvense*), is found in the project area. Canada thistle can crowd out native species and reduce crop and forage yields if not properly controlled. Uranerz has committed to mitigation measures, which include washing vehicles that come into the proposed Nichols Ranch ISR Project washed and herbicide application, as necessary, to control the spread of Canada thistle and prevent the introduction of any additional noxious weeds (Uranerz, 2007).

Because the area of disturbed land area would be a small percentage of the total proposed project site, some vegetation would be affected, but impacts would not generally affect a sizeable segment of any species' population. Additionally, disturbed areas would be re-vegetated according to a Reclamation Plan, and Uranerz would take mitigative measures to minimize the spread of noxious weeds. Overall, impacts to vegetation during the construction phase would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to vegetation during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.1.1.2 *Wildlife*

As discussed in Section 4.3.5.1 of the GEIS, during construction, terrestrial wildlife may be affected through (1) habitat loss or alteration and incremental habitat fragmentation; (2) displacement of wildlife from project construction; and (3) direct and/or indirect mortalities from project construction and operation. The GEIS also states that construction impacts to wildlife habitat would be minimized with the timely reseeding of disturbed areas following construction. In general, wildlife species are expected to disperse from the project area as construction activities approach, although smaller, less mobile species may die during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities are possible, and thus construction impacts would be SMALL to MODERATE. These impacts may be mitigated if standard management practices issued by the WGFD are followed. Impacts to greater sage-grouse and big game species could be mitigated if BLM and WGFD guidelines are followed. Impacts to raptor species from power distribution lines could be mitigated by following the Avian Power Line Interaction Committee (APLIC) guidance and avoiding disturbances near active nests, especially prior to the fledgling of young (APLIC, 2006).

Big Game

Pronghorn antelope (*Antilocapra Americana*) and mule deer (*Odocoileus hemionus*) are the most likely big game species to be impacted by construction of the proposed Nichols Ranch ISR Project. These species would be affected by reduction of available habitat due to fencing of primary facilities, disturbance of a portion of winter/yearlong range, loss of forage, and potential for vehicular collision accidents. During baseline wildlife inventories conducted by Uranerz (2007), pronghorn antelope were mainly observed in mixed grassland and sagebrush shrubland vegetative communities, which are the vegetative communities most likely to be disturbed during construction. Mule deer were generally observed in mixed sagebrush grassland and juniper outcrop vegetative communities. Juniper outcrop would likely continue to be available for foraging through the life of the proposed project.

As discussed previously, an estimated 121 ha (300 ac) would be disturbed during the approximate 10-year life of the ISR facility with 24 to 32 ha (60 to 80 ac) disturbed at a time. Winter/yearlong range carrying capacity for big game species could be reduced during the life of the proposed Nichols Ranch ISR Project and for several years thereafter until vegetative growth in restored areas becomes productive enough to support big game. However, the proposed Nichols Ranch ISR Project site represents a small portion of the 2,485 km^2 (1,544 mi^2) area occupied by the Pumpkin Buttes Antelope Herd Unit and therefore, is not likely to measurably decrease the population of pronghorn antelope during the construction phase or over the course of the 10-year project lifespan. The Pumpkin Buttes Mule Deer Herd Unit also occupies a large area (4,355 km^2 [2,706 mi^2]) in proportion to the area that will be disturbed by the proposed Nichols Ranch ISR Project and is unlikely to be measurably affected during construction or any other phase of the proposed project.

Potential for vehicular collisions with big game species would not be expected to significantly increase in the area due to the short distances and required low speed on the access roads.

Impacts to big game species during the construction phase would likely affect a small number of individuals and are not expected to threaten the continued existence of either the pronghorn antelope or mule deer populations within the vicinity of the project site. Big game species may be indirectly affected during construction by noise, lighting, and human presence, which may cause avoidance of habitat adjacent to disturbed areas. Uranerz has identified mitigation plans that would be enacted during the lifespan of the project, which include reduced speed limits and fencing to reduce risk of vehicular collision (Uranerz, 2007). Overall, impacts to big game species during the construction phase would be SMALL.

Upland Game Birds

Greater sage-grouse (*Centrocercus urophasianus*) and gray partridge (*Perdix perdix*) are the most likely upland game bird species to be impacted by construction of the proposed Nichols Ranch ISR Project. Sage-grouse is a State of Wyoming species of concern and BLM-designated sensitive species and is discussed in more detail in Section 4.6.1.1.3. Direct impacts to upland birds from project activities would include habitat loss and fragmentation from well field, road, pipeline, and power line construction; alteration of plant and animal communities; increased human activity or noise that could cause the birds to avoid a specific area or reduce breeding efficiency; increased motorized access to the public, which could lead to harvesting of individuals (legal and illegal); greater risk of mortality from vehicular collisions; and an increase in mortality from raptors if power poles or tall buildings are placed in occupied habitat.

As discussed previously, only a small portion of the proposed Nichols Ranch ISR Project site would be disturbed at any one time; therefore, some individuals would be displaced, and some temporary habitat loss would occur during the life of the project. Uranerz would minimize the removal and/or disturbance of vegetation, where possible, through the use of existing ranch roads for travel and for the placement of pipelines. All lands disturbed by project activities would be re-vegetated following approved reclamation practices, which would restore the habitat loss experienced during the project. Mitigative measures, such as minimizing noise, vehicular traffic, and human proximity, would be taken near greater sage-grouse leks (discussed in detail in Section 4.6.1.1.3), which would also benefit gray partridge and other upland bird species and nests within the vicinity of the leks. Overall, impacts to upland game birds during the construction phase would be SMALL.

<u>Raptors</u>

The red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), long-eared owl (*Asio otus*), great horned owl (*Bubo virginianus*), and the rough-legged hawk (*Buteo lagopus*) were determined to occur on or in the vicinity of the proposed Nichols Ranch ISR Project site and would be the primary raptor species impacted by project activities. Raptors are particularly sensitive to noise and the presence of human activity, which would be heightened during the period of construction. Direct impacts to raptor species include displacement, loss of forage habitat, increased potential for collisions with structures and vehicles, increased potential for nest abandonment and reproductive failure due to increased human disturbances, and potential reduction in prey populations within the project site.

Uranerz would follow an annual raptor monitoring and mitigative plan to minimize conflicts between active nest sites and project-related activities (Uranerz, 2007). Mitigative measures, such as minimizing noise, vehicular traffic, and human proximity, would be taken near greater sage-grouse leks (discussed in detail in Section 4.6.1.1.3), which would also benefit raptor species and nests within the vicinity of the leks. Additional seasonal guidelines with respect to noise, vehicular traffic, and human proximity for wildlife have been established by the WGFD (WGFD, 2009) and BLM (BLM, 2008). Based on the mitigative measures in that Uranerz has stated would be enacted, impacts to raptor species during the construction phase would be SMALL.

<u>Waterfowl and Shorebirds</u>

Only limited, seasonal wetland habitat exists on the proposed Nichols Ranch ISR Project site for waterfowl and shorebirds; therefore construction would not be expected to disrupt any breeding or nesting habitat. The wetland areas would not be disturbed by construction and would be avoided by project-related vehicles (discussed in more detail in Section 4.5.1); therefore no impact to the limited existing habitat is expected. Overall, impacts to waterfowl and shorebirds during the construction phase would be SMALL.

<u>Nongame/Migratory Birds</u>

Impacts to nongame/migratory birds are expected to be similar to those discussed for upland game birds (Section 4.6.1.1.1.2.2). Some habitat loss and potential reduction in the carrying capacity for nongame/migratory birds within the proposed project area would occur; however, the amount of habitat lost would be minimal in relation to the total size of the site. Direct impacts would include habitat loss and fragmentation, alteration of plant and animal communities, and increased human activity or noise that could cause the birds to avoid a specific area or reduce breeding efficiency. Nongame/migratory birds would benefit from mitigation measures taken near greater sage-grouse leks (discussed in detail in Section 4.6.1.1.3), which would limit impacts near these areas. Overall, impacts to nongame/migratory birds during the construction phase would be SMALL.

Other Mammals

Mammalian predators such as the bobcat (*Lynx rufus*), badger (*Taxidea taxus)*, coyote (*Canis transens*), and swift fox (*Vulpes velox*) would experience habitat loss and fragmentation and potential range reduction. Displacement of prey species may reduce food availability within the area; however, the documented outbreak of Tularemia in the vicinity of the site during the 2006 and 2007 wildlife inventories may have already affected the rodent prey base and caused a shift of predators to neighboring areas. Predator species are more sensitive to noise and the presence of human activity, which would be heightened during the period of construction, though the species documented onsite are nocturnal; therefore, construction activities during daylight hours should not noticeably alter these species' patterns or behavior. Impacts to swift fox (*Vulpes velox*), specifically, are discussed in more detail in Section 4.6.1.1.3.

Desert cottontails (*Sylvilagus audubonii*), white-tailed jackrabbits (*Lepus townsendii*), ground squirrels (*Spermophilus tridecemlineatus*), black-tailed prairie dogs (*Cynomys ludovicianus*) and other rodents would experience habitat loss and/or displacement. Because these species build dens, loss of habitat due to construction activities on or near dens would have greater effects for these species than would be expected for the mammalian predator species discussed above. Additional impacts include increased potential for vehicular collision. Because small mammals are relatively abundant in the project area, and generally show a preference for disturbed areas, construction impacts are not expected to impact population size of any small mammal species within the area. Impacts to black-tailed prairie dogs, specifically, are discussed in more detail in Section 4.6.1.1.3.

Overall, impacts to mammal species during the construction phase would be SMALL.

Reptiles and Amphibians

Prairie rattlesnake (*Crotalus viridis*) and bullsnake (*Pituophis melanoleucas sayi*) were the only species observed during the 2006 and 2007 wildlife inventories conducted by Uranerz (2007). During construction activities, reptile and amphibian species would experience impacts similar to those discussed for mammal species (Section 4.6.1.1.1.2.7), which include loss or fragmentation of habitat, displacement, disturbance from noise and human proximity, and increased risk of vehicular collision. Due to the small amount of land that will be disturbed at any given time during the lifespan of the project, these impacts are not expected to measurably affect any reptile or amphibian species' population. Overall, the impacts to reptiles or amphibian species during the construction phase would be SMALL.

Overall Impacts to Wildlife

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to wildlife during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.1.2 Aquatic Ecology

According to Section 4.3.5.1 of the GEIS, aquatic species are expected to be temporarily disturbed by in-stream channel activities, and such impacts would be SMALL. Sediment loads are expected to taper off quickly both in time and distance and long-term impacts would be SMALL. Additionally, standard management practices issues by the WGFD would help to limit impacts to aquatic life.

Due to the minimal and ephemeral surface water features located on the proposed Nichols Ranch ISR Project site, no impacts to aquatic species are anticipated.

4.6.1.1.3 Threatened and Endangered Species

According to Section 4.3.5.1 of the GEIS, threatened or endangered species are identified in the project site during surveys, impacts may be SMALL to LARGE, depending on site conditions. Mitigation plans to avoid and reduce impacts to potentially affected species would be developed.

No Federally-listed species are known to occur on or in the vicinity of the proposed Nichols Ranch ISR Project site (FWS, 2008b). No suitable habitat for the blowout penstemon (*Penstemon haydenii*) or ute ladies'-tresses orchid (*Spiranthes diluvialis*) exists on the site.

Potential suitable habitat (a black-tailed prairie dog complex totaling 381.1 ha [941.8 ac]) for the black-footed ferret (*Mustela nigripes*) exists; however, no black-footed ferret population occurs near the site. The closest successfully reintroduced population of black-footed ferrets is in Shirley Basin, Wyoming, approximately 160 km (100 mi) south of the proposed Nichols Ranch ISR Project site (FWS, 2008a). As discussed in Chapter 3, the U.S. Fish and Wildlife Service (FWS) (FWS, 2004) relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations; therefore, no specific surveys were conducted during Uranerz's 2006 and 2007 wildlife inventories on the proposed Nichols Ranch ISR Project site. However, the FWS continues to direct federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a future reintroduction site for the black-footed ferret (FWS, 2004). Due to the presence of black-tailed prairie dog habitat, consultation with the FWS is ongoing to ensure that the provisions of the *Endangered Species Act* (ESA) are upheld regarding the black-footed ferret.

Several Wyoming species of concern and BLM-designated sensitive species are known to occur on and in the vicinity of the site. The bald eagle (*Haliaeetus leucocephalus*), black-tailed prairie dog (*Cynomys ludovicianus*), greater sage-grouse, and swift fox (*Vulpes velox*) were recorded during wildlife inventories conducted by Uranerz (2007) in 2006 and 2007.

No known bald eagle nests or roosts would be displaced during the construction phase. The identified nearby nest (16 km [10 mi] west of the proposed site) and winter roost (7.2 km [4.5 mi] southwest of the Nichols Ranch Unit) would not be directly impacted by construction. However, individuals nesting nearby or migrating through the area may use the proposed Nichols Ranch ISR Project site and surrounding lands for foraging during winter months and would not be able to use these lands during construction until the disturbed areas were reclaimed and prey species returned. Only 24 to 32 ha (60 to 80 ac) would be disturbed at any given time during the life of the proposed ISR project, which would not significantly reduce the amount of available habitat on the 1,365 ha (3,371 ac) site (Uranerz, 2007). Additionally, bald eagles prefer to nest and hunt near large lakes, rivers, and other open bodies of water near forested habitat (WGFD, 2005a); therefore, the proposed Nichols Ranch ISR Project site does not represent optimal or preferred habitat for the species.

A black-tailed prairie dog complex, consisting of eleven black-tailed prairie dog colonies and totaling 381.1 ha (941.8 ac) exist on or within a 3.2-km (2-mi) radius of the proposed Nichols Ranch ISR Project site. The largest of the colonies is on the Nichols Ranch Unit. Uranerz (2007) states that it "will take steps to minimize disturbance to known small mammal habitat such as black-tailed prairie dog towns, but some disturbance will be unavoidable." Because slightly over one-third (1443 ha [356.5 ac]) of the prairie dog habitat is onsite, construction activities could significantly reduce available habitat to this species. Because construction would only disturb small areas of land at a time, the species may only be displaced and would be able to adapt to small losses of habitat over the course of the 10-year project lifespan. This species also provides prey to number of species including the black-footed ferret, swift fox, mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*), all of which are Federally- or State-listed species. Therefore, displacement of prairie dogs could affect these species as well.

The WGFD (2005b) *Final Comprehensive Wildlife Strategy* contains management objectives for grassland and sagebrush shrubland habitat, which supports a number of Wyoming species of concern, including the black-tailed prairie dog. The objectives focus on working with private landowners and cooperatives with FWS, BLM, and U.S. Forest Service (USFS) (WGFD, 2005b). The WGFD aims to preserve 88,600 ha (219,000 ac) of black-tailed prairie dog habitat across the state. However, the WGFD gives priority management attention to black-tailed prairie dog complexes that are at least 2,000 ha (5,000 ac), as the WGFD considers conserving these to be "integral to the black-tailed prairie dog's ecology" and "important habitat for many associated or dependent species" (WGFD, 2005b). The black-tailed prairie dog habitat on and in the vicinity of the proposed Nichols Ranch ISR Project site is not large enough to be considered a management priority; however, efforts should be made to avoid these areas and minimize noise and traffic surrounding these areas during construction. As discussed above, consultation with the FWS is ongoing to ensure that the provisions of the ESA are upheld regarding the black-footed ferret. This consultation process will also benefit the black-tailed prairie dog and ensure that appropriate measures are taken to minimize the impacts of construction activities on this species.

Eight greater sage-grouse leks were identified within a 3.2-km (2.0-mi) radius of the proposed Nichols Ranch ISR Project site, according to information gathered from the BLM Buffalo Field Office and WGFD. Formal surveys conducted by Uranerz (2007) identified two additional leks in April 2006. None of these leks occur within the proposed project site; however, construction would result in habitat loss and fragmentation to the species, as well as alteration of the plant and animal communities in disturbed areas and increased noise and human activity, which could cause sage-grouse to avoid previously used habitat. Uranerz would take the following mitigative measures during construction to minimize the impacts to the greater sage-grouse:

- Minimized or delayed project activity and vehicular traffic within 0.15 km (0.25 mi) of active leks between the hours of 8:00 p.m. and 8:00 a.m. during the March 1 to May 15 strutting period;
- Minimized or delayed project activity within 1.6 km (2.0 mi) of active leks between March 15 and July 15;
- No construction of overhead power lines or high-profile structures within 0.15 km (0.25 mi) of leks to minimize raptor predation; and
- Minimized removal of vegetation, where possible, and re-vegetation of disturbed areas as soon as practicable following project completion.

Seasonal guidelines for greater sage-grouse with respect to noise, vehicular traffic, and human proximity have been established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b). The mitigation measures above are consistent with these guidelines.

Swift fox (*Vulpes velox*) is known to occur within the vicinity of the site (Uranerz, 2007). No family groups or dens have been identified on the site; however, construction could decrease the range of individuals and shift prey availability. Noise and the presence of human activity, which would be heightened during the period of construction, could cause avoidance of habitat adjacent to the proposed site. However, the swift fox is nocturnal; therefore, construction activities during daylight hours should not noticeably alter these species' patterns or behavior. The WGFD considers the swift fox habitat vulnerable, but not in a state of ongoing significant loss (WGFD, 2005c); therefore, the small amount of land disturbed at a time over the course of the proposed Nichols Ranch ISR project lifespan is unlikely to affect the local population of swift fox.

Additional BLM-designated sensitive species and Wyoming species of concern may occur on or in the vicinity of the site but were not documented during 2006 and 2007 wildlife inventories conducted by Uranerz (2007). If any additional protected species are identified on the site, Uranerz is encouraged to contact the WGFD and/or FWS to report the occurrence.

No Federally-listed species are known to occur in the vicinity of the site; therefore, no Federally-listed species would be impacted by construction activities. Some BLM-designated sensitive species and Wyoming species of concern are likely to be impacted by habitat loss or displacement. Additionally, behavioral changes may occur due to noise, lighting, and human proximity. Impacts to protected species would be minimized because only small areas of land will be disturbed at any given time during the lifespan of the project. Regarding the black-footed ferret, because potential habitat exists on and in the vicinity of the site, the NRC conducted a teleconference with the FWS on November 6, 2009 (NRC, 2009), to ensure that the provisions of the ESA are upheld for this species. During the teleconference, the NRC updated the FWS on the status of the Nichols Ranch ISR Project environmental review and described the black-tailed prairie dog habitat on and in the vicinity of the proposed site. The FWS indicated that, consistent with the 2004 FWS letter (FWS, 2004) block-clearing the State of Wyoming from conducting black-footed ferret surveys in black-tailed prairie dog habitat less than 400 ha (1,000 ac) in size, the black-tailed prairie habitat on the proposed Nichols Ranch ISR Project site does not need to be surveyed. The FWS also concluded that the NRC does not need to initiate formal consultation or submit a biological assessment (BA) for the black-footed ferret for the proposed Nichols Ranch ISR Project. Overall, impacts to protected species from construction activities are anticipated to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to threatened and endangered species during construction would be SMALL to LARGE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.2 *Operation Impacts*

As discussed in Section 4.3.5.2 of the GEIS, wildlife habitats could be altered by operations (fencing, traffic, noise), and individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing.

However, the WGFD specifies fencing construction techniques to minimize impediments to big game movement.

As further indicated in the Section 4.3.5.2 of the GEIS, temporary contamination or alteration of soils would be likely from operational leaks and spills and possible from transportation or land application of treated waste water. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil limit the magnitude of overall impacts to terrestrial ecology. Spill detection and response plans would also be expected to reduce impacts to aquatic species from spills around well heads and leaks from pipelines. Uranerz would employ mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys, which would be expected to reduce the significance of overall impacts to SMALL. These mitigation measures are discussed in more detail in Chapter 6.

Impacts to ecological resources during proposed Nichols Ranch ISR Project operation activities would be consistent with the description presented in the GEIS. Generally, impacts previously discussed from construction activities would continue during the operation phase. Less noise and reduced vehicular activity would be expected during operation, which would reduce disruption to wildlife populations and decrease the risk of vehicular collisions. Only minor additional impacts to vegetative communities would be expected as the majority of clearing would have been completed during construction activities. Wildlife use of areas adjacent to ISR operations is anticipated to increase as animals become habituated to activities on the site. Invasive and noxious weeds could potentially colonize disturbed areas, but would be monitored by Uranerz. Disturbed areas would be reseeded with WDEQ- and BLM-approved seed mixture to prevent the establishment of competitive weeds and restore habitat to native species. If noxious weeds continue to be a concern, other alternatives, such as herbicide application, would be considered.

Continued adherence to seasonal guidelines established by the WGFD (2009) and BLM (2008b) for active sage-grouse leks with respect to noise, vehicular traffic, and human proximity would reduce the impact to these species. Potential conflicts between active raptor nest sites and project-related activities would continue to be mitigated by annual raptor monitoring and mitigation plans.

Overall, impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, aquatic species, and protected species) during operation are expected to be less than those during construction and SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecology and incorporates by reference the GEIS's conclusions that the impacts to ecology during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.3 *Aquifer Restoration*

Section 4.3.5.3 of the GEIS discusses the potential impacts to ecological resources during the aquifer restoration phase. Impacts may include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance.

The GEIS also indicates that contamination of soils and surface waters could result from leaks and spills. However, detection and response techniques, and eventual survey and decommissioning of all potentially impacted soils and sediments, would limit the magnitude of overall impacts to terrestrial and aquatic ecology. Uranerz would employ mitigation measures such as perimeter fencing, netting, and leak detection and spill response plans, which would reduce the significance of overall impacts to SMALL. These mitigation measures are discussed in more detail in Chapter 6. Impacts to threatened and endangered species would be similar to those from operations, because existing infrastructure would continue to be used.

Impacts to ecological resources during proposed Nichols Ranch ISR Project aquifer restoration activities would be consistent with the description presented in the GEIS. Because the existing infrastructure would be used during aquifer restoration and mitigation measures would continue to apply, potential impacts to ecological resources would be similar to those discussed for operation. Overall, impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, aquatic species, and protected species) during aquifer restoration would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecology and incorporates by reference the GEIS's conclusions that the impacts to ecology during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.4 *Decommissioning Impacts*

As discussed in Section 4.3.5.4 of the GEIS, during decommissioning and reclamation, there would be temporary disturbance to land as soils are excavated, buried piping is recovered and removed, and structures are demolished and removed. However, re-vegetation and re-contouring would restore habitat previously altered during construction and operations. Wildlife would be temporarily displaced, but are expected to return after decommissioning and reclamation are completed and vegetation and habitat are reestablished. Decommissioning and reclamation activities also could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. For these reasons, in the GEIS, the overall significance of potential impacts during decommissioning was expected to be SMALL.

As stated in the GEIS, with respect to threatened and endangered species, potential impacts resulting from individual takes would occur due to conflicts with decommissioning activities (equipment, traffic). Temporary land disturbance would occur as structures are demolished and removed and the ground surface is re-contoured. An inventory of threatened or endangered species developed during the site-specific environmental review of the detailed decommissioning plan would identify unique or special habitats, and ESA consultations with the FWS would assist in reducing impacts. With the completion of decommissioning, re-vegetation, and re-contouring, habitat would be reestablished and impacts would, therefore, be limited. Impacts to threatened and endangered species may be SMALL to LARGE, depending on site conditions.

Impacts to ecological resources during proposed Nichols Ranch ISR Project decommissioning activities would be consistent with the description presented in the GEIS. Re-vegetation of native grasses and plants would occur during the decommissioning stage. Sagebrush shrubland, which is the dominant vegetative community on the proposed site, is difficult to successfully re-establish, though refined techniques in seeding sagebrush have shown significant improvements in successful establishment of the species (Lambert, 2005). Such improved methods may include the use of cased-hole punched seeding with polypropylene casings as described by Booth (2005). For those areas previously dominated by sagebrush, use of a trained biologist to re-establish sagebrush using such techniques could increase success of sagebrush habitat restoration. As required, Uranerz would submit an updated reclamation plan for approval, following review and approval by the appropriate state and federal agencies

Impacts to wildlife would be similar to those discussed during the construction phase. Populations of small mammals and birds would likely re-inhabit the project site after completion of initial construction activities and could be displaced again during decommissioning. Noise, lighting, and human proximity could cause wildlife to avoid the project site and adjacent habitat.

Overall, impacts to ecological resources (including vegetation, big game, upland game birds, raptors, waterfowl and shorebirds, nongame/migratory birds, other mammals, reptiles and amphibians, aquatic species, and protected species) during decommissioning would be similar to those experienced during construction and SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecology and incorporates by reference the GEIS's conclusions that the impacts to ecology during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no ISR facility construction, operation, aquifer restoration, or decommissioning related to this project; therefore, no land disturbance would occur that might impact vegetation or wildlife populations. The area would continue to provide vegetation communities and wildlife habitat typical of the region, as characterized in Chapter 3. Land would continue to be used for pastureland and extraction activities. As a result of the No-Action Alternative, there would be no impacts to ecological resources.

4.6.3 Modified Action – No Hank Unit (Alternative 3)

Impacts during all phases of the project would be similar in nature to those experienced under the proposed action, but would only affect approximately 60 ha (150 ac) on Nichols Ranch Unit as opposed to about twice the land area for the proposed action. Nine active raptor nests identified on the Hank Unit would not be disrupted by project activities. The majority of the black-tailed prairie dog colonies is located on the Nichols Ranch Unit and would continue to be affected as described in Section 4.6.2 under this alternative. No other unique habitats, protected species, or ecological resources exist on the Hank Unit that would otherwise increase or reduce the potential impacts under this alternative. Therefore, the impacts to ecological resources for construction, operation, aquifer restoration, and decommissioning would be SMALL.

4.7 Air Quality Impacts

As discussed in Section 4.3.6 of the GEIS, air quality impacts from ISR facilities are not major sources of air emissions, and impacts would be classified as SMALL if the following three conditions are met:

1) Gaseous emissions from the ISR facility are within regulatory limits and requirements;

2) Air quality in the region is in compliance with the National Ambient Air Quality Standards (NAAQS); and

3) The facility is not classified as a major source under the New Source Review or operating (Title V) permit programs (described in Section 1.7.2 of the GEIS).

All three of these criteria would be met for the proposed Nichols Ranch ISR Project. Carbon monoxide (CO) and particulate matter (PM_{10}, and $PM_{2.5}$, collectively referred to as PM) would be the primary sources of air emissions from project-related motor vehicle traffic traveling to and from the proposed Nichols Ranch ISR Project. A discussion of air quality during construction, operation, aquifer restoration, and decommissioning phases of the proposed Nichols Ranch ISR Project is provided in the following sections. See Chapter 5 for a discussion of climate change at the proposed site.

4.7.1 Proposed Action (Alternative 1)

4.7.1.1 *Construction Impacts*

As discussed in Section 4.3.6.1 of the GEIS, fugitive dust and combustion (vehicle and diesel equipment) emissions during land-disturbing activities associated with construction would be expected to be short-term, and reduced through best management practices (e.g., wetting of roads and cleared land areas to reduce dust emissions). Estimated fugitive dust emissions during ISR construction are expected to be well below the NAAQS for $PM_{2.5}$ and for PM_{10}. Additionally, particulate, sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) emissions from ISR facilities are expected to account for a small percentage (1 to 9 percent) of the Prevention of Significant Deterioration (PSD) Class II allowable increments. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL.

The proposed Nichols Ranch ISR Project would meet the conditions pertaining to air quality specified in the GEIS as discussed in Section 4.7 above, and therefore, impacts would be SMALL. Uranerz would also implement BMPs to ensure that the construction air quality control equipment would be maintained to mitigate fugitive dust emissions. Uranerz would also wet and stabilize unpaved roads and disturbed land to suppress dust generation and schedule construction activities to minimize the amount and duration of exposed earth. Uranerz would minimize wind erosion by reclaiming disturbed soil and using a vegetative cover on soil piles. Uranerz would also utilize stationary equipment to install the well fields so as to lessen the traffic volume on the roads.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.1.2 *Operation Impacts*

Section 4.3.6.2 of the GEIS states that operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. Additionally, although excess vapor pressure in pipelines could be vented throughout the system, such emissions would be rapidly dispersed in the atmosphere and so potential impacts are expected to be SMALL, due in part to the expected low volume of effluent produced. The GEIS also states that other potential non-radiological emissions during operations include fugitive dust and fuel from equipment, maintenance, transport trucks, and other vehicles. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL.

Finally, the GEIS notes that radiological impacts can result from dust releases from drying of lixiviant pipeline spills, radon releases from well system relief valves, resin transfer or elution, and gaseous/particulate emissions from yellowcake dryers. Only small amounts of low dose materials would be expected to be released based on operational controls and rapid response to spills. Required prevention, control, and response procedures would be used to minimize impacts from spills. HEPA filters and vacuum dryer designs reduce particulate emissions from operations, and ventilation reduces radon buildup during operations. Compliance with the NRC-required radiation monitoring program would ensure releases are within regulatory limits. The impacts from radiological emissions are addressed under Section 4.3.12, Public and Occupational Health Impacts.

During operations of the proposed Nichols Ranch ISR Project, the already SMALL impacts to air quality during construction would be further reduced and criteria pollutant levels would remain below the NAAQS; therefore, impacts to air quality during operation would be SMALL. The mitigation measures described under Section 4.7.1.1 would also pertain to the operation phase.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.1.3 *Aquifer Restoration Impacts*

As discussed in Section 4.3.6.3 of the GEIS, because the same infrastructure is used during aquifer restoration as during operations, air quality impacts from aquifer restoration are expected to be similar to, or less than, those during operations. Additionally, fugitive dust and fuel emissions from vehicles and equipment during aquifer restoration is expected to be similar to, or less than, the dust and fuel emissions during operations. For NAAQS attainment areas, non-radiological air quality impacts would be SMALL.

This phase of the proposed Nichols Ranch ISR Project would use existing infrastructure and equipment similar to that employed during the operation phase, but require less vehicular traffic. Accordingly, impacts would be smaller than during the operation phase and thus, the impacts would be SMALL. The mitigation measures described under Section 4.7.1.1 would also pertain to the aquifer restoration phase.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.1.4 *Decommissioning Impacts*

In Section 4.3.6.4 of the GEIS, it is expected that fugitive dust, vehicle emissions, and diesel emissions during land-disturbing activities associated with decommissioning would come from many of the same sources as used during construction. In the short-term, emission levels are expected to increase given the activity (demolishing of process and administrative buildings, excavating and removing contaminated soils, grading of disturbed areas). However, such emissions would be expected to decrease as decommissioning proceeds, and therefore, overall, impacts would be similar to, or less than, those associated with construction, would be short-term, and would be reduced through best management practices (e.g., dust suppression). For NAAQS attainment areas, non-radiological air quality impacts would be SMALL.

Emissions levels at the proposed Nichols Ranch ISR Project site would not exceed those described in Section 4.7.1.1. Accordingly, impacts of the decommissioning phase to air quality would be SMALL. The mitigation measures described under Section 4.7.1.1 would also be implemented during the decommissioning phase.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.2 No-Action (Alternative 2)

Under this alternative, there would be no change in the air quality at this site or at any surrounding receptors. This area currently meets the NAAQS for attainment status, and it is expected that this area would continue to meet the NAAQS based on the current land uses of grazing, oil and gas extraction, and CBM.

4.7.3 Modified Action – No Hank Unit (Alternative 3)

4.7.3.1 *Construction Impacts*

Under this alternative, the construction activities for the Hank Unit would not occur. Fugitive dust and engine combustion emissions from equipment performing land disturbing activities would not occur within the Hank Unit. Furthermore, overall traffic counts along the main T-Chair Livestock ranch road would likely decrease relative to the proposed action because less construction materials would be required. Both of these outcomes would likely diminish the potential for impacts at nearby and downwind (easterly) receptors. Therefore, impacts during the construction phase of this alternative on air quality would be SMALL. The BMPs stated in the proposed action would still be implemented under this alternative.

4.7.3.2 *Operation Impacts*

The impacts of operation of this alternative would be largely the same as those stated for the proposed action. Because the Hank Unit would not be constructed, stationary emissions sources (e.g., generator and compressor engines) would not be present on the Hank Unit. More importantly, diesel emissions from trucks transferring ion exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant would not occur. The lack of active well fields in the Hank Unit would also diminish the traffic volume with respect to incoming shipments of process chemicals and outgoing shipments of yellowcake. Impacts during the operation phase of this alternative on air quality would be SMALL. The BMPs stated in the proposed action would still be implemented under this alternative.

4.7.3.3 *Aquifer Restoration Impacts*

The impacts of aquifer restoration for this alternative would be the same as those stated for the proposed action. With the exception of passing traffic along the gravel T-Chair ranch road, sources of emissions would not be present in the vicinity of the Hank Unit. Impacts during the aquifer restoration phase of this alternative on air quality would be SMALL. The BMPs stated in the proposed action would still be implemented under this alternative.

4.7.3.4 *Decommissioning Impacts*

The impacts of the decommissioning of this alternative would be the same as those stated for the proposed action. Though soil and road reclamation and infrastructure demolition would result in emissions higher than that of the operation and decommissioning phases, the levels of pollutants generated are similar to that of the construction phase and diminished relative to the proposed action because the Hank Unit would not be present. Impacts during the decommissioning phase of this alternative on air quality would be SMALL. The BMPs stated in the proposed action would still be implemented under this alternative.

4.8 Noise Impacts

Potential environmental impacts from noise at the proposed Nichols Ranch ISR Project site may occur during all phases of the ISR facility's lifecycle. These impacts would be associated with the operation of equipment such as trucks, bulldozers, and compressors; from traffic due to commuting workers or material/waste shipments; and well field, central processing plant and satellite facility activities, and equipment. A discussion of the potential environmental impacts from noise due to construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.8.1 Proposed Action (Alternative 1)

4.8.1.1 *Construction Impacts*

As discussed in the GEIS (Section 4.3.7.1), potential noise impacts are expected to be greatest during construction of the ISR facility, due to the heavy equipment involved and given the likelihood that these facilities would be built in a rural, previously undeveloped area where background noise levels are lower. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the well fields, drill the wells, develop the necessary access roads, and build the production facilities would generate noise that would be audible above the undisturbed background levels. Noise levels are expected to be higher during daylight hours when construction is more likely to occur, and more noticeable in proximity to the operating equipment. Administrative and engineering controls would be expected to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. For individuals living in the vicinity of the site, ambient noise levels would be expected to return to background at distance more than 300 m (1,000 ft) from the construction activities. Overall, these types of noise impacts would be SMALL, given the use of hearing controls for workers and the expected distance of nearest residents from the site.

Additionally, as stated in the GEIS, traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, and compressors) is expected to be localized, and limited to highways in the vicinity of the site, access roads within the site, and roads in the well fields. Relative short-term increases in noise levels associated with passing traffic would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural roads through smaller communities.

The closest residential receptor is Pfister Ranch, which is located 9,500 m (0.6 mi) from the proposed Nichols Ranch ISR Project area, which is greater than the 300 m (1,000 ft) radius specified by the GEIS; therefore, impacts to noise on residential receptors from the proposed site would be SMALL. Impacts from traffic-related noise are expected to be SMALL due to the limited traffic volume associated with the proposed project as a whole (see Section 4.3). The incremental increase in project-related traffic on the relatively well-traveled public roadways in the area (e.g., I-25, SR 387, SR 50, and SR 59) would not be expected to be noticeable. Compliance with OSHA noise regulations would ensure that noise impacts to workers would remain SMALL. Therefore, the overall impacts to noise during construction would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to noise during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.1.2 *Operation Impacts*

As discussed in Section 4.3.7.2 of the GEIS, noise-generating activities in the central processing plant would be indoors, thus reducing offsite sound levels. Well field equipment (e.g., pumps, compressors) would be contained within structures (e.g., header houses, satellite facilities), also reducing sound levels to offsite individuals. Administrative and engineering controls would be used to maintain noise levels in work areas below OSHA regulatory limits and further mitigated by use of personal hearing protection. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would be expected to be localized, limited to highways in the vicinity of the proposed site, access roads within the proposed site, and roads in well fields. Relative short-term increases in noise levels associated with this traffic would be SMALL for the larger roads, but may be MODERATE for lightly traveled rural roads through smaller communities. Thus, the overall impact to noise levels from operations is expected to be SMALL to MODERATE.

During operation, a variety of mechanical equipment, such as generators, pumps, air compressors, and heating, ventilation, and air conditioning systems at the proposed Nichols Ranch ISR Project would generate sound levels. Traffic in and out of the site would also continue. Impacts from noise during operation on the site would be less than during construction because fewer pieces of heavy machinery would be used and thus the impacts would be SMALL. Impacts from traffic-related noise would be similar to levels during construction and would be SMALL. Compliance with OSHA noise regulations would ensure that noise impacts to workers would remain SMALL. Therefore, the overall impacts to noise during operation would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to noise during operations would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.1.3 *Aquifer Restoration Impacts*

Section 4.3.7.3 of the GEIS states that general noise levels during aquifer restoration would be expected to be similar, or less than, those levels experienced during operations. Additionally, workplace noise exposure would be managed using the same administrative and engineering controls as during operations. Pumps and other well field equipment contained in buildings would reduce sound levels to offsite receptors. Existing operational infrastructure would be used, and traffic levels would be expected to be less than that seen during construction and operations. Impacts, therefore, would be expected to be SMALL to MODERATE.

Sound levels generated during the proposed Nichols Ranch ISR Project aquifer restoration phase would be similar or less than those levels experienced during operation. Vehicular traffic is expected to be limited to delivery of supplies and staff accessing the site, therefore resulting in fewer trips than during the operation phase. Since equipment and traffic were assumed to be similar to those of the operation phase, the degree of noise impact is the same as the operation phase. Therefore, impacts to noise during aquifer restoration would be SMALL. Compliance with OSHA noise regulations would ensure that noise impacts to workers would remain SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to noise during aquifer restoration would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.1.4 *Decommissioning Impacts*

Section 4.3.7.4 of the GEIS discusses the potential noise impacts during decommissioning. General noise levels during decommissioning and reclamation would be expected to be similar, or less than, those levels experienced during construction. Equipment used to dismantle buildings and milling equipment, remove any contaminated soils, or grade the surface as part of reclamation activities would generate noise levels that would be expected to exceed the background. These noise levels would be temporary and once decommissioning and reclamation activities were complete, noise levels would return to baseline, with occasional vehicle traffic for any longer term monitoring activities. As with construction, noise levels are expected to be higher during daylight hours when decommissioning and reclamation is more likely to occur, and more noticeable in proximity to the operating equipment. Noise generated during decommissioning would be noticeable only in proximity to equipment and temporary (typically daytime only). Workplace noise exposure would be managed using the same administrative and engineering controls as during construction and operations, and given the likely distance of nearby residents from the activity (i.e., greater than 300 m [1,000 ft]), it is not expected that the noise would be discernable to offsite residents or communities. Therefore, the GEIS considered noise impacts from decommissioning to be SMALL to MODERATE.

Sound levels generated at the Nichols Ranch ISR Project site during decommissioning would be similar or lower to the construction phase and would include earth moving, excavation, and building demolition. Less vehicular traffic associated with shipments to and from the site would occur as decommissioning progressed. Also, the closest residential receptor is located beyond the 300 m (1,000 ft) radius specified by the GEIS. Therefore, impacts to noise during decommissioning would be SMALL. Compliance with OSHA noise regulations would ensure that noise impacts to workers would remain SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to noise during decommissioning would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in the sound levels in the project area or at any surrounding receptors. While natural resource exploration activities would continue and perhaps expand in the future, these activities would typically be of short duration and would involve few vehicles and no permanent, noise-emitting infrastructure.

4.8.3 Modified Action – No Hank Unit (Alternative 3)

4.8.3.1 *Construction Impacts*

Under this alternative, the construction activities for the Hank Unit would not occur. No construction-related sound would be generated from the Hank Unit, with the exception of traffic passing through the area on the main T-Chair ranch road en route to the Nichols Ranch Unit. Furthermore, overall traffic counts along this road would likely decrease relative to the proposed action because less construction materials would be required. Both of these outcomes would likely diminish the potential for noise impacts at the offsite receptors. In addition, the nearest residential receptor location to the Nichols Ranch Unit is located approximately 1.4 km (0.9 mi) north, which is greater than the 300 m (1,000 ft) radius specified by the GEIS. Therefore, noise impacts from the construction activities for this alternative are expected to be SMALL. Compliance with OSHA noise regulations would ensure that noise impacts to workers would remain SMALL.

4.8.3.2 *Operation Impacts*

Because the Hank Unit would not be constructed, stationary sources of noise (e.g., generators and compressors, idling vehicles) would not be present. More importantly, traffic noise related to the transfer of ion exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant along the 13.4 km (8.3 mi) of gravel ranch road between the two locations would not occur. The lack of active well fields in the Hank Unit would also diminish the traffic volume with respect to incoming shipments of process chemicals and outgoing shipments of yellowcake, and subsequently, the noises emitted by these passing vehicles. Therefore, noise impacts from the operation activities for this alternative are expected to be SMALL. Compliance with OSHA noise regulations would ensure that noise impacts to workers would remain SMALL.

4.8.3.3 *Aquifer Restoration Impacts*

With the exception of passing traffic along the gravel ranch road, sources of noise would not be present in the vicinity of the Hank Unit. Sound levels generated during this phase would be similar or less than those levels experienced during operation. Vehicular traffic is expected to be limited to delivery of supplies and staff accessing the site, which is would be less than for the proposed action. Therefore, noise impacts from the aquifer restoration activities for this alternative are expected to be SMALL.

4.8.3.4 *Decommissioning Impacts*

Though soil and road reclamation and infrastructure demolition would result in heavy equipment usage and associated noise levels higher than that of the operation and restoration phases, the levels of noise generated would be similar to that of the construction phase and diminished relative to the proposed action because the Hank Unit would not be present. Less vehicular traffic associated with shipments to and from the site would occur as decommissioning progressed. Also, the closest residential receptor is located beyond the 300 m (1,000 ft) radius specified by the GEIS. Therefore, noise impacts from the decommissioning activities for this alternative are expected to be SMALL.

4.9 Historical, Cultural, and Paleontological Resources Impacts

Potential environmental impacts to historical, cultural, and paleontological resources at the proposed Nichols Ranch ISR Project site may occur during all phases of the facility's lifecycle. Predominantly, these impacts could result from the loss of or damage to historical, cultural, and archaeological resources, as well as temporary restrictions on access to these resources. Detailed discussion of the potential environmental impacts to historical, cultural, and paleontological resources from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.9.1 Proposed Action (Alternative 1)

4.9.1.1 *Construction Impacts*

As discussed in Section 4.3.8.1 of the GEIS, the potential impacts during ISR facility construction could include loss of, or damage to, historical and cultural resources due to excavation activities as a part of construction. Additionally, access to, historical, cultural, and archaeological resources could be temporarily restricted during construction.

As stated in the GEIS, the NRC expects that the applicant would conduct the appropriate historical and cultural resource surveys as part of pre-license application activities. Further, it is anticipated that the eligibility evaluation of cultural resources for listing in the *National Register of Historic Places* (NRHP) under criteria in 36 CFR 60.4(a)–(d) and/or as TCPs would be conducted as part of the site-specific review and NRC licensing procedures undertaken during the *National Environmental Policy Act* (NEPA) review process. Additionally, the NRC requires licensed facilities to submit a decommissioning plan for review, which would ensure compliance with Section 106 of the *National Historic Preservation Act* (NHPA) during the decommissioning phase.

The evaluation of impacts to any historical properties designated as TCPs and tribal consultations regarding cultural resources and TCPs also would be expected to occur during the site-specific licensing application and review process. To determine whether significant cultural resources would be avoided or mitigated, consultations involving the NRC, the applicant, SHPO, other government agencies (e.g., FWS and State Environmental Departments), and Native American Tribes would be expected to occur as part of the site-specific review. Additionally, as discussed in the GEIS, an NRC licensee would likely be required, under conditions in its NRC license, to stop work upon discovery of previously undocumented historical or cultural resources and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures. The GEIS determined that potential impacts to historical and cultural resources from construction could be SMALL to LARGE depending on the presence or absence of historical and cultural resources on the site.

Archaeological sites and isolated finds identified within both the Nichols Ranch Unit and Hank Unit project areas would be directly affected during construction. Activities would include the construction of well fields and access roads. Only one archaeological site at the Nichols Ranch Unit and eight archaeological sites at the Hank Unit are eligible to the NRHP. Four of these sites could be impacted during the construction (48CA5391, 48CA6146/6147, 48CA6148, and 48CA6927). Site 48CA5391 (Nichols Ranch Unit) is located within a proposed well field. Sites 48CA6146/6147, 48CA6148, and 48CA6927 (Hank Unit) are located either on top or between the ore body and within areas for proposed monitoring wells.

If it is determined that the sites cannot be avoided, then mitigation must be completed prior to construction per treatment plans. Treatment plans would be established following the development of a Memorandum of Agreement (MOA) between Uranerz, NRC, BLM (if BLM lands are involved), SHPO, and the State Attorney General's Office. The MOA would outline the mitigation process for each affected resource and why the sites cannot be avoided. If an MOA is developed, the actions in the MOA are enforceable by the NRC as the lead federal agency. Prior to construction, Uranerz would have to develop an Unexpected Discovery Plan that would outline the steps required in the event that unexpected historical and cultural resources are encountered. In the event that mitigation is conducted, the impact to the sites would be MODERATE. If mitigation is not implemented, then the impacts would be MODERATE to LARGE. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding potential impacts to these sites is ongoing (see Appendix A).

The existing Pumpkin Buttes PA between the BLM and Wyoming SHPO (BLM, 2009) serves as a baseline for considering the effects of the proposed project on this TCP. Although Uranerz does not propose any physical development above the 1,676 m (5,500 ft) above mean sea level (AMSL) boundary, the BLM has determined that development of the Hank Unit would have an adverse effect to the setting of Pumpkin Buttes and that mitigation measures must be developed to lessen the visual impact to the resource (BLM, 2008a). Such mitigation measures, as described in the PA, include using areas of existing disturbance wherever possible, placing wells in areas that avoid dense sage brush or other vegetation, and painting of aboveground infrastructure to blend in with the surrounding topography. The Northern Cheyenne noted that noise and dust may affect the integrity of the setting of Pumpkin Buttes. These effects could be mitigated and are discussed later in the visual and scenic resources impacts section of this chapter. If Uranerz becomes a signatory to the PA and the mitigation measures outlined in the PA are implemented, then the impact to the resource would be MODERATE because the effects of the structures would be long-term even though the dust and noise associated with construction would be short-term. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding potential impacts to the TCP is ongoing. Correspondence related to this consultation process can be found in Appendix A.

Paleontological specimens are present in both project areas. Construction would impact both geological units including the surficial Quaternary deposits and near surface Wasatch Formation deposits. However, based on the geology of the site and the poor exposure of fossil bearing sediment, the proposed Nichols Ranch ISR Project would not significantly impact the fossil remains identified. Uranerz would have a monitor present during construction activities involving depths in excess of a few feet. If fossil remains are discovered during construction, work would stop and contacts would be made to the appropriate state and federal agencies. Therefore, any impact from construction on paleontological resources would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to historical and cultural resources during construction would be SMALL to LARGE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be MODERATE. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.1.2 *Operation Impacts*

In Section 4.3.8.2 of the GEIS, it is expected that potential impacts to historical, cultural, and archaeological resources from operations would be less than during construction, because less land disturbance occurs during the operations phase. Additionally, conditions in the NRC license typically require the licensee to stop work upon discovery of previously undocumented historical or cultural resources and to notify the appropriate federal, tribal, and state agencies with regard to mitigation measures. For these reasons, the GEIS determined that ISR operation impacts to historical and cultural resources would be SMALL.

There would be minimal impacts from operations on archaeological sites recommended eligible to the NRHP at the proposed Nichols Ranch ISR Project. Impacts to archaeological sites would be mitigated prior to facility construction. There are no cultural resources known in the project area that would be affected by facility operation or maintenance. Should resources be encountered during routine maintenance activities, per site procedures, work would stop and proper notifications would be undertaken (SHPO). Therefore, the impacts to cultural resources are SMALL.

In regards to the Pumpkin Buttes TCP, concern was expressed by the Northern Cheyenne that traffic, noise, dust, and extraction in general may affect the integrity of the setting of Pumpkin Buttes. A plan to mitigate the consequences of such actions has not been formulated by Uranerz but BLM has noted that mitigation responses have to be developed (BLM, 2009a). These effects could be mitigated and are discussed later in the visual and scenic resources impacts section of this chapter. If Uranerz becomes a signatory to the PA and the mitigation measures outlined in the PA are implemented, then the impact to the resource would be SMALL because the dust and noise associated with any ground disturbing activities related to maintenance would be limited and short-term. Due to the proximity of the site to the Pumpkin Buttes TCP, Section 106 consultation between the NRC, SHPO, BLM, and Uranerz is ongoing to ensure that the provisions of the National Historic Preservation Act are upheld. Documentation related to the consultation process is provided in Appendix A.

In the case of paleontological resources, routine maintenance during operations could require ground disturbing activities which may impact fossil-bearing deposits. However, maintenance actions are usually near the surface and would likely be limited to pre-disturbed areas. Should there be ground disturbing activities with ground disturbance depths in excess of a few feet, Uranerz would have a monitor in place and its procedures would cover inadvertent discovery. Therefore, any impact from operations on paleontological resources would be SMALL and short-term.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for historical and cultural resources and incorporates by reference the GEIS's conclusions that the impacts to historical and cultural resources during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.1.3 *Aquifer Restoration Impacts*

In Section 4.3.8.3 of the GEIS, aquifer restoration impacts to historical and cultural resources are expected to be similar to, or less than, potential impacts from operations. This is because aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing plant). Additionally, the NRC license condition regarding the discovery of previously undocumented historical or cultural resources would be expected to remain in effect. For these reasons, the GEIS determined the potential impacts from aquifer restoration to historical and cultural resources to be SMALL.

There would be minimal aquifer restoration impacts on historical and cultural resources recommended eligible to the NRHP at the proposed Nichols Ranch ISR Project. The significant cultural resources were mitigated prior to the construction. However, Uranerz has procedures that have inadvertent discovery provisions in case additional ground disturbing activities are required. Therefore, the impacts to cultural resources are SMALL.

In regards to the Pumpkin Buttes TCP, concern was expressed by the Northern Cheyenne that traffic, noise, dust, and extraction in general may affect the integrity of the setting of Pumpkin Buttes. A plan to mitigate the consequences of such actions has not been formulated by Uranerz but BLM has noted that mitigation responses have to be developed (BLM, 2009a). These effects could be mitigated and are discussed later in the visual and scenic resources impacts section of this chapter. If Uranerz becomes a signatory to the PA and the mitigation measures outlined in the PA are implemented, then the impact to the resource would be SMALL because the dust and noise associated with any ground disturbing activities related to aquifer restoration would be short-term. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding potential impacts to the TCP is ongoing. Documentation related to the consultation process is provided in Appendix A.

Regarding paleontological resources, should aquifer restoration activities involve ground disturbance depths in excess of a few feet, Uranerz would have a monitor in place and their procedures would cover inadvertent discovery. Therefore, any impact from aquifer restoration on paleontological resources would be SMALL and short-term.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for historical and cultural resources and incorporates by reference the GEIS's conclusions that the impacts to historical and cultural resources during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.1.4 *Decommissioning Impacts*

Section 4.3.8.4 of the GEIS discusses potential impacts from decommissioning to historical and cultural resources. It is expected that decommissioning and reclamation activities would focus on previously disturbed areas, and that historical and cultural resources within the potential area of effect would already be known. As a result, the GEIS considered the potential impacts to historical, cultural, and archaeological resources during decommissioning and reclamation to be SMALL.

There would be minimal decommissioning impacts on historical and cultural resources recommended eligible to the NRHP at the proposed Nichols Ranch ISR Project. The significant cultural resources were mitigated prior to the construction phase. If ground disturbing activities occur outside of previously surveyed areas, then archaeological surveys should be conducted prior to the activity. Therefore, the impacts to cultural resources are SMALL.

In regards to the Pumpkin Buttes TCP, concern was expressed by the Northern Cheyenne that traffic, noise, dust, and extraction in general may affect the integrity of the setting of Pumpkin Buttes. A plan to mitigate the consequences of such actions has not been formulated by Uranerz but BLM has noted that mitigation responses have to be developed (BLM, 2009a). These effects could be mitigated and are discussed later in the visual and scenic resources impacts section of this chapter. If Uranerz becomes a signatory to the PA and the mitigation measures outlined in the PA are implemented, then there would be short-term impact to the resource due to the noise and dust generated during the removal of the structures; however, the long-term impact would be SMALL as the proposed project site would be returned to the natural landscape during this stage. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding potential impacts to the TCP is ongoing. Documentation related to the consultation process is provided in Appendix A.

Regarding paleontological resources, should decommissioning activities involve ground disturbance depths in excess of a few feet, Uranerz would have a monitor in place and their procedures would cover inadvertent discovery. Therefore, any impact from decommissioning on paleontological resources would be SMALL and short-term.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for historical and cultural resources and incorporates by reference the GEIS's conclusions that the impacts to historical and cultural resources during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.2 No-Action (Alternative 2)

Under the No-Action Alternative, the proponent would not be issued a license for the construction, operation, aquifer restoration, and decommissioning of ISR facilities at the proposed site. No archaeological sites, isolated cultural resources, or paleontological resources would be affected. The cultural impacts associated with current land activities such as CBM extraction, oil and gas extraction, and cattle ranching would persist.

4.9.3 Modified Action – No Hank Unit (Alternative 3)

4.9.3.1 *Construction Impacts*

The proposed alternative would result in the construction of the Nichols Ranch Unit. This would have a direct impact on archaeological site 48CA5391, which is eligible to the NRHP. Site 48CA5391 is located within a proposed well field. If site 48CA5391 cannot be avoided, then mitigation must be completed and prior to construction per a treatment plan. The treatment plan would be established following the development of a MOA between all interested parties, as described in Section 4.9.1.1. Should mitigation measures be implemented, the impact to site 48CA5391 would be MODERATE. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding impact to this site is ongoing.

The existing Pumpkin Buttes PA between the BLM and Wyoming SHPO serves as a baseline for considering the effects of the project on this resource. The final clause of the PA states that "BLM and SHPO agree that construction of all energy development related federal undertakings within 2 mi [3.2 km] of the Pumpkin Buttes Traditional Cultural Property shall be implemented in accordance with the stipulations [of the PA]." (BLM, 2009b) The Nichols Ranch Unit is located 9.6 km (6 mi) east of Pumpkin Buttes. Thus, there would be negligible effects to the Pumpkin Buttes from construction of the Nichols Ranch Unit; therefore, the impact is SMALL.

Paleontological specimens are present at the Nichols Ranch Unit. Construction would impact both surficial Quaternary deposits and near surface Eocene Wasatch Formation deposits. However, based on the geology of the site and the poor exposure of fossil bearing sediment, activities associated with this alternative would not significantly impact the fossil remains identified. Uranerz would have a monitor present during construction activities involving depths in excess of a few feet, therefore the impact is SMALL. Construction would be halted and the monitor would immediately contact the appropriate state and federal agencies.

4.9.3.2 *Operation Impacts*

There would be minimal impacts from plant operations on archaeological sites eligible to the NRHP. Most impacts would occur during the construction phase of the project; however, impacts would be mitigated prior to ground disturbing activities. There are no cultural resources known in the project area that would be affected by facility operation or maintenance. However, Uranerz has procedures that have inadvertent discovery provisions. Should resources be encountered during routine operation or maintenance activities, work would be halted and contact would be made with the appropriate state and federal agencies. Therefore, the impacts to cultural resources are SMALL.

Most impacts to the Pumpkin Buttes TCP would occur during the construction phase. Since operational activities would occur only at the Nichols Ranch Unit site, the impact on this resource would be less compared to the proposed action. Therefore, any impact of plant operations on the Pumpkin Buttes would be SMALL.

Paleontological resources could be impacted by routine maintenance during operations. Most impacts would occur during initial plant construction. However, routine maintenance and plant operational activities could have minor effects on fossils. Should resources be encountered during routine operation or maintenance activities, work would be halted and contact would be made with the appropriate state and federal agencies. Therefore, any impact from operations on paleontological resources would likely be SMALL.

4.9.3.3 *Aquifer Restoration Impacts*

There would minimal to no aquifer restoration impacts on historical and cultural resources eligible to the NRHP. Most impacts would occur during initial plant construction and impacts to historical and cultural resources would be mitigated prior to any ground disturbing activities. However, Uranerz has procedures that have inadvertent discovery provisions. Should resources be encountered during aquifer restoration, work would be halted and contact would be made with the appropriate state and federal agencies. Therefore, the impacts to cultural resources are SMALL.

Since activities are limited to the Nichols Ranch Unit site, impacts to the Pumpkin Buttes TCP would be reduced due to its distance from the Nichols Ranch Unit. Aquifer restoration activities could involve ground disturbing activities; however, the impacts would be less compared to the proposed action. Therefore, any impact of plant operations on the Pumpkin Buttes would be SMALL.

Regarding paleontological resources, should aquifer restoration activities involve ground disturbance depths in excess of a few feet, Uranerz would have a monitor in place and their procedures would cover inadvertent discovery. Therefore, any impact from aquifer restoration on paleontological resources would likely be SMALL and short-term.

4.9.3.4 *Decommissioning Impacts*

There would be no decommissioning impacts on historical and cultural resources eligible to the NRHP, therefore the impacts are SMALL. Most impacts occurred during initial plant construction and impacts to historical and cultural resources would be mitigated prior to any ground disturbing activities. The significant cultural resources were mitigated during the construction phase. If ground disturbing activities occur outside of previously surveyed areas, then surveys should be conducted prior to the activity.

In regards to the Pumpkin Buttes TCP, concern was expressed by the Northern Cheyenne that traffic, noise, dust, and extraction in general may affect the integrity of the setting of Pumpkin Buttes. However, since activities would only occur at the Nichols Ranch Unit and it is located at a distance of 9.7 km (6 mi) from the TCP, the impact on the TCP should be lessened in this alternative as compared to the proposed action. Therefore, the impact to the TCP would be SMALL.

Regarding paleontological resources, should decommissioning activities involve ground disturbance depths in excess of a few feet, Uranerz would have a monitor in place and their procedures would cover inadvertent discovery. Therefore, any impact from decommissioning on paleontological resources would likely be SMALL and short-term.

4.10 Visual and Scenic Resources Impacts

Potential visual and scenic impacts from the proposed Nichols Ranch ISR Project may occur during all phases of the ISR facility's lifecycle. These impacts primarily would be associated with the use of equipment such as drill rigs; dust and other emissions from such equipment; the construction of facility buildings, other structures, and site and well field access roads; land clearing and grading activities; and lighting for nighttime operations. Such impacts could be mitigated by rolling topography, color considerations for structures, and dust suppression techniques.

Also of consideration in the significance of visual impacts is the use of the BLM Visual Resource Management (VRM) classification of landscapes. Most of the landscape in the Wyoming East Uranium Milling Region identified in the GEIS is VRM Class III or Class IV, thus allowing for an activity to contrast with basic elements of the characteristic landscape to a limited extent (Class III) or to a much greater extent (Class IV).

4.10.1 Proposed Action (Alternative 1)

The Nichols Ranch and Hank Units are separated from one another by about 9.6 km (6 mi) and their settings are topographically different. The effects of construction, operations, aquifer restoration, and decommissioning on the two units may differ because of the considerations that must be taken in regards to Pumpkin Buttes TCP, immediately adjacent to and partially overlapped by the Hank Unit. After an overall impact assessment for each issue, the impacts of the Nichols Ranch and Hank Units are discussed separately with regard to the Pumpkin Buttes TCP.

The BLM Buffalo Field Office has identified the potential for a visual impact on the Pumpkin Buttes TCP from the proposed development in the Hank Unit, which could affect the Pumpkin

Buttes TCP's setting, feeling, and association (BLM, 2009a). The PA (BLM, 2009b) for the Pumpkin Buttes TCP requires developers to complete a Class III survey of any proposed project within the area, submit detailed construction plans, and participate in an onsite evaluation with BLM. This process would ensure that the effects of both units of the proposed Nichols Ranch ISR Project on visual resources are mitigated.

4.10.1.1 *Construction Impacts*

As discussed in Section 4.3.9.1 of the GEIS, visual impacts during construction can result from equipment (e.g., drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of a proposed ISR facility relative to viewpoints such as highways, process facility construction and drill rigs could be visible. For nighttime operation, the drill rigs would be lighted, and this would create a visual impact because the drill rigs would be most visible and provide the most contrast if they were located on elevated areas. Most impacts would be temporary as equipment is moved and would be mitigated by BMPs (e.g., dust suppression). Additionally, because these sites are expected to be in sparsely populated areas and there would be generally rolling topography of the region, most visual impacts during construction would not be expected to be visible from more than about 1 km [0.6 mi]. As previously discussed, PSD Class I areas require more stringent air quality standards that can affect visual impacts; however, there are no PSD Class I areas in the Wyoming East Uranium Milling Regions. Finally, proposed ISR facilities are expected to be located more than 16 km (10 mi) from the closest VRM Class II area, and the visual impacts associated with ISR construction would be consistent with the predominant VRM Class III and IV classification, Therefore, visual impacts associated with ISR construction would be expected to be SMALL. The following is a site-specific discussion on construction impacts to both units at the proposed project site specific to the TCP.

4.10.1.1.1 <u>Nichols Ranch Unit</u>

Visual impacts from construction in the Nichols Ranch Unit would be consistent with impacts described above and assumptions made in the GEIS. No visual contrast during construction would affect any Class II areas and visual impacts during construction are expected to be SMALL. Regarding the Pumpkin Buttes TCP, the Nichols Ranch Unit is not within a 3.2-km (2-mi) radius of any TCP element. Mitigation responses for actions greater than 3.2 km (2 mi) have not yet been developed. The BLM completed a scenic quality field inventory, the first step in a contrast rating evaluation, in the summer of 2009. Once completed, the contrast rating evaluation will determine the extent to which proposed activities at the Nichols Ranch Unit can be seen from the Pumpkin Buttes. Continued coordination with the BLM will ensure that mitigation options are considered for any identified visual effects. Additionally, if Uranerz signs the PA (discussed in more detail in Section 4.10.1.1.2), mitigation strategies specified in the PA would be applied to both the Nichols Ranch and Hank Units, which would further reduce the SMALL impacts to visual and scenic resources from the Nichols Ranch Unit. Section 106 consultation, which could also further reduce the SMALL impacts from the Nichols Ranch Unit, regarding impacts to the TCP is ongoing between the NRC, SHPO, BLM, and Uranerz. Documentation related to the consultation process is provided in Appendix A.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions for the Nichols Ranch Unit are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.1.1.2 Hank Unit

Because the Hank Unit overlaps with and is within the 3.2-km (2-mi) radius of the Pumpkin Buttes TCP, mitigation measures identified in the PA for the Pumpkin Buttes TCP would apply to construction activities in the Hank Unit. The PA (BLM, 2009b) for the Pumpkin Buttes TCP includes appendices that detail measures that can be employed to lessen construction impacts. Some of these measures include:

- Temporary single-lane roads for dry-season use should not exceed 6.1 m (20 ft) in width including the 3.7-m (12-ft) wide running surface;
- Resource roads should not exceed 12.2 m (40 ft) in width with a 4.9-m (16-ft) wide running surface and should not have a gravel surface that contrasts with the surrounding vegetation and soil color;
- Construction of all road types should be sited outside of areas of dense sagebrush in order to lessen visual contras, and roads should follow natural contours when possible;
- Pipelines should be aligned within roads whenever possible and includes trenching methods to minimize the visual impact of pipelines; and
- In-situ wells should not be built in dense vegetation stands that would lead to high color contrast and any well heads and above ground infrastructure should be painted a color that blends with the surrounding landscape.

If signed by Uranerz, the implementation of the requirements of the PA for the Pumpkin Buttes TCP and additional mitigation measures, such as those mentioned above, would limit the impacts to visual and scenic resources from the Hank Unit. If not signed by Uranerz, a separate MOA with specific mitigation measures would have to be developed with the BLM to limit the impacts to visual and scenic resources from the Hank Unit. However, because of the proximity of the Hank Unit to the Pumpkin Buttes TCP and the presence of construction machinery in plain view, some visual and scenic effects from construction are likely, and therefore, impacts are anticipated to be MODERATE. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding impact to the TCP is ongoing. Documentation related to the consultation process is provided in Appendix A.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions for the Hank Unit differ from those described in the GEIS for visual and scenic resources. The GEIS concludes that the impacts to visual and scenic resources during construction are expected to be SMALL. However, the proximity of the Hank Unit to the Pumpkin Buttes TCP is unique to the proposed Nichols Ranch ISR Project site. For the reasons described in the above section, the staff concludes that the impacts to visual and scenic resource for the Hank Unit during construction would be MODERATE.

4.10.1.2 *Operation Impacts*

Section 4.3.9.2 of the GEIS states that visual impacts during operations would be expected to be less than those associated with construction. Most of the well field surface infrastructure would have a low profile, and most piping and cables would be buried. The tallest structures would be expected to include the central processing plant (10 m [30 ft]) and power lines (6 m

[20 ft]). Because these sites are in sparsely populated areas with generally rolling topography, most visual impacts during operations would not be visible from more than about 1 km (0.6 mi). Irregular layout of well field surface structures such as wellhead protection and header houses would further reduce visual contrast. BMPs, and design (e.g., painting buildings) and landscaping techniques would be used to mitigate potential visual impact. The Wyoming East Uranium Milling Region as identified in the GEIS is located more than 16 km (10 mi) from the closest VRM Class II region, and the visual impacts associated with ISR construction would be consistent with the predominant VRM Class III and IV. Therefore, the GEIS considered visual and scenic impacts from operations to be SMALL.

Project operations are planned for an area where extensive CBM development has already occurred and where additional CBM development is planned. CBM installations include networks of wells, underground piping, pump structures, and overhead power lines. Despite the existing visual impacts from CBM development, Uranerz intends to implement measures to lessen the visual impact from the proposed Nichols Ranch ISR Project. Buildings and other structures would be painted so as to blend in to the natural landscape and power lines and pipelines would be buried where applicable. Long-term impacts would result from the ongoing operations at and between facilities and well fields. However, impacts of operations on visual and scenic resources are anticipated to be SMALL.

Operation impacts to visual and scenic resources would be SMALL according to the nature of routine maintenance on both units as described by Uranerz (2007). Additionally, implementation of the requirements of the PA for the Pumpkin Buttes TCP would limit the operation impacts to visual and scenic resources from the Hank Unit. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding impact to the TCP is ongoing.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.1.3 *Aquifer Restoration Impacts*

Section 4.3.9.3 of the GEIS addresses visual and scenic impacts from aquifer restoration. The GEIS states that aquifer restoration activities are expected to take place some years after the facility had been in operation and that restoration activities would use in-place infrastructure. As a result, potential visual impacts would be similar to, or less than, those experienced during operations. Additional mitigation measures (e.g., dust suppression) could be used to further reduce visual and scenic impacts. Therefore, such impacts are expected to be SMALL.

Since Uranerz would implement dust suppression to reduce visual and scenic impacts and the assumptions made in the GEIS are the same as those proposed for the Nichols Ranch ISR Project, the visual and scenic impacts from aquifer restoration are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.1.4 *Decommissioning Impacts*

As discussed in the GEIS (Section 4.3.9.4), because similar equipment would be used and activities conducted, potential visual impacts during decommissioning would be similar to, or less than, those experienced during construction. It would be expected that most potential visual impacts during decommissioning would be temporary as equipment is moved and would be mitigated by best management practices (e.g., dust suppression). Additionally, visual impacts would be low, because these sites are expected to be in sparsely populated areas, and that impacts would diminish as decommissioning activities decrease. NRC licensees are required to conduct final site decommissioning and reclamation under an approved site reclamation plan, with the goal of returning the landscape to preconstruction conditions. While some roadside cuts and hill slope modifications may persist beyond decommissioning and reclamation, the GEIS analysis expects visual and scenic impacts from decommissioning to be SMALL. Mitigation through BMPs (e.g., dust suppression) would further reduce the SMALL visual and scenic impacts of decommissioning.

Since Uranerz would implement dust suppression to reduce visual and scenic impacts and the assumptions made in the GEIS are the same as those proposed for the Nichols Ranch ISR Project, the visual and scenic impacts from decommissioning are expected to be SMALL. Additionally, mitigation measures included in the Pumpkin Buttes PA (BLM, 2009b) would continue to be followed as during all other phases of the project, which would result in SMALL impacts to this TCP.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.2 No-Action (Alternative 2)

Under the No-Action Alternative, the proponent would not be issued a license for the construction, operations, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing at the proposed site. The lack of these activities would allow visual and scenic resources to remain in their current state. There would be no additional scars placed or left on the landscape associated with the proposed project under the No-Action Alternative. Natural resource exploration activities and cattle grazing would continue on the proposed site.

4.10.3 Modified Action – No Hank Unit (Alternative 3)

Under this alternative, the Hank Unit would not be considered and all proposed facilities would be confined to the Nichols Ranch Unit. As noted in the discussion of the proposed action, coordination with the BLM and SHPO would determine the extent to which the actions at Nichols Ranch Unit would be visible from the Pumpkin Buttes TCP and would help identify appropriate mitigation strategies. Because of the distance between the Nichols Ranch Unit and the Pumpkin Buttes TCP, impacts of this alternative under all phases are expected to be less than under proposed action and thus, SMALL.

4.11 Socioeconomic Impacts

Potential environmental impacts to socioeconomics from activities at the proposed Nichols Ranch ISR Project site may occur during all phases of the facility's lifecycle. Potential impacts to socioeconomics would result predominantly from employment at an ISR facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force.

Detailed discussion of the potential environmental impacts to socioeconomics from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

The GEIS socioeconomic analysis is based on 2000 U.S. Census Bureau data. The socioeconomic analysis presented in this SEIS for the proposed Nichols Ranch ISR Project region of influence (ROI) is based on a combination of 2000 U.S. Census Bureau data, U.S. Census Bureau 2005-2007 American Community Survey 3-Year Estimates, and U.S. Census Bureau 2009 State and County QuickFacts. Though specific numbers may differ, the analysis of socioeconomics presented in Section 4.3.10 of the GEIS remains valid for the proposed Nichols Ranch ISR Project.

4.11.1 Proposed Action (Alternative 1)

4.11.1.1 *Construction Impacts*

In Section 4.3.10.1 of the GEIS, the potential impacts to socioeconomics from construction of an ISR facility are discussed. These impacts would result predominantly from employment at an ISR facility and demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. The GEIS estimated total peak employment to be about 200 people, including company employees and local contractors, depending on timing of construction with other stages of the ISR lifecycle. Additionally, the GEIS estimated 140 ancillary jobs could be created associated with the ISR facility. During construction of surface facilities and well fields, it is expected that a general practice would be to use local contractors (drillers, construction workers, etc.), as available, and that local building materials and building supplies would be used to the extent practical.

The GEIS also considered that most employees would choose to live in larger communities with access to more services. However, the GEIS expected that some construction workers would commute from outside the county to the ISR facility, and that skilled employees (e.g., engineers, accountants, managers) would come from outside the local work force. The potential also exists that some of these employees would temporarily relocate to the project area and contribute to the local economy through purchasing goods and services and paying taxes. Depending on where the workforce and supplies came from, the GEIS determined that potential impacts to towns and communities, in terms of housing and employment structure, could be SMALL to MODERATE. Given the expected short duration of construction activities (12 to 18 months), it was not expected that families would relocate closer to the site. For this reason, potential impacts to education and use of local services was determined to be SMALL.

Because of the small relative size of the ISR construction workforce, the overall potential impacts to socioeconomics from construction would be expected to be SMALL. The following subsections describe the construction impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services for the proposed Nichols Ranch ISR Project.

4.11.1.1.1 Demographics

Construction for the two units is anticipated to last for approximately one year (Uranerz, 2007). Workers are likely to locate in larger population centers such as Gillette, and some may also commute from towns such as Casper and Buffalo. Some workers may locate in the small town of Wright. Campbell County and larger towns, such as Gillette and Casper, have the capacity to more easily manage increases in population. Uranerz would employ approximately 45 to 55 people during construction. Due to the short duration of construction, these 45 to 55 construction workers would have a limited effect on public services and community infrastructure in these towns. Uranerz would try to employ workers from the surrounding area to alleviate any burden on public services and community infrastructure in these towns. Further, construction workers are less likely to relocate their entire family to the region, thus minimizing impacts from an outside workforce. Therefore, the impacts of the proposed action on demographics are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to demographics during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.1.2 Income

No changes to income are anticipated as a result of construction activities. It is expected that workers would be paid the regional rates typical of the area. Therefore, impacts of the proposed action on income are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to income during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.1.3 Housing

As discussed in Chapter 3, the vacancy rates in Gillette are near zero. However, the Dry Fork Station transmission construction project by Basin Electric Power Cooperative is expected to be completed in 2011, thus freeing up some housing in Gillette and the surrounding area (Basin Electric, 2009a). Sweetwater Management Group, LLC, has made 126 units in South Fork Apartments located in Gillette available specifically for Dry Fork Station project employees, which would be more than the number of units required for the estimated 45 to 55-person workforce required for the proposed Nichols Ranch ISR Project construction phase (Basin Electric, 2009b). Impacts to existing local residents earning low wages and those on fixed incomes could be negatively affected by increased demand for housing. Housing demand is anticipated to increase during construction of the proposed Nichols Ranch ISR Project, but housing demand will likely be met due to the availability of temporary housing by the beginning of the construction phase. In addition, Uranerz would try to employ workers from the surrounding area to reduce some of the housing demand. Therefore, impacts of the proposed action on housing are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to housing during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.1.4 Employment Rate

Given the recent state and county increase in unemployment as discussed in Chapter 3, a slight positive effect on employment rates may occur as a result of construction activities associated with the proposed Nichols Ranch ISR Project. Uranerz anticipates a combined operations and construction workforce of 45 to 55 company employees. Uranerz plans to employ local employees and contractors whenever possible. Since the proposed Nichols Ranch ISR Project is located in a rural, low-population density area, the construction work force would largely come from surrounding towns and cities. These impacts would be positive but SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to the employment rate during construction would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.1.5 Local Finance

Local finance represents revenue associated with economic activity in the area (minus the cost associated with providing services for a changing population). The added construction work force would have a SMALL beneficial impact on the local economy through the purchasing of local goods and services, as well as providing county and state tax revenues. Taxes derived from the value of construction equipment and use tax on purchases for the proposed Nichols Ranch ISR Project would also add to the Campbell County and Johnson County tax bases. This income would help offset the increased needs for public services, although the demand for the public service is immediate and tax revenues generally lag. Small towns experiencing increased population/public service demand may not receive a proportionate level of tax increase as sales tax revenue is more likely to increase in the larger population centers. In general however, impacts to local finances are anticipated to be positive but SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions differ from those described in the GEIS for local finance. The GEIS concludes that the impacts to local finance during construction are expected to be MODERATE. However, based on the smaller number of required workers (200 estimated in the GEIS versus 45 to 55 estimated in Uranerz's ER) for the proposed Nichols Ranch ISR Project site and the reasons described in the above section, the staff concludes that the impacts to local finance during construction would be SMALL.

4.11.1.1.6 Education

If the construction work force and their families secure local housing, an increased demand for local infrastructure, schools, and public services would occur. However, given the small estimated construction work force, and given that most workers are not anticipated to relocate their entire families during construction, impacts to the local infrastructure, schools, and public services from the proposed project would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for education and incorporates by reference the GEIS's conclusions that the impacts to education during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.1.7 Health and Social Services

Increased demand would be expected for doctors, hospitals, and police during the construction phase of the Nichols Ranch ISR Project in response to workers and their families relocating to the area. Local governments are expected to have the capacity to effectively plan for and manage the changing demands on health and social services because population increases are not expected to be significant in any one town or city. Therefore, it is anticipated that impacts to health and social services would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for health and social services and incorporates by reference the GEIS's conclusions that the impacts to health and social services during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2 *Operation Impacts*

As discussed in Section 4.3.10.2 of the GEIS, employment levels during ISR facility operations would be expected to be less than those for construction, with total peak employment depending on timing and overlap with other stages of the ISR lifecycle. Use of local contract workers and local building materials would diminish, because drilling and facility construction would diminish. Revenues would be generated from federal, state, and local taxes on the facility and the uranium produced. Employment types would be expected to be more technical during operations, and as a result, it was expected that the majority of the operational workforce would be staffed from outside the region, particularly during initial operations.

Effects on community services (e.g., education, health care, utilities, shopping, and recreation) during operation are expected to be similar to effects during construction (less in volume/quantity, but longer in duration). Overall, the GEIS determined that potential impacts to socioeconomics from operations would be expected to be SMALL to MODERATE.

Because of the small relative size of the ISR operational workforce at the proposed Nichols Ranch ISR Project, the overall potential impacts to socioeconomics from construction would be expected to be SMALL. The following subsections describe the operation impacts related to demographics, income, housing, employment rate, local finance, education, and health and social services.

4.11.1.2.1 Demographics

It is anticipated that the operations staff would be equal to the construction staff (45 to 55 workers, according to Uranerz [2007]), however the operations staff would stay in the area longer (approximately 9 years), and so would be more likely to secure permanent, or semi-permanent housing in the area than the construction staff would. Operation would require a number of specialized workers, such as plant managers, technical professionals, and skilled tradesmen that would likely come from outside the local area. This increase in population would spur additional job creation to service the larger population, which may create additional immigration to the area. Impacts to demographics during operations are expected to be MODERATE.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to demographics during operations would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be MODERATE. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.2 Income

The average annual salary for all full-time employees would be roughly $50,000 (Uranerz, 2007). This is slightly above the Wyoming average of $48,205 (USCB, 2008). Impacts to income during operations are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to income during operations would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.3 Housing

Housing demand is anticipated to increase during operations. The surrounding towns of Wright, Edgerton, and Midwest, as well as larger cities such as Gillette and Casper, which are within commuting distance to the project area. Vacancy rates are currently low in these and other surrounding towns and cities, and the added work force could further impact or exhaust the small inventory of available housing. Impacts to existing local residents earning less than the median income, and those on fixed incomes could be negatively affected by the increased demand for housing. Impacts to housing during operations are expected to be MODERATE.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for housing and incorporates by reference the GEIS's conclusions that the impacts to housing during operations are expected to be MODERATE. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.4 Employment Rate

Operation of the proposed Nichols Ranch ISR Project would create new jobs such as project managers, plant operators, lab technicians, and drill contractors. However, these skilled positions are more likely to be filled by people moving into the area rather than providing employment opportunities to the local population. Wyoming has experienced an increase in employment in the mining industry and a decrease in diversification of the state economy over the past few years. Diversified economies are more equipped to weather fluctuations in one industry. Jobs provided by the proposed Nichols Ranch ISR Project would contribute to the observed decreased in economic diversification. However, the proposed project would provide jobs to an area that has suffered an increasing unemployment rate over the past year, though it is likely that many skilled workers would be drawn from areas outside of the immediate region. Impacts to employment rate during operations are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for the employment rate and incorporates by reference the GEIS's conclusions that the impacts to the employment rate during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.5 Local Finance

Tax revenue would continue to accrue to the counties through all stages of operation. Regarding the direct operation of the proposed project, the personal property tax would be applied to the value of all equipment used by the project as discussed in Section 4.11.1.1.5. In addition, a state mineral severance tax would be applied to extracted uranium; however, this tax would not be directly returned to Campbell and Johnson Counties. A county ad valorem tax for production would also contribute to local government revenue. Indirectly, the counties would benefit from increased sales tax revenue from the increased population and resultant demand for goods and services. Impacts to local finance during operations are expected to be positive and MODERATE.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to local finance during operations would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Nichols Ranch ISR Project are expected to be MODERATE. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.6 Education

The added population associated with the additional 45 to 55 workers and their families relocating during operations would impact local schools and infrastructure. Some increase in education-related services would have already been experienced during the construction phase; however, due to the longer timeframe of operational activity, it is more likely that workers would relocate with their families during the operation phase than during the construction phase. The average family size in Wyoming is 2.97 (USCB, 2005-2007); therefore, a conservative estimate for number of school-aged children that would relocate to the area would be 45 to 55, though the actual number would likely be smaller as not all workers would relocate with their families. Due to this increase in school-aged children, the already high student-to-teacher ratio in

Campbell County (19.2-to-1) could initially increase (CCESC, 2009). The Johnson County student-to-teacher ratio is relatively low (10.2-to-1) and would not be significantly affected (WBC, 2008). Discussion with county planners indicated that the schools themselves probably could accommodate a small increase in the number of students. Impacts to local schools and public infrastructures during operations are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for education and incorporates by reference the GEIS's conclusions that the impacts to education during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.7 Health and Social Services

As during the construction phase, a small increase in demand would be expected for doctors, hospitals, and police during the operations phase of the proposed Nichols Ranch ISR Project in response to workers and their families relocating to the area. These operational impacts are not expected to differ significantly from those during construction. Though more workers and their families would be expected to relocate to the area during operations, a higher demand for health and social services would have already been experienced over the period of construction. Therefore, the small additional increase in demand that would occur between construction and operations phase would likely already have been met during the construction phase. Impacts to health and social services during operations are expected to remain SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for health and social services and incorporates by reference the GEIS's conclusions that the impacts to health and social services during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.3 *Aquifer Restoration Impacts*

Section 4.3.10.3 of the GEIS indicates that aquifer restoration impacts to socioeconomics would be expected to be similar to impacts experienced during operations. This is because the same level of employment and demand on services would be expected as during operations. The GEIS determined potential impacts to socioeconomics to be SMALL.

Impacts from the aquifer restoration process at the proposed Nichols Ranch ISR Project would be similar to those seen in the operation phase. There may be adverse impacts on the local housing inventory in neighboring towns if the staff chooses to occupy local housing. However, because the aquifer restoration phase would be temporary and would not require specialized skills, some workers would likely remain from the operation phase and additional workers would likely be drawn from the local area. Impacts on local infrastructure, as well as health, social and educational services would be SMALL since it is likely that workers would have already relocated their families to the area or that temporary workers working only during the aquifer restoration phase would not relocate their families to the area. The work force would have a positive impact on the local economy though the purchasing of local goods and services, as well as county and state tax revenues. By this stage of the project, local governments have adapted to the changes brought on by the project years earlier. Impacts of aquifer restoration on socioeconomics are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for socioeconomics and incorporates by reference the GEIS's conclusions that the impacts to socioeconomics during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.4 *Decommissioning Impacts*

Section 4.3.10.4 of the GEIS discusses the potential impacts of decommissioning on socioeconomics. It is expected that decommissioning and reclamation activities (e.g., dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/re-contouring the ground surface) would draw on a skill set similar to the construction workforce. Employment levels (up to 200 personnel) and use of local contractor support during decommissioning would be expected to be similar to those required for construction. Decommissioning activities are expected to be short in duration (24 to 30 months), and so employment would be temporary. Impacts to employment structure and housing were expected to be similar to those for construction, due to similar employment levels. The GEIS determined that overall, potential impacts to socioeconomics from decommissioning would be SMALL to MODERATE.

Decommissioning activities for the proposed Nichols Ranch ISR Project may impact the demand for housing, local infrastructure, as well as health, social and educational services if new workers relocate their families to the local area. These impacts are anticipated to be SMALL, especially if a number of ISR employees remain from the previous stage of the ISR project.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to socioeconomics during decommissioning would be SMALL to MODERATE. The staff concludes that site-specific impacts for the Nichols Ranch ISR Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change to socioeconomic factors in Campbell or Johnson Counties. This alternative would result in neither beneficial nor adverse impacts to socioeconomic factors. Natural resource extraction activities already contributing to the local economy would continue in the area.

4.11.3 Modified Action – No Hank Unit (Alternative 3)

Under this alternative, the Hank Unit would not be considered and all proposed facilities would be confined to the Nichols Ranch Unit. A reduced number of employees would be required for each phase of the project, which would result in slightly reduced impacts to income, housing, employment, local finance, education, and health and social services. Impacts associated with this alternative are expected to be similar, but less than the impacts of the proposed action for all phases of the project. However, the qualitative socioeconomic methods used to identify impacts on socioeconomic factors are not sensitive enough to significantly change as a result of this alternative. Impacts from construction would remain SMALL, impacts from operations would be SMALL to MODERATE (coinciding with the level of impact identified for each area of socioeconomics for the proposed action), impacts from aquifer restoration would be SMALL, and impacts from decommissioning would be SMALL.

4.12 Environmental Justice Impacts

Under Executive Order (E.O.) 12898 (59 FR 7629), federal agencies are required to identify and address disproportionately high or adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. A specific consideration of equity and fairness in resource decision-making is encompassed in the issue of environmental justice. As required by law and Title VI, all federal actions would consider potentially disproportionate negative impacts on minority or low-income communities.

In response to E.O. 12898, the NRC has issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040), which states the following:

> The Commission is committed to the general goals set forth in Executive Order 12898, and strives to meet those goals as part of its National Environmental Policy Act (NEPA) review process.

Environmental justice is not considered in detail in the GEIS, and is, therefore, assessed in this section of the SEIS. The census geographic units (e.g. block groups) near the proposed Nichols Ranch ISR Project are larger than 6.4-km (4-mi) radius at which the Commission Policy directs the staff to assess impacts on environmental justice. This is because the area around the proposed Nichols Ranch ISR Project is sparsely populated, and the minority and low income populations within a 6.4-km (4-mi) radius cannot be determined using 2000 Census data. This is analytically unimportant given the homogeneous nature of the state population (both in terms of race/ethnicity and poverty).

4.12.1 Proposed Action (Alternative 1)

Campbell, Johnson, and Natrona Counties are considered as the ROI for purposes of this environmental justice analysis. The environmental justice analysis presented in this SEIS for the proposed Nichols Ranch ISR Project ROI is based on a combination of U.S. Census Bureau 2005-2007 American Community Survey 3-Year Estimates and U.S. Census Bureau 2009 State and County QuickFacts in order to be consistent with the socioeconomics analysis presented in Section 4.11. Though the GEIS does not address environmental justice, the GEIS uses 2000 U.S. Census Bureau data in its analysis of socioeconomics. As stated in Section 4.11, these differences in data would not change the resulting impact level conclusions in this SEIS.

In 2008, the estimated populations for Campbell, Johnson, and Natrona Counties were 41,473, 8,464, and 73,129, respectively, and minority populations accounted for 3.6, 2.0, and 4.9 percent, respectively (USCB, 2009). By percentage, minority populations accounted for less than the state average of 6.1 percent within the ROI (See Table 4-1) (USCB, 2009).

In 2007, the most recent year for which data are available, the percentage of the population below the poverty level was below the state-wide poverty level of 9.5 percent in Campbell and Johnson Counties (5.9 and 8.0 percent, respectively) and higher than the state-wide level in Natrona County (9.9 percent) (See Table 4-2) (USCB, 2009).

Population percentages of both minority groups and individuals living below the poverty level are well within the 20 percent threshold established by the NRC for determining impacts to minority and low income populations. Based on the data above, no significant concentrations of minority populations or people living below the poverty level are located near the proposed Nichols Ranch ISR Project. Therefore, no disproportionately high and adverse impacts would result to minority or low-income populations from the Proposed Action.

Table 4-1. 2005-2007 Minority Population Estimates for Campbell, Johnson, and Natrona Counties

	Campbell County		Johnson County		Natrona County		3-County ROI	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
One race								
Black or African American	201	0.5	6	0.1	485	0.7	491	0.4
American Indian and Alaska Native	487	1.3	45	0.6	671	1.0	1203	1.1
Asian	112	0.3	8	0.1	456	0.6	576	0.5
Native Hawaiian and Other Pacific Islander	0	0.0	0	0.0	74	0.1	74	0.0
Some other race	896	2.3	39	0.6	1,913	2.7	2848	2.5
Two or more races	462	1.2	112	1.6	1,726	2.4	2300	2.0
Total	**2158**	**5.6**	**210**	**3.0**	**5,325**	**7.5**	**7,693**	**6.5**
Hispanic or Latino (of any race)	1,775	4.6	148	2.1	3,814	5.4	5737	5.1

Source: USCB, 2005-2007

Table 4-2. 2007 Percent of Individuals Below the Poverty Level for Campbell, Johnson, and Natrona Counties

Geographic Unit	Percent Poverty
Campbell County	5.9
Johnson County	8.0
Natrona County	9.9
Wyoming	9.5
U.S.	13.0

Source: USCB, 2009

4.12.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change to the area demographics due to the proposed Nichols Ranch ISR Project. No construction workers or employees would be attracted to the area due to the proposed action and the relative proportion of minority or low-income residents would not be affected. Therefore, there would be no disproportionately high and adverse impacts to minority or low-income populations expected from the No-Action alternative.

4.12.3 Modified Action – No Hank Unit (Alternative 3)

Under this alternative, the impacts to environmental justice during all four phases of this alternative would be the same as stated for the proposed action. Therefore, no disproportionately high and adverse impacts would result to minority or low-income populations from this alternative.

4.13 Public and Occupational Health and Safety Impacts

The standards for protecting public and occupational health and safety from exposure to ionizing radiation are established by the NRC in 10 CFR Part 20, *Standards for Protection against Radiation*. These standards are used in establishing specific criteria for evaluating impacts resulting from the proposed action and alternatives. The standards for protecting occupational exposure to chemical hazards are established by the OSHA in 29 CFR Part 1910, "Occupational Health and Safety Standards."

4.13.1 Proposed Action (Alternative 1)

4.13.1.1 *Construction Impacts*

Section 4.3.11.1 of the GEIS concludes that impacts from inhalation of fugitive dust would be SMALL due to the fact that radionuclide concentrations are expected to be low. However, based on baseline radiological environmental monitoring for the proposed facility, some survey locations exhibit concentrations of radioactive materials in soil that are well above natural background levels. Yet, because the average concentrations of radionuclides in the soil are low, it is not expected that the inhalation of fugitive dust would result in any significant dose. Therefore, the conclusions stated in the GEIS are valid for the proposed facility. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, construction is expected to have a SMALL impact on workers and the general public.

As described in Chapter 2 of this SEIS, construction activities associated with the proposed Nichols Ranch ISR Project would include those construction activities (drilling wells, clearing and grading associated with road construction and building foundations, trenching, and laying pipelines) described in the GEIS. The only significant radiation exposure pathway during construction would be through worker's potential direct exposure to, inhalation of, or ingestion of high concentrations of radionuclides within and emanating from (in the case of radon) the disturbed soil. Inhalation of fugitive dust from vehicle traffic during construction activities could also contribute to radiation dose. Therefore, the site-specific impacts would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for public and occupational health and safety and incorporates by reference the GEIS's conclusions that the impacts to public and occupational health and safety during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.2 *Operation Impacts*

4.13.1.2.1 Radiological Impacts from Normal Operations

As discussed in the GEIS, some amount of radioactive material would be released to the environment during normal ISR operations. The radionuclides of interest at an ISR facility are those in the uranium decay scheme, including uranium, thorium-230, radium-226, radon-222 and lead-210. Radon-222, because it is a gas, is the primary radionuclide of concern with respect to potential human exposure and would be the only radiological airborne effluent produced by the operation of the ISR facility. The potential sources of radon at the proposed Nichols Ranch ISR Project site would be extraction of uranium-bearing solution from the well fields, processing of the pregnant lixiviant on the ion exchange columns, the elution of the uranium from the ion exchange columns and subsequent precipitation of uranium, and the drying and packaging of yellowcake.

The potential impact for these releases can be evaluated by the MILDOS-AREA computer code (Argonne, 1989), which was developed by Argonne National Laboratory for calculating radiation doses to individuals and populations from releases that occur at uranium recovery facilities. MILDOS-AREA uses a multi-pathway analysis for determining external dose, inhalation dose, and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. MILDOS-AREA uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

The potential source term (i.e., atmospheric releases) for new well installation, production, and reclamation activities was calculated using the modeling of MILDOS-AREA. The MILDOS-AREA code represents the modeling as used by the NRC for its assessments included in the GEIS. Table 4-3 summarizes releases for each major functional activity.

Table 4-3. Estimated Radon-222 Releases

Location	Drilling (Ci/yr)	Production (Ci/yr)	Restoration (Ci/yr)	Total (Ci/yr)
Nichols Ranch Unit Production Area #1	0.045	170	180	350
Nichols Ranch Unit Production Area #2	0.045	170	180	350
Hank Unit Production Area #1	0.038	260	230	490
Hank Unit Production Area #2	0.038	260	230	490
Total	0.17	860	820	1,680
Source: Uranerz, 2007				

Based on the source term (Uranerz, 2007), radiation doses at the site boundary in each of the four compass directions (i.e., N, E, S, and W) and at "nearest resident" locations were calculated using the MILDOS-AREA code. The principal pathways of exposure modeled include inhalation, ingestion, and direct exposure. The highest dose at the site boundary for the Nichols Ranch Unit is 0.03 mSv (3 mrem) per year total effective dose equivalent (TEDE) at the west boundary, which is 3 percent of the 1 mSv (100 mrem) per year dose limit for a member of the public as specified in 10 CFR 20.1301. For the Nichols Ranch Unit, the highest dose at the site boundary is 0.05 mSv (5 mrem) per year TEDE at the east boundary, which is 5 percent of the 1 mSv (100 mrem) per year public dose limit. The maximum exposed nearby resident (Pfister Ranch) to the northeast of the proposed site is calculated to be 0.009 mSv (0.9 mrem) per year, which is a small fraction of the 1 mSv (100 mrem) per year regulatory limit. These doses are consistent with the doses as identified in the GEIS for other ISR facilities.

An assessment of the collective dose was performed using MILDOS-AREA for the population of 21,819 individuals residing within 80 km (50 mi) of the proposed facility. This dose, which is a measure of the total radiological impact from routine operations for the potentially affected communities, was 0.002 person-Sv (0.2 person-rem) per year. This collective dose is small compared with the person-Sv per year radiation dose of 65 person-Sv (6,500 person-rem) per year from natural background radiation sources to this population.

All radioactive liquid waste from the processing operations would be disposed of in deep injection wells. Therefore, there are no anticipated routine liquid releases or pathways of exposure from facility operations. Leaks and spills in the well fields are evaluated as abnormal conditions in the subsequent section. No routine releases of radioactive liquids are proposed for the facility operations.

As described in the GEIS and as proposed by Uranerz, the drying of the precipitated uranium is to be conducted under vacuum; therefore, there are not expected to be any emissions from the yellowcake dryer exhaust. Uranerz has conducted MILDOS-AREA modeling to demonstrate that normal operation of the yellowcake dryer would result in a TEDE to members of the public of less than 1 mrem. Additionally, Uranerz would install air particulate monitors, radon-222 detectors, and gamma dosimeters to monitor the area to verify that expected radiation levels outside the dryer are maintained. Uranerz also intends to use ventilation in the work area to limit work exposure (Uranerz, 2007).

The GEIS presents historical data for ISR operations, providing a range of estimated offsite doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure locations have been reported, ranging between 0.004 and 0.32 mSv (0.4 and 32 mrem) per year and well below the 10 CFR Part 20 annual radiation dose limit of 1 mSv (100 mrem) per year (NRC, 2009a). The GEIS also provides a summary of doses to occupationally-exposed workers at ISR facilities. As stated, doses are expected to be well within the 10 CFR Part 20 annual occupational dose limit of 0.05 Sv (5 rem). The largest annual dose average over a 10-year period (1994 to 2006) was 0.007 Sv (0.7 rem). More recently, the maximum total dose equivalents reported for 2005 and 2006 were 0.0068 Sv (0.68 rem) and 0.0071 Sv (0.713 rem), respectively. There is no information to indicate that the impacts from yellowcake drying and packaging at the proposed facility would be outside the bounds of the impacts stated in the GEIS.

In summary, with accident procedures in place, potential radiation doses to occupationally exposed workers and members of the public are expected to be SMALL. Calculated radiation doses from the modeling of releases of radioactive materials to the environment are small fractions of the limits of 10 CFR Part 20 that have been established for the protection of the public health and safety. Therefore, the staff has determined that there would be no significant radiological impacts from normal operations to the public or occupational exposed workers beyond those discussed in the GEIS.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for radiological impacts to public and occupational health and safety from accidents and incorporates by reference the GEIS's conclusions that the impacts during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.2.2 Radiological Impacts from Accidents

The GEIS provides an identification, discussion, and consequence assessment for the abnormal and accident conditions that may occur with ISR operations. As discussed in Section 4.3.11.2.2 of the GEIS, a radiological hazard assessment was performed by Mackin et al. (2001), which considers types of potential accidents associated with ISR operation:

- Thickener failure and spill;
- Pregnant lixiviant and loaded resin spill (radon release); and
- Yellowcake dryer accident release.

In addition to these three types of accidents, this section of the SEIS presents the impacts associated with the transport of yellowcake from the Hank Unit satellite facility to the Nichols Ranch Unit central processing plant. An overview of each of these accident scenarios is presented below:

Thickener Failure and Spill

Thickeners are used to concentrate the yellowcake slurry before it is transferred to the dryer or packaged for offsite shipment. Radionuclides could be inadvertently released to the atmosphere through thickener failure or spill. The accident scenario as evaluated in the GEIS assumed a tank or pipe leak that releases 20 percent of the thickener inside and outside of the processing building. The analyses included a variety of wind speeds, stability classes, release durations, and receptor distances. A minimum receptor distance of 46 m (152 ft) was selected because it is found to be the shortest distance between a processing facility and an urban development for current operating ISR facilities. Offsite, unrestricted doses from such a spill could result in a dose of 0.25 mSv (25 mrem), or 25 percent of the annual public dose limit of 1 mSv (100 mrem) with negligible external doses based on sufficient distance between facility and receptor.

As discussed in the GEIS, doses to unprotected workers inside the facility would have the potential to exceed the annual dose limit of 0.05 Sv (5 rem), if timely corrective measures were not taken for protecting workers and remediating the spill. Typical protection measures, such as respiratory protection and material control, which would be a part of Uranerz's Radiation Protection Program, would reduce the worker exposures and resulting doses to a small fraction of those evaluated.

Pregnant Lixiviant and Loaded Resin Spills

Process equipment, ion exchange columns, and drying and packaging facilities would be located on curbed concrete pads to prevent any liquids from spills or leaks from exiting the building and contaminating the outside environment of the facility. Therefore, except for well field leaks, as further evaluated below, the potential for an accidental liquid release with liquid pathways of exposure are not considered realistic. The primary radiation source from liquid releases within the facility would be the resulting airborne radon-222 as released from the liquid or resin tank spill.

The radon accident release scenario assumes a pipe or valve of the ion exchange system, containing pregnant lixiviant, develops a leak and releases (almost instantaneously) all radon-222 at a high activity level (1×10^5 pCi/L). For a 30-minute exposure, dose to a worker located inside the building performing light activities without respiratory protection was 13 mSv (1,300 mrem). The estimated dose is below the 10 CFR Part 20 occupational dose limit. Considering that atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, due to distance and dispersion, any dose to a member of the public would be minimal. Uranerz's Radiation Protection Program controls and monitoring measures would be expected to minimize the magnitude of any such release and further reduce the consequences of this type accident.

Yellowcake Dryer Accident Release

Dryers used to produce yellowcake powder from yellowcake slurry are another source for accidental release of radionuclides. The multiple hearth dryers are capable of releasing yellowcake powder inside the processing building as a result of an explosion, which was evaluated in the GEIS as a bounding condition for yellowcake dryer accident scenarios. The analysis assumes about 4,300 kg (9,500 lb) of U_3O_8 yellowcake is released within the building area housing the dryer and of this, 1 kg (2 lb) is subsequently released as an airborne effluent to the outside atmosphere as a 100 percent respirable powder. Due to the nature of the material, most of the yellowcake would rapidly fall out of airborne suspension. For the occupationally-exposed worker using respiratory protection, the dose was calculated to be 0.088 Sv (8.8 rem), which exceeds the annual occupational dose limit of 0.05 Sv (5 rem). Additionally, such exposure would exceed the chemical toxicity limit for uranium. The amount assumed to remain airborne and to be transported outside the building for atmospheric dispersion to an offsite location is 1 kg (2 lb) of yellowcake. The rapid fallout within the building and the atmospheric dispersion to an offsite location would significantly reduce the exposure to members of the public, where the calculated dose was less than 1 mSv (100 mrem).

Uranerz would use a rotary vacuum dryer with heat transfer fluid circulating through the dryer shell. This configuration separates the heater combustion source from the dryer itself, thereby reducing the possibility of an explosion. Additionally, emergency response procedures would be in place to provide proper directions for mitigating worker exposures and emergency training drills, dosimetry, respiratory protection, and contamination control and decontamination would be required as part of Uranerz's Radiation Protection Program. These would further reduce the consequences of this accident and others. Table 4-4 presents the generic accident dose analysis for ISR operations using data adapted from the GEIS.

Table 4-4. Generic Accident Dose Analysis for ISR Operations

Accident Scenario	Maximum Dose to Workers	Maximum Dose to Public
Thickener spill	50 mSv (5,000 mrem)	0.25 mSv (25 mrem)
Pregnant lixiviant, resin spill	13 mSv (1,300 mrem)	<0.13 mSv (<13 mrem)
Yellowcake dryer release	0.1 Sv (10 rem) Generic <0.01 Sv (1 rem)	< 1 mSv (<100 mrem)
Source: NRC, 2009a		

Loaded Resin Transport from Satellite Facility

For the Nichols Ranch ISR Project, it has been proposed that loaded resin from the Hank Unit would be transported to the Nichols Ranch Unit central processing plant. The loaded resin would be transported in specially designed tanker trailers, capable of holding approximately 14 m^3 (500 ft^3) of resin, and transported over private roads. No public roadways would be used. The resin would be dewatered with a minimal amount of barren lixiviant. Due to the nature of the resin, any release during a transportation accident would be localized and small, provided timely remediation actions are taken. The radioactive material is affixed to the resin and no airborne release, which could transport the activity offsite, is expected. Due to the absence of water bodies on the proposed site, any spilled resin would be expected to remain in the immediate area of the accident. Any resulting contamination, resin and solids, would be remediated. Considering the above, any impact from a loaded resin spill or accident is considered SMALL.

Accident Analysis Conclusions

The evaluations of the GEIS appropriately encompass the type of accidents and related consequences that might occur for the proposed Nichols Ranch ISR Project. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, it has been determined that there would be no significant radiological impacts from potential accidents to the public or occupational exposed workers beyond those discussed in the GEIS; the impact to workers could be SMALL (if accident procedures are followed) to MODERATE (if accident procedures are not followed); whereas impacts to the general public would be SMALL.

4.13.1.2.3 Non-radiological Impacts from Normal Operations

The GEIS includes an identification of the various chemicals, hazardous and nonhazardous, along with quantities that are typically used at ISR facilities. The use of hazardous chemicals at ISR facilities are controlled under several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to the use and storage include:

- 40 CFR Part 68, "Chemical Accident Prevention Provisions." This regulation includes a list of regulated toxic substances and threshold quantities for accidental release prevention;
- 29 CFR 1910.119, OSHA Standards (which includes Process Safety Management [PSM]). This regulation provides a list of highly hazardous chemicals, including toxic and reactive materials that have the potential for a catastrophic event at or above the Threshold Quantity (TQ);
- 40 CFR Part 355, "Emergency Planning and Notification." This regulation contains a list of extremely hazardous substances and their threshold planning quantities (TPQs) for the development and implementation of ERPs. A list of Reportable Quantity (RQ) values is also provided for reporting releases; and
- 40 CFR 302.4, "Designation, Reportable Quantities, and Notification - Designation of Hazardous Substances." This regulation provides a list of *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) hazardous substances compiled from the *Clean Water Act*, *Clean Air Act*, *Resource Conservation and Recovery Act* (RCRA), and the *Toxic Substances and Control Act* (TSCA).

Listed below are the bulk hazardous chemicals and their associated protective provisions expected to be used at the proposed Nichols Ranch ISR Project (Uranerz, 2007):

- Sodium chloride ($NaCl$);
- Sodium bicarbonate ($NaHCO_3$);
- Sodium hydroxide ($NaOH$);

- Hydrochloric acid (HCl);
- Hydrogen peroxide (H_2O_2);
- Carbon dioxide (CO_2);
- Oxygen (O_2);
- Anhydrous ammonia (NH_3); and
- Diesel, gasoline, and bottled gases.

Onsite quantities for some of these chemicals exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices (Uranerz, 2007). Compliance with applicable regulations reduces the likelihood of a release. As discussed in the GEIS, risks from the use and handling of chemicals during normal operation of an ISR facility are expected to be SMALL.

In general, the handling and storage of chemicals at the facility would follow standard industrial safety standards and practices. Industrial safety aspects associated with the use of hazardous chemicals are regulated by the Wyoming State Mine Inspector. Uranerz plans to use chemicals to extract uranium, process wastewater, and restore groundwater. The Nichols Ranch and Hank Units would store chemicals that are both hazardous and nonhazardous. The different types of chemicals would be stored in separate locations. Any bulk hazardous materials that could impact the radiological safety of the facility would be isolated and stored in accordance with regulatory agency requirements. Chemicals that are considered nonhazardous and would not affect radiological safety can be stored inside the main buildings. Material Safety Data Sheets (MSDSs) for each of the chemicals would be reviewed for facility safety and for radiological effects and the sheets would be located at the Nichols Ranch and Hank Units.

Uranerz identifies anhydrous ammonia as the most hazardous chemical to be used onsite. Its use would require a Risk Management Program, which would include accidental release modeling, safety information, hazards reviews, operating procedures, safety training, and emergency preparedness.

The types of chemicals (hazardous and nonhazardous) for use at the Nichols Ranch and Hank Units are consistent with those evaluated in the GEIS. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, the impact to public and occupational health and safety from chemical usage at the Nichols Ranch and Hank Units are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for non-radiological impacts from normal operations and incorporates by reference the GEIS's conclusions that the impacts during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.2.4 Non-radiological Impacts from Accidents

The risks from accidents associated with the use of the typical hazardous and nonhazardous chemicals for ISR operations are not different from those for other typical industrial applications. In general, these risks are deemed acceptable as long as design and safety policies and practices meet industry and regulatory standards. Past history at current and former ISR facilities has shown they can be designed and operated with appropriate measures to ensure proper safety for workers and the public (Uranerz, 2007).

Appendix E of the GEIS, Hazardous Chemicals, provides an accident analysis for the more hazardous chemicals. As discussed, chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. The GEIS did not evaluate potential hazards to workers or the public due to specific types of high consequence low probability accidents (e.g., a fire or large magnitude sudden release of chemicals from a major tank or piping system rupture). The application of common safety practices for handling and use of chemicals is expected to decrease the likelihood of these high consequence events.

Spills of reportable quantities from chemical bulk storage areas are to be reported to WDEQ in accordance with WDEQ-Water Quality Division (WQD) Rules and Regulations, Chapter 17, Part E and 40 CFR Part 302 (CERCLA).

The types and quantities of chemicals (hazardous and nonhazardous) for use at the Nichols Ranch and Hank Units are not different from those evaluated in the GEIS. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, the non-radiological impact to public and occupational health and safety from potential accidents would be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for non-radiological impacts from accidents and incorporates by reference the GEIS's conclusions that the impacts during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.3 *Aquifer Restoration Impacts*

As discussed in the GEIS, aquifer restoration activities involve activities similar to those during operations (e.g., operation of well fields and wastewater treatment and disposal) and thus, the types of impacts on public and occupational health and safety are expected to be similar to operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion exchange) during aquifer restoration further limits the relative magnitude of potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the assessments of Section 4.13.1.2.1 for operations. Similarly, non-radiological hazards are covered by the discussions in Section 4.13.1.2.3. Accident consequences are expected to be smaller than those evaluated in Section 4.13.1.2.2 and 4.13.1.2.4. Therefore, aquifer restoration is expected to have a SMALL impact on workers (primarily from radon-222 gas) and the general public for a six month period.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for public and occupational health and safety and incorporates by reference the GEIS's conclusions that the impacts during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.4 *Decommissioning Impacts*

As addressed in the GEIS, environmental impacts during decommissioning of an ISR facility are expected to be SMALL. The degree of potential impact decreases as hazards are reduced or removed, soils and facility structures are decontaminated, and lands are restored to pre-operational conditions. Typically, the initial decommissioning steps include removal of hazardous chemicals. As such, the majority of safety issues that are addressed during decommissioning involve radiological hazards at the facility.

To ensure the safety of the workers and the public during decommissioning, the NRC requires licensed facilities to submit a decommissioning plan for review. The plan includes details of the radiation safety program that is implemented during decommissioning activities that ensure that the workers and public are adequately protected and that their doses are compliant with 10 CFR Part 20 limits. An approved plan would also provide as low as reasonably achievable (ALARA) provisions to further ensure that best safety practices are being use to minimize radiation exposures. Adequate protection of workers and the public during decommissioning is further ensured through NRC plan approval, license conditions, and inspection and enforcement.

Following decommissioning, the site could be released for unrestricted use. Due to the construction of access roads, the released site would be easier to access than it was prior to operations, which could result in an increase in public usage and, likewise, an increase in potential public exposure to any remaining, residual radioactivity. The decommissioning, and any subsequent NRC approval for release of the site for unrestricted access, would conform to NRC's radiation protection standards as developed for decommissioning.

Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, impacts from and following decommissioning are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for public and occupational health and safety and incorporates by reference the GEIS's conclusions that the impacts during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no occupational exposure. There would be no additional radiological exposures to the general public from project related effluent releases, and there would be no impact on long-term environmental radiological conditions. Radiation exposure and risk to the general public would continue to be determined by exposure from natural background, medical-related exposures, consumer products and exposures from existing residual contamination.

4.13.3 Modified Action – No Hank Unit (Alternative 3)

4.13.3.1 *Construction Impacts*

Issuing a license to conduct ISR operations solely at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would result in a smaller scope of construction activities. No satellite facility would be constructed at the Hank Unit and fewer total wells would be drilled.

Therefore, potential construction impacts from human interaction with high concentrations of radioactive material in soil would decrease by eliminating the Hank Unit. Based on the impact conclusion in Section 4.13.1.1, the combined public and occupational health impacts from construction of the Nichols Ranch and Hank Units are expected to be small. Therefore, eliminating the impacts from construction of the Hank Unit would also resulting SMALL impacts to public and occupational health and safety,

4.13.3.2 *Operation Impacts*

Issuing a license to conduct ISR operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would result in a smaller ISR operation than that of the proposed action. There would be no change in the types of activities conducted, though fewer wells would be needed. Also, there would be neither any satellite facility from which to transport loaded resin nor any satellite unit to which to ship chemicals from suppliers. Choosing this alternative (eliminating the Hank Unit) would therefore reduce the impacts to public and occupational health and safety seen with the proposed action. Therefore, the impacts would be SMALL.

4.13.3.3 *Aquifer Restoration Impacts*

Issuing a license to conduct ISR operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would result in a smaller scope of aquifer restoration activities. There would be no change in the types of activities conducted. However, because no well field development would occur at the Hank Unit and fewer aquifer restoration activities would be required, this alternative would further reduce the proposed action's SMALL impacts to public and occupational health and safety from aquifer restoration. Therefore, the impacts would be SMALL.

4.13.3.4 *Decommissioning Impacts*

Issuing a license to conduct ISR operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit would result in a smaller scope of decommissioning activities and a smaller area to be released for unrestricted use. There would be no change in the types of activities conducted and because there would be no well field development at the Hank Unit, there would be fewer decommissioning activities required to return the land to an acceptable condition. As with the proposed action, due to the construction of access roads, the released site would be easier to access than it was prior to operations, which could result in an increase in public usage and, likewise, an increase in potential public exposure to any remaining, residual radioactivity. However, under this alternative, the site would be smaller and there would be a decreased amount of road development, potentially limiting future public access and exposure. Choosing this alternative would reduce the impacts to public and occupational health and safety from decommissioning. Therefore, the impacts would be SMALL.

4.14 Waste Management Impacts

Potential environmental impacts from waste management at the proposed Nichols Ranch ISR Project site may occur during all phases. ISR facilities generate radiological and non-radiological liquid and solid wastes that must be handled and disposed of properly. The types of waste streams to be disposed are addressed in Chapter 2. The primary radiological wastes to be disposed of are process-related liquid wastes and process-contaminated structures and soils, all of which are classified as 11e.(2) byproduct material. Before operations begin, the NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept 11e.(2) byproduct material.

Detailed discussion of the potential environmental impacts of waste management from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.14.1 Proposed Action (Alternative 1)

4.14.1.1 *Construction Impacts*

As discussed in Section 4.3.12.1 of the GEIS, waste management impacts from construction are expected to be SMALL. This is because construction activities are relatively small-scale and incremental well field development at ISR facilities would generate low volumes of construction waste. Primarily, the wastes expected to be disposed are solid wastes, such as building materials and piping.

As discussed in Section 3.13, the Campbell County Landfill and associated construction and demolition pit in Gillette are both not at capacity. Due to the available capacity and the proposed small-scale development and resulting low volumes of waste at the site, the waste management impacts at the proposed Nichols Ranch ISR Project site due to construction are SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.1.2 *Operation Impacts*

As discussed in Section 2.7 of the GEIS, operational wastes are primarily liquid waste streams consisting of process bleed (1 to 3 percent of the process flow rate) and aquifer restoration water. Wastes would also be generated from well development, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. The method used for handling and processing these wastes (water treatment followed by disposal by deep well injection) would serve to reduce waste volumes destined for disposal at an approved facility, thereby reducing waste-related environmental impacts. State permitting actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public, and overall impacts would be SMALL.

Depending on the waste disposal method selected, Section 4.3.12.2 of the GEIS notes that licensees must obtain the necessary permits and approvals from federal and state agencies. These permits and approvals would serve to mitigate impacts from liquid waste management so long as the licensee operates in accordance with the provisions of the permits and approvals. For example, an UIC permit from EPA or the appropriate state agency, and NRC approval is needed prior to construction and injection of liquid wastes down a deep well. The licensee would conduct monitoring of the well and of the disposed wastes, and the NRC and state can inspect to ensure that permit requirements are met. Therefore, the GEIS states that potential waste management impacts from the disposal of process-related liquid wastes would be expected to be SMALL.

Solid wastes generated from operations that are classified as 11e.(2) byproduct wastes can be sent to a licensed facility for disposal. Contaminated materials, equipment, and buildings would be similarly disposed or decontaminated and released for unrestricted use according to NRC requirements. Nonradioactive hazardous wastes would be segregated and disposed of at a hazardous waste disposal facility. Non-radiological uncontaminated wastes would be disposed of as ordinary solid waste at a municipal solid waste facility. Disposal impacts would be SMALL for radioactive wastes as a result of required preoperational disposal agreements. Impacts for hazardous and municipal waste would also be expected to be SMALL assuming the volumes of wastes are small. For remote areas with limited available disposal capacity, such wastes may need to be shipped greater distances to facilities that have capacity; however, the number of such shipments would be expected to be low (NRC, 2009a).

As stated earlier, Uranerz plans to have two Class I deep disposal wells, one at the Nichols Ranch Unit and one at the Hank Unit, for disposal of the liquid effluent wastes generated during operations. Uranerz would have to obtain approval from the NRC and a UIC permit from the WDEQ, who has primacy for the program as delegated by the EPA. Since WDEQ does an analysis of these deep disposal wells as part of their permitting process and the licensee would have to operate in accordance with the provisions of the WDEQ permit and NRC license, the potential waste management impacts from the disposal of process-related liquid waste at the proposed Nichols Ranch ISR Project site is expected to be SMALL.

Regarding 11e.(2) byproduct wastes, Uranerz would have to enter into a written agreement with the low-level waste disposal site it choose which would ensure that there was available capacity at the site. Regarding nonradioactive hazardous wastes, Uranerz would have to contract with a WDEQ-approved hazardous waste treatment, storage, or disposal facility and adhere to the Conditionally Exempt Small Quantity Generator (CESQG) requirements for storage. Regarding municipal solid wastes, Uranerz would likely dispose of these wastes at the Campbell County Landfill which as mentioned in Chapter 3, has adequate capacity in both its landfill and construction and demolition pit for several years. As long as Uranerz abides by these permits and agreements and operates in accordance with the provisions set in these permits and agreements, the potential waste management impacts from the disposal of solid wastes at the proposed Nichols Ranch ISR Project site are expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.1.3 *Aquifer Restoration Impacts*

As discussed in Section 4.3.12.3 of the GEIS, waste management activities during aquifer restoration would use the same treatment and disposal options implemented for operations. Therefore, impacts associated with aquifer restoration would be similar to operational impacts. While the amount of wastewater generated during aquifer restoration would be dependent on site-specific conditions, the potential exists for additional wastewater volume and associated treatment wastes during the restoration period. For the proposed Nichols Ranch ISR Project, no additional wastewater volume and associated treatment wastes beyond that estimated for the operations phase is expected for the aquifer restoration phase. Based on the foregoing analysis, site-specific conditions are consistent with the assumptions stated in the GEIS. Therefore, waste management impacts from aquifer restoration at the proposed Nichols Ranch ISR Project site would be expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.1.4 *Decommissioning Impacts*

Section 4.3.12.4 of the GEIS states that radioactive wastes from the decommissioning of ISR facilities (including contaminated excavated soil, process equipment) would be disposed of as 11e.(2) byproduct material at a licensed facility. A pre-operational agreement with a licensed disposal facility to accept radioactive wastes would ensure that sufficient disposal capacity would be available for byproduct wastes generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required decommissioning plan for NRC review prior to starting decommissioning activities. Such a plan would detail how a 10 CFR Part 20 compliant radiation safety program would be implemented during decommissioning to ensure the safety of workers and the public and compliance with applicable safety regulations. Overall, the GEIS expects that volumes of radioactive, chemical, and solid wastes generated during decommissioning would be SMALL. Overall, waste management impacts from decommissioning would be expected to be SMALL.

At the time of decommissioning at the proposed Nichols Ranch ISR Project, a large fraction of the process equipment and materials would be reusable (Uranerz, 2007). Materials would be surveyed for residual radioactive material contamination. Uncontaminated materials would be removed for reuse or disposal. Contaminated materials may be decontaminated, transferred to another licensed facility for use, or disposed of as radioactive waste. The cement foundations for the buildings would be removed for appropriate disposal. Uranerz has committed to having an agreement for disposal of 11e.(2) byproduct wastes in-place before commencing construction on the proposed Nichols Ranch ISR Project. Transport of radioactive materials (waste and reusable materials) would be in accordance with the USDOT (49 CFR Part 173) and NRC (10 CFR Part 71) transportation requirements. Due to the size of the overall project, Uranerz's intent to decontaminate and reuse equipment and components, and Uranerz's proposed use of well field monitoring instrumentation and well field visual inspections for timely identification and remediation of leaks and spills, the impact from decommissioning waste is expected to be SMALL.

Additionally, after its independent review of the Uranerz's ER; the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.2 No-Action (Alternative 2)

If no action is taken, there would be no waste generated of any kind. There would be no deep well injection of liquid wastes, and a decommissioning plan would not be submitted. In addition, there would be no need for agreements with a licensed radioactive waste disposal facility to dispose of radioactive wastes generated during operation and decommissioning. Therefore, there would be no impacts to waste management from this alternative.

4.14.3 Modified Action – No Hank Unit (Alternative 3)

Issuing a license to conduct ISR operations at the proposed Nichols Ranch ISR Project site without permitting activities at the adjacent Hank Unit site would result in a smaller scope of activities during all phases of the project. Only a central processing plant would be constructed and fewer wells would be drilled, reducing the quantity of construction waste generated. In addition, only one septic system and one deep disposal well would be constructed due to the reduced quantity of liquid effluent waste generated by the process. This alternative would reduce the overall impacts to waste management as compared to the proposed action. Since the overall impacts were found to be SMALL for the proposed action, the overall impacts would also be SMALL for this alternative.

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5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality (CEQ)'s *National Environmental Policy* Act (NEPA) regulations, as amended (40 CFR Part 1500 to 40 CFR Part 1508) define cumulative effects as "...the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects or impacts[7] can result from individually minor but collectively significant actions taking place over a period of time." Thus, the proposed project could contribute to cumulative impacts when its impacts overlap with those of other past, present, or reasonably foreseeable future actions. For this supplemental environmental impact statement (SEIS), other past, present, and future actions in the project area include (but are not limited to) coal mining, oil and gas production, coal bed methane operations, other mining (i.e., sand, gravel, bentonite, clinker), in-situ recovery (ISR) operations, conventional uranium mining, and wind farms.

The analysis of the cumulative impacts of the proposed action were based on publicly available information on existing and proposed projects, information in the GEIS (NRC, 2009), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable changes to existing conditions. The primary concern is the resurgence in interest in mineral mining and oil and gas development within the last few years. This resurgence has not necessarily translated into active projects as of yet, thus there is a lack of information available. It is estimated that there would be no long-term changes within about 8 km (5 mi) of the proposed site, except for the possible installation of a small number of dirt roads. No long-term changes are anticipated within this area due to extensive restoration and reclamation activities planned by Uranerz. Within the vicinity of the site, there are several ISR and conventional uranium projects in the decommissioning, and pre-licensing stages, as well as oil and gas operations that could contribute to the cumulative effects in the area. At greater distances, it has been assumed that the resurgence in extractive industries along with government and industry efforts to develop infrastructure would continue.

The GEIS (NRC, 2009) provides an example methodology for conducting a cumulative impacts assessment. The methodology used in this SEIS is provided in Section 5.1.2.

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The project area is located in the middle of the Powder River Basin, which is an approximately 26,000 km^2 (10,000 mi^2) area that spans large portions of northeastern Wyoming and southeast Montana. This area holds the largest deposits of coal in the U.S., as well as significant reserves of uranium and other natural resources such as oil and gas. As such, there have been, and continue to be substantial mining activities throughout the Powder River Basin. Coal bed methane (CBM) extraction continues to be the most prolific mining activity in the region, and is a form of natural gas extraction from coal beds. There have been several environmental impact statements (EISs) completed by the U.S. Bureau of Land Management (BLM) and environmental groups in the Powder River Basin dating back to the 1970s. These studies have looked at the various effects that coal-related mining activities have on the affected environment.

[7] For the purposes of this analysis, "cumulative impacts" is deemed to be synonymous with "cumulative effects."

The various past, present, and reasonably foreseeable future actions in the vicinity of the proposed Nichols Ranch ISR Project are discussed separately below.

5.1.1.1 *Uranium Recovery Sites*

Past, existing, and potential uranium recovery sites in the Powder River Basin are listed in Table 5-1. There are 25 uranium recovery facilities listed in the table, comprising 20 ISR facilities and 5 conventional mining facilities. The only two facilities listed as operational or licensed for operation are the Smith Ranch-Highland and Irigaray/Christensen Ranch ISR facilities. Three of the five conventional sites are in the decommissioning process and the other two are listed as either a *Uranium Mill Tailings Radiation Control Act* (UMTRCA) Title I (reclamation work at inactive tailings site) or II (licensed uranium recovery facilities and mill tailings site).

Along with the proposed Nichols Ranch ISR Project, there are other ISR and conventional uranium (underground and pit) operations that are in various stages of the licensing process within the Powder River Basin. An application for an ISR facility has been received by the U.S. Nuclear Regulatory Commission (NRC) for the Moore Ranch site, located approximately 32 km (20 mi) to the southeast and there are several inactive and decommissioned uranium mills in the 80-km (50-mi) radius.

Table 5-1. Uranium Recovery Sites in Wyoming East Uranium Milling Region

Site Name	Company/Owner	Type[a]	County, State	Status[b]
Reno Creek 1	Rocky Mountain Energy Co.	ISR[1]	Campbell, WY	License terminated
Reno Creek 2	International Uranium Corp.	ISR[3]	Campbell, WY	Not licensed – applicant withdraws
Ruby Ranch	Conoco	ISR[1]	Campbell, WY	Not licensed – applicant withdraws
Ruby Ranch	Power Resources, Inc. (PRI)	ISR	Campbell, WY	Potential site
Reno Creek	Strathmore Minerals Corp.	ISR	Campbell, WY	Potential site
Moore Ranch	Uranium One	ISR[3]	Campbell, WY	Potential site - license application under review by NRC
North Butte & Ruth	PRI	ISR[2,3]	Campbell, WY	Licensed - on standby
Collins Draw	Cleveland Cliffs Iron Co.	ISR[1]	Campbell, WY	License terminated
Shirley Basin South	U.S. Department of Energy (DOE)	Conv.	Carbon, WY	UMTRCA Title II disposal site
Peterson Ranch	Arizona Public Service Co. Malapai Resources	ISR[1]	Converse, WY	Not pursued
Ludeman	Uranium One	ISR	Converse, WY	Potential site

Site Name	Company/Owner	Type[a]	County, State	Status[b]
Highland 1	Exxon Minerals	ISR[3]	Converse, WY	Licensed, but not pursued
Reynolds Ranch	PRI	ISR[2]	Converse, WY	Licensed, but not operational
Highland 2	Everest Minerals	ISR[3]	Converse, WY	Licensed - later combined with Smith Ranch facility license
Smith Ranch - Highland	PRI	ISR[3]	Converse, WY	Operating
Bear Creek	Bear Creek Uranium Co.	Conv.	Converse, WY	Decommissioning
Highlands	Exxon Mobile Corp.	Conv.	Converse, WY	Decommissioning
Leuenberger	Teton Exploration Drilling	ISR[1,3]	Converse, WY	License terminated
South Powder River Basin	Kerr-McGee	ISR[1]	Converse, WY	License terminated with approval of Smith Ranch license
Spook	DOE	Conv.	Converse, WY	UMTRCA Title I disposal site
Allemand-Ross	Uranium One	ISR	Johnson, WY	Potential site
Irigaray/ Christensen Ranch	Cogema Malapai Resources	ISR[2,3]	Johnson, WY	Licensed for operations
Willow Creek	J&P Corp. Western Nuclear	ISR[1]	Johnson, WY	License terminated with approval of Irigaray license
Shirley Basin	Pathfinder Mines Corp.	Conv.	Natrona, WY	Decommissioning
North Platte	Uranium Resources	ISR[1]	Platte, WY	License terminated

Source: NRC table "Expected New Uranium Recovery Facility Applications/ Restarts/Expansions: Updated 08/26/2009" <http://www.nrc.gov/info-finder/materials/uranium/ur-projects-list-public.pdf>.

(a) Type: 1 = Research and Development/Pilot, 2 = Satellite, 3 = Commercial scale, Conv. = Conventional uranium mill

(b) UMTRCA Title I and Title II sites are uranium mill processing or tailings sites that have been decommissioned. The DOE is the long-term custodian of these sites.

5.1.1.2 *Coal Mining*

The Powder River Federal Coal Region was decertified as a federal coal production region by the Powder River Regional Coal Team (PRRCT) in 1990. Decertification of the region allows leasing to take place on an application basis. Between 1990 and 2008, the BLM's Wyoming

State Office held 25 competitive lease sales and issued 19 new federal coal leases containing more than 5.7 billion tons of coal using the "lease by application" process (BLM, 2005a; 2005b; 2005c). In 2003, Powder River Basin coal mines produced 363 million tons of coal (BLM, 2005a; 2005b; 2005c). These mines make up over 96 percent of the coal produced in Wyoming each year (BLM, 2005a; 2005b; 2005c). In 2003, the cumulative disturbed land area of the Powder River Basin attributable to coal mines totaled nearly 28,000 ha (70,000 ac). Reasonably foreseeable future development projects for cumulative land area disturbed range from 47,400 to 50,600 ha (117,000 to 125,000 ac) in the year 2015, under low and high production scenarios, respectively. Other development related to coal includes railroads, coal-fired power plants, major (230 kV) transmission lines, and coal technology projects. The total land area of other coal-related disturbance in the Powder River Basin in 2003 was nearly 2,000 ha (5,000 ac).

Table 5-2 contains a list of coal mines in the Powder River Basin in Wyoming. The Wyoming East Uranium Milling Region includes 16 surface mines. Surface mining of coal can cause adverse impacts on land use, geology and soils, water resources, ecology, air quality, noise, historical and cultural resources, visual and scenic resources, socioeconomics, and waste management.

Table 5-2. Coal Mines in Wyoming East Uranium Milling Region

Site Name	Company/Owner	Type	County, State	Production in 2008 (Tons)
Buckskin	Buckskin Mining Company	Surface	Campbell, WY	26,076,356
Rawhide	Powder River Coal Company	Surface	Campbell, WY	18,409,307
Dry Fork	Western Fuels of Wyoming, Inc.	Surface	Campbell, WY	5,261,242
Eagle Butte	Foundation Coal West	Surface	Campbell, WY	20,443,413
KFx Plant	Evergreen Energy	Surface	Campbell, WY	0 (was in production 2006, 2007)
Wyodak	Wyodak Resources Development Corp.	Surface	Campbell, WY	6,017,311
Caballo	Powder River Coal Company	Surface	Campbell, WY	31,205,381
Belle Ayr	Foundation Coal West	Surface	Campbell, WY	28,707,982
Cordero/Rojo Complex	Rio Tinto Energy America	Surface	Campbell, WY	40,033,283
Coal Creek	Thunder Basin Coal Company, LLC	Surface	Campbell, WY	11,453,547 (not in production from 2001 to 2005)
Jacobs Ranch	Rio Tinto Energy America	Surface	Campbell, WY	42,145,705
Black Thunder	Thunder Basin Coal Company, LLC	Surface	Campbell, WY	88,587,310

Site Name	Company/Owner	Type	County, State	Production in 2008 (Tons)
North Antelope/ Rochelle Complex	Powder River Coal Company	Surface	Campbell & Converse, WY	97,578,499
North Rochelle	Triton Coal Company	Surface	Campbell, WY	no data
Antelope	Rio Tinto Energy America	Surface	Campbell & Converse, WY	35,795,491
Dave Johnston	Glenrock Coal Company	Surface	Converse, WY	Reclaimed – no production since 2000
Source: Wyoming Mining Association (data through 2008). "Wyoming Coal Data." <http://www.wma-minelife.com/coal/coalfrm/coalfrm1.htm> (13 October 2009).				

5.1.1.3 *Oil and Gas Production*

There are approximately 472 oil and gas production units in the Powder River Basin in various stages of production. These are also evenly dispersed throughout the entire Powder River Basin. The Wyoming Oil and Gas Conservation Commission reported that in 2003, oil and gas wells in the Powder River Basin produced approximately 13 million barrels of oil and 1.1 billion m^3 (40 billion ft^3) of conventional gas (BLM, 2005a, 2005b, 2005c).

Most of Wyoming's current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low (WSGS, 2002, as cited in BLM, 2008). In the Powder River Basin, from 1992 to 2002 oil production from conventional oil and gas wells in Campbell and Converse Counties decreased approximately 60.4 percent.

Natural gas production has been increasing in Wyoming. In the Powder River Basin, this is due to the development of shallow CBM resources (BLM, 2005a, 2005b, 2005c). Annual CBM production in the Powder River Basin increased rapidly between 1999 and 2003, with nearly 15,000 producing CBM wells in the Powder River Basin in 2003. Total production in 2003 was 364 billion cubic feet (BLM, 2005a, 2005b, 2005c).

Oil and gas related development include major transportation pipelines and refineries. Cumulative disturbed land area in the Powder River Basin in 2003 from oil and gas, CBM, and related development was nearly 76,100 ha (188,000 ac). The corresponding projection for the year 2015 is 123,000 ha (305,000 ac) (BLM, 2005a, 2005b, 2005c). Depth to gas and oil-bearing strata generally ranges from 1,220 to 4,120 m (4,000 to 13,500 ft), but some wells are as shallow as 76 m (250 ft) (BLM, 2005a, 2005b, 2005c).

There are over 4,500 CBM wells within the Powder River Basin in various stages of development. The largest amounts of CBM are found at deep elevations greater than 60 m (200 ft) below ground surface (bgs). The CBM-rich water and gas are pumped to the surface and then piped to processing plants where the gas is separated from water and other constituents and processed. Major coal mines in the area include; Belle Ayr, Caballo, Coal Creek, and Cordero-Rojo.

5.1.1.4 *Other Mining*

Sand, gravel, bentonite, and clinker (or scoria) have been and are being mined in the Powder River Basin. Bentonite is weathered volcanic ash that is used in a variety of products, including drilling mud and kitty litter, because of its absorbent properties. There are three major bentonite producing districts in and around the Powder River Basin. Aggregate, which is sand, gravel, and stone, is used for construction purposes. In the Powder River Basin, the largest identified aggregate operation is located in northern Converse County. It has an associated total disturbance area of approximately 27 ha (67 ac), of which 1.6 ha (4 ac) have been reclaimed. Scoria, or clinker, is used as aggregate where alluvial terrace gravel or in-palace granite/igneous rock is not available. Scoria generally is mined in Converse and Campbell Counties of the Powder River Basin (BLM, 2005a, 2005b, 2005c).

5.1.1.5 *EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions*

One final indicator of present and reasonably foreseeable future actions (RFFAs) is the number of draft and final environmental impact statements (EISs) prepared by federal agencies within a recent time period. Using information in NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS) (NRC 2009), Section 5.2.2 and publicly available information, several EISs were identified for the Powder River Basin in addition to draft and final programmatic EISs for large-scale actions related to several states including Wyoming (See GEIS, Tables 5.2-3 and 5.2-4). These projects could contribute to both local and regional cumulative impacts on air quality, land usage, terrestrial plants and animals, and groundwater and surface water resources.

5.1.2 Methodology

In determining potential cumulative impacts, the following methodology was developed, on the GEIS recommendation to follow CEQ guidance to calculate cumulative impacts (CEQ, 1997):

1) Identify for each resource area, the potential environmental impacts that would be of concern from a cumulative impacts perspective. These impacts are discussed and analyzed in Chapter 4;

2) Identify the geographic scope for the analysis for each resource area. This scope is expected to vary from resource area to resource area, depending on the geographic extent to which the potential impacts could be at issue. In this document, the scope for the different resource areas is found in both Chapters 3 and 4;

3) Identify the time frame over which cumulative impacts would be assessed. For this project, the time frame selected was the license period (i.e., the time from issuance of the license with subsequent commencement of construction to license termination and the end of site decommissioning and reclamation);

4) Identify existing and anticipated future projects and activities in and surrounding the project site. These projects and activities are identified in this chapter; and

5) Assess the cumulative impacts for each resource area from the proposed action and reasonable alternatives, and other past, present, and reasonably foreseeable future actions. This analysis would take into account the environmental impacts of concern identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

The following terminology was used to define the level of cumulative impact:

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

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

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

In conducting this assessment, the staff recognized that for many aspects of the activities proposed as part of the Nichols Ranch ISR Project, there is expected to be a SMALL impact on the affected resources. Therefore, the staff considers that, for these resource areas (i.e., those for which all phases of the proposed ISR facility's lifecycle would have a SMALL impact), the activities at the proposed ISR site is not likely to contribute a perceptible increase in potential impacts to the resource beyond those resulting from past, present, and anticipated future actions.

5.2 Land Use

Cumulative impacts to land use are assessed within the immediate vicinity of the proposed Nichols Ranch ISR Project site and access roads.

The Powder River Basin encompasses approximately 26,000 km^2 (10,000 mi^2) in land area and is one of the largest sources of CBM with more than 4,500 CBM wells in various stages of development. Land use in much of the Powder River Basin is diversified and cooperative, with CBM and oil and gas extraction activities sharing land with livestock grazing. Although federal grasslands and forests occupy an important portion of the region (roughly 21 percent), most rangeland is privately owned (68 percent) and is primarily used for grazing cattle and sheep.

Land use impacts related from the proposed Nichols Ranch ISR project are anticipated to be SMALL for all stages and are discussed in detail in Chapter 4 of this SEIS. In addition to the proposed Nichols Ranch ISR Project, a variety of ongoing natural resource extraction and production facilities exist within the vicinity of the proposed Nichols Ranch ISR Project site that impact land use. Land use impacts include interruption to, reduction or impedance of, livestock grazing areas, recreational areas, sagebrush habitat, open wildlife areas, overall land access, and natural resource extraction activities related to active CBM operations, and oil and gas production units. Operational uranium ISR facilities and wind energy operations are also located in the Powder River Basin; however, none are located within the near vicinity of the proposed Nichols Ranch ISR Project.

Construction and operational improvements and activities such as roads and infrastructure systems associated with the multiple facilities represent a long-term impact, as they would likely be present throughout the proposed Nichols Ranch ISR Project lifespan and would remain beyond this time to accommodate the processing of other potential projects in the vicinity of the site. However, most facility and road construction impacts to the project area are impermanent, since the land would ultimately be returned to its natural condition.

Cumulatively, the SMALL and mitigated impacts to land use from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to land use in the immediate vicinity of the proposed Nichols Ranch ISR Project site and access roads when added to past, present, and reasonably foreseeable future actions.

5.3 Transportation

Cumulative impacts to transportation are assessed within the immediate vicinity of the proposed Nichols Ranch ISR Project site and access roads.

Project related transportation impacts include new road construction, elevated traffic counts on existing road networks and associated surface wear, and the potential for accidents involving the commuting workforce and/or the release of low-level radioactive materials. The principal access roads linking existing T-Chair ranch roads with the Hank Unit satellite facility and the Nichols Ranch Unit central processing plant represent long-term impacts, as they would be present throughout the project lifespan. Secondary roads from the plants to the well fields and any tertiary, two-track roads are also long-term impacts. However, no road construction impacts to the proposed project area can be considered permanent, since the land would ultimately be returned to its natural condition after approximately ten years, when production and decommissioning are complete. Transportation-related impacts from the proposed Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

Like the proposed Nichols Ranch ISR Project area, land use in much of the surrounding area is diversified and cooperative, with CBM and oil and gas extraction activities sharing land with livestock grazing. In addition, there are large surface mining operations and rail construction activities to support the transport of coal. Many unimproved, two-track dirt roads and gravel roads are present in the region, installed primarily for livestock grazing but also facilitating access for natural resource exploration and extraction and recreation and off-road vehicle use. Oil and gas production facilities, coal mines, and CBM have been, and continue to be, developed on both public and private lands throughout the Powder River Basin.

Because the preferred means of transporting the products of ISR operations is by road, future projects like the proposed Nichols Ranch ISR Project would require the construction of new road surfaces or the improvement of existing roads within the vicinity of the proposed Nichols Ranch ISR Project site and access roads. The number of roads and road networks can be expected to grow concurrently with the natural resource exploration and extraction activities. Current and future CBM and oil and gas extraction projects would also require use of roadways, and traffic would likely increase as a result. There would also be an increase in vehicular traffic and risk of traffic accidents on existing roadways from daily travel by workers and their families. Demand for railroads, pipelines, and transmission lines would increase to meet the increased demand for capacity to move coal, oil and gas, and electricity from production locations in the area to markets outside the area.

Cumulatively, the roads at the proposed Nichols Ranch ISR Project would be reclaimed and overall project-related transportation impacts are thus relatively minor. However, past and ongoing natural resource development and extraction activities in the vicinity of the proposed Nichols Ranch ISR Project and access roads have resulted in an extensive network of roads. Future activities (ISR and otherwise) would require the construction of additional road surfaces and other transportation-related developments. The SMALL impacts to transportation from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to transportation in the area when added to past, present, and reasonably foreseeable future actions.

5.4 Geology and Soils

Cumulative impacts to geology and soils are assessed within the immediate vicinity of the proposed Nichols Ranch ISR Project site and access roads.

The principal impacts on geology and soils from the proposed Nichols Ranch ISR Project would result from earth-moving activities associated with constructing surface facilities, access roads, well fields, and pipelines. Earth-moving activities that might impact soils include the clearing of ground or topsoil and preparing surfaces for the Nichols Ranch Unit central processing plant, Hank Unit satellite facility, header houses, access roads, drilling sites, and associated structures. As discussed in Chapter 4, all phases of the proposed Nichols Ranch ISR Project are anticipated to have a SMALL impact to geology and soils.

Development activities from ongoing and future activities in the vicinity of the proposed Nichols Ranch ISR Project site would continue to impact geology and soils. Past, ongoing, and inevitable future drilling into the earth for locatable minerals disturb the geology of the region, and, if not properly abandoned, leave opportunity for long-term problems. Increased vehicle traffic, clearing of vegetated areas, soil salvage and redistribution, discharge of CBM- and ISR-produced groundwater, and construction and maintenance of project-specific components (e.g., roads, well pads, industrial sites, and associated ancillary facilities) are all activities that could cause impacts (BLM, 2008). Of the past, present, and reasonably foreseeable future activities, coal mining would create the most concentrated cumulative impacts to soils, due to the extensive acreage involved and nature of the operation as well as the tendency for mining operations to occur in contiguous blocks.

Long-term and short-term impacts to soils include accelerated wind or water erosion, declining soil quality factors, a decline in microbial populations, fertility, and organic matter, compaction, and the permanent removal of soil (BLM, 2005c). Some degree of soil reclamation is possible, although not all overburden materials can be used to re-establish vegetation. Potential impacts to soils can also include a change in alkalinity due to discharge of CBM-produced water.

In the Task 3D Report (BLM, 2005c), BLM evaluated the cumulative impacts of past, present, and reasonably foreseeable future actions in the Powder River Basin on geology and soils, under two different coal production scenarios. Under the "upper coal production" scenario, a total of 60,360 ha (149,089 ac) of disturbed land are projected for the year 2020, versus the 2003 baseline total of 27,852 ha (68,794 ac). The 41 ha (100 ac) of temporary disturbance anticipated for the proposed Nichols Ranch ISR Project amounts to less than 0.1 percent of the land area disturbed in the Powder River Basin in 2003. The ways in which soils are impacted for the proposed Nichols Ranch ISR Project are also far less damaging or adverse then the impacts which result from surface coal mining.

Road development from future activities in the proposed site vicinity would also continue to impact geology and soils, though, as discussed in Section 5.3, the roads at the proposed Nichols Ranch ISR Project would be reclaimed and would not contribute significantly to the cumulative impact from other road development.

Cumulatively, the SMALL impacts to geology and soils from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to geology and soils in the immediate vicinity of the proposed Nichols Ranch ISR Project site and access roads when added to past, present, and reasonably foreseeable future actions.

5.5 Water Resources

5.5.1 Surface Waters and Wetlands

The proposed Nichols Ranch ISR Project is located in the Cottonwood and Willow Creek drainage areas, which consists mainly of ephemeral streams that flow after snow melt or heavy rains. Surface water-related impacts from the proposed Nichols Ranch ISR project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

Coal extraction, natural gas, uranium extraction, and cattle ranching in the area may cumulatively affect surface water resources. Two licensed ISR projects are located in the vicinity of the proposed Nichols Ranch ISR Project: PRI's North Butte ISR Project, located 3.2 km (2 mi) north of the Hank Unit, and Cogema's Irigaray/Christensen Ranch ISR Project, located 9.6 km (6 mi) north of the Nichols Ranch Unit and 6.4 km (4 mi) northwest of the Hank Unit. These projects have the potential to degrade water quality in the area and cause erosion and subsequent siltation of streambeds. Future ISR and CBM projects and associated construction in the area could necessitate new roads, power lines, underground piping, and well drilling, all of which could have negative effects on surface waters. However, as CBM activities in the region continue to expand, new artificial wetlands and ponds would be created from the pumping and discharge of groundwater onto the ground surface, providing cumulative beneficial surface water acreage and functions. Cattle ranching is a source of nonpoint pollution to waterways in the Cottonwood and Willow Creek drainages. Due to the arid climate, overgrazing, if not properly managed, could cause intermittent streams to be present fewer days per year due to decreased vegetative cover in the drainage area.

Operational practices to mitigate impacts and prevent erosion and water quality degradation on a regional basis would be an important component to the future of surface waters and wetlands. Compliance with applicable federal and state regulations, permit conditions, the use of best management practices (BMPs), and required mitigation measures would reduce construction impacts to surface waters.

Cumulatively, the SMALL impacts to surface waters from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the SMALL to MODERATE potential impacts to Cottonwood and Willow Creek drainages when added to past, present, and reasonably foreseeable future actions.

5.5.2 Groundwater

Potential environmental impacts to groundwater resources in the proposed Nichols Ranch ISR Project can occur during each phase of the ISR facility's lifecycle. ISR activities can impact aquifers at varying depths (separated by aquitards) above and below the uranium-bearing aquifer as well as adjacent surrounding aquifers in the vicinity of the uranium-bearing aquifer. Surface activities that can introduce contaminants into soils are more likely to impact shallow (near-surface) aquifers while ISR operations and aquifer restoration are more likely to impact the deeper uranium-bearing aquifer, any aquifers above and below, and adjacent surrounding aquifers. ISR facility impacts to groundwater resources can occur from surface spills and leaks, consumptive water use, horizontal and vertical excursions of leaching solutions from production aquifers, degradation of water quality from changes in the production aquifer's chemistry, and waste management practices involving deep well injection. Onsite groundwater-related impacts from the proposed Nichols Ranch ISR Project are anticipated to vary from SMALL to MODERATE, depending on the specific issue, and are discussed in detail in Chapter 4 of this SEIS. After uranium production and restoration ceases, groundwater levels will recover and groundwater restoration will restore all impacted aquifers to acceptable water quality levels.

Future ISR activities and present and future CBM activities in the vicinity of the proposed project area may cumulatively affect groundwater resources. Two licensed operations, PRI's North Butte ISR Project and Cogema's Irigaray/Christensen Ranch ISR Project, in the vicinity of the proposed project are not currently in operation. However, when operations do begin, they could potentially be extracting ore from the same aquifer as the proposed Nichols Ranch ISR Project.

The resulting effects may include temporary impacts on groundwater levels in the ore zone aquifer and a geochemical change in the chemistry of the ore zone aquifer at those sites (Uranerz, 2007).

Cumulative impacts on groundwater resulting from the interaction between ISR activities and CBM activities may occur but are not likely since the CBM production and the ISR activities are conducted in stratigraphically separate aquifers. For the proposed Nichols Ranch ISR Project, the ISR activities would take place in sandstone aquifers at depths of 90 to 180 m (300 to 600 ft). In comparison, the CBM production from coal seams occurs at depths equal to or greater than 300 m (1,000 ft). Communication between the uranium ore zone aquifer and CBM coal seam is possible if the CBM wells happen to be located near any of the ISR well fields and if the CBM well was not completed properly. However, like the mechanical integrity tests conducted by ISR companies, CBM producers use a similar procedure to test the integrity of each CBM well. CBM wells in the proposed project area would be in place prior to Uranerz beginning operations at the proposed Nichols Ranch ISR Project. Uranerz would monitor ore zone aquifers to see if potential impacts resulting from unanticipated aquifer communication are taking place between the CBM well and the ISR ore zone aquifer. Uranerz would address these problems and resolve them before ISR operations began on the proposed site (Uranerz, 2007). The Final Environmental Impact Statement (EIS) Powder River Basin Oil and Gas Project states that the areal extent and magnitude of drawdown effects on coal zone aquifers and overlying or underlying sand units in the Wasatch Formation would be limited by the discontinuous nature of different coal zones within the Fort Union Formation and sandstone layers within the Wasatch Formation (BLM, 2003).

Cumulatively, the MODERATE impacts to groundwater from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE to LARGE impacts to groundwater in the affected aquifer when added to past, present, and reasonably foreseeable future actions.

5.6 Ecological Resources

Land disturbance resulting from the construction of the proposed Nichols Ranch ISR Project and accompanying roadways would be the primary source of impacts to ecological resources. Ecology-related impacts from the proposed Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

The total area of land disturbed from development in the Powder River Basin is projected to increase from 89,347 ha (220,688 ac) to 208,257 ha (514,732 ac) from 2003 to 2020 (BLM, 2005b). Of these disturbed land areas, 45,257 ha (111,786 ac) was reclaimed in 2003 and a total of 151,713 ha (374,732 ac) is estimated to be reclaimed in 2020 (BLM, 2005b). Land disturbance resulting from other development activities in the Powder River Basin are likely to have similar ecological impacts as those discussed earlier for the proposed Nichols Ranch ISR Project. However, the cumulative result of land disturbances and alterations has likely cause habitat fragmentation, reduced habitat ranges for certain species and an increased susceptibility to invasive species in these areas. Past and continued reduction in natural brush and grass communities can change light, wind, and temperature conditions on a small scale. For species with specialized habitat requirements, future population viability would be strongly influenced by the quality and composition of the remaining habitat.

Cumulatively, the SMALL impacts to ecology from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to habitats within the Powder River Basin when added to past, present, and reasonably foreseeable future actions.

5.7 Air Quality

Air quality impacts from the proposed Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS. Regional air quality in Campbell and Johnson Counties, in which the proposed Nichols Ranch ISR Project is located, is in attainment for all National Ambient Air Quality Standards (NAAQS) criteria pollutants. Neither of these counties is within an Air Quality Control Region, as designated by the U.S. Environmental Protection Agency (EPA). Generally, limited air pollution emissions sources and effective atmospheric dispersion conditions result in good air quality conditions throughout the Powder River Basin (BLM, 2005a; 2005b; 2005c). Individual surface coal mines within the Powder River Basin, however, have shown some exceedances of the 24-hour PM_{10} standard since 2001, though the majority of these exceedances have been the product of high wind conditions and low precipitation, which resulted in a short-term elevation in PM_{10} levels (WDEQ, 2006).

The BLM also used models to predict air quality conditions up to the year 2020 in the Powder River Basin. Results of the models indicated that sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) levels would increase, but to levels that would be well below ambient standards. Maximum 24-hour PM_{10} levels, on the other hand, were predicted to increase to levels greater than the ambient air standard in some near-field receptors in the Powder River Basin.

Regarding the potential for cumulative air quality impacts that could lead to climate change, the GEIS (NRC, 2009) did not address human-induced climate change given the imprecise state of the science for making human-induced climate predictions and the relatively short time frame of the ISR facility lifecycle. Public comments during scoping for the GEIS addressed the potential for ISR facilities to release carbon dioxide (CO_2) and other greenhouse gas emissions including methane (CH_4), water vapor, ozone (O_3), nitrous oxide (N_2O), hydroflurocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The following paragraphs discuss this potential relative to other industries that could produce these greenhouse gas emissions.

Section 3.3.6 of the GEIS provides a discussion of the meteorology, climatology, and air quality within the Wyoming East Uranium Milling Region, where the proposed Nichols Ranch ISR Project is located. The entire Wyoming East Uranium Milling Region (including the proposed Nichols Ranch ISR Project), is classified as in attainment for all primary pollutants under the National Ambient Air Quality Standards (NAAQS) (NRC, 2009). Other past, present, and reasonably foreseeable activities that may contribute to pollutant emissions and greenhouse gas emissions are identified in Section 5.1 of this SEIS.

As discussed in Section 4.7 of this SEIS, air-quality impacts throughout the lifecycle of the proposed Nichols Ranch ISR Project would come primarily from fugitive dust and engine exhaust emissions. Fugitive dust would be generated by vehicular traffic, earth-moving activities during construction, and wind erosion of disturbed areas. As discussed, these types of emissions are not expected to be significant as they would be intermittent (temporary), quickly dispersed and would not cause any exceedance of any applicable air quality standards. Additionally, Uranerz may use best management practices (e.g., wetting of dirt roads and cleared land areas) to reduce fugitive dust and emissions.

Additionally, gaseous emissions during ISR operations may come from the release of pressurized vapor from well field pipelines and during resin transfer or elution. These gases come from two sources: (1) the liquefied gases such as oxygen and carbon dioxide used in the lixiviant that come out of solution and (2) gases in the underground environment that are mobilized. Venting the well pipeline system allows the release of naturally occurring radon gas. Gaseous emission levels from the proposed Nichols Ranch ISR Project are expected to comply with applicable regulatory limits and restrictions and would not be expected to reach levels that result in the proposed Nichols Ranch ISR facilities being classified as major sources under the operating (Title V) permit process.

Surface coal mines have the potential to cumulatively impact air quality in the region, which may lead to climate change. Surface coal mining activities generate fugitive dust particulates and gaseous emissions from large mining equipment. Activities such as blasting, excavating, loading, and hauling of overburden and coal and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are also emitted from small boilers and off-road vehicles (BLM, 2009a). Overburden and coal blasting can produce gaseous clouds that contain nitrogen dioxide (NO_2).

Other air pollutant emission sources potentially having a cumulative impact within the region include carbon monoxide (CO) and nitrogen oxides (NO_X) from internal combustion engines used at natural gas and coal bed natural gas (CBNG) pipeline compressor stations; CO, NO_X, particulates (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions; particulate matter (dust) generated by vehicle travel traffic on unpaved roads, agricultural activities, and application of sand to paved roads in winter; NO_2 and PM_{10} emissions from railroad locomotives; SO_2 and NO_X from other power plants; and air pollutants transported from emission sources located outside the Powder River Basin (BLM, 2009a).

The Center for Climate Strategies (CCS) estimates that activities in Wyoming will account for approximately 60.3 million metric tons (tonnes) (66.5 million T) of gross CO_2 equivalent emissions in Year 2010 and 69.4 million tonnes (76.5 million T) in Year 2020 (CCS, 2007). Using those projections, the Year 2007 emissions from the three applicant coal mines reviewed by the staff total represents 2.22 percent of the Year 2010 statewide emissions. With the addition of the expected six new coal mines, the estimated total emissions at the three applicant mines would represent 3.61 percent of the projected Year 2020 state-wide emissions (BLM, 2009a).

The proposed Nichols Ranch ISR Project is not expected to be a major contributor of greenhouse gases due to the size of the facility, small construction and decommissioning workforce, and relative short term of operation. Additionally, it is expected that greenhouse gas emissions associated with the proposed Nichols Ranch ISR Project would be much lower than other actions in Campbell and Johnson Counties associated with natural resource-based extraction facilities (i.e., surface coal mining) and would not be expected to contribute a perceptible increase to greenhouse gas emissions in the Powder River Basin and the State of Wyoming.

Cumulatively, the SMALL impacts to meteorology, climatology, and air quality from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE potential impacts to air quality in Campbell and Johnson Counties when added to past, present, and reasonably foreseeable future actions.

5.8 Noise

Noise impacts from the proposed Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS. The nearest residential receptor is located 9,500 m (0.6 mi) from the proposed Nichols Ranch ISR Project area, which is greater than the 300 m (1,000 ft) radius specified by the GEIS.

Past, present, and reasonably foreseeable future noise-generating activities in the vicinity of the proposed Nichols Ranch ISR Project are primarily traffic noise, oil and gas operations, CBM operations, and uranium mining/milling operations. The Final EIS Powder River Basin Oil and Gas Project states that sound levels from CBM operations surrounding the project area are expected to be unnoticeable for distances of 490 m (1,600 ft) and beyond. These CBM operations were categorized as having no cumulative impact to the surrounding area (BLM, 2003). Oil and gas operations would generate noise during well drilling, which decrease to 54 decibels (dBA) at 610 m (2,000 ft) from the drill rig. Oil and gas operations also generate noise during the ongoing operations of compressor stations, although noise levels were anticipated to be below 55 dBA at distances of 490 m (1,600 ft) and beyond (BLM, 2003). Although noise related impacts are generally constrained to the 610 m (2,000 ft) immediately surrounding each discrete use (e.g., drill rig, compressor station), the level of development within the vicinity of the proposed Nichols Ranch ISR Project, particularly energy-related operations, has been increasing and is anticipated to continue growing. However, within the 8-km (5-mi) radius considered for this analysis, energy-related operations are not likely to increase significantly in density.

Cumulatively, the SMALL impacts to noise from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the SMALL potential impacts to noise in the 8-km (5-mi) vicinity when added to past, present, and reasonably foreseeable future actions. Additionally, noise levels would be mitigated by administrative and engineering controls in order to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits.

5.9 Historical and Cultural Resources

Historical and cultural impacts from the proposed Nichols Ranch ISR Project are anticipated to be MODERATE and are discussed in detail in Chapter 4 of this SEIS.

Twenty-one cultural resources were identified in the vicinity of the proposed Nichols Ranch ISR Project area that were determined not eligible to include in the *National Register of Historic Places* (NRHP). Six additional cultural resources in the project are recommended as eligible to be included in the NRHP. The analysis of cumulative impacts on historical and cultural resources would be focused on these identified cultural resources, which are discussed in more detail in Chapter 3 of this SEIS. A Draft EIS for the South Gillette Area Coal Lease Applications (BLM, 2009b) lists various actions which have the greatest potential for cumulative effects on cultural resources in the Powder River Basin. These actions include coal extraction actions, oil and gas operations, utility transmission and distribution actions, other mining/milling actions including uranium, wind power activities, reservoir development, various non-energy related developments including transportation, and county-level economic development actions. Of these actions, coal extraction, oil and gas operations, other mining actions, reservoir development, and wind power activities most closely resemble the actions that are likely to take place in the vicinity of the proposed Nichols Ranch ISR Project, and which have the potential to affect the identified cultural resources. Impacts to cultural resources are likely to be minimized for projects that are on federal or state lands or are funded in part by a government entity because they would be subject to the *National Historic Preservation Act* (NHPA), the Section 106 consultation process, and other applicable statutes, whereas actions that are on private land pose the threat of irrevocable loss of cultural resources. The Fortification Creek Area Draft Resource Management Plan Amendment/Environmental Assessment (BLM, 2008) concludes that cumulatively, cultural resources may be indirectly affected by consequences of nearby projects, such as erosion, destabilization of land surfaces, increased area access, and increased vibration from truck traffic, which can degrade cultural resources overall.

The GEIS considers cumulative impacts to four regions including the Wyoming East Uranium Milling Region which encompasses Campbell and Johnson Counties. Fourteen projects, mostly related to minerals extraction, are considered in the analysis. The impact of these current or proposed projects on cultural resources would be similar. The GEIS also considers the cumulative effects of traditional land uses, wildlife/fisheries/forest management, recreation, government lands and land management, mineral extraction and energy development (including coal), and cultural resources preservation. Despite the fact that many of the actions require inventory, evaluation, mitigation, avoidance, or protection of the cultural resources, it is acknowledged that adverse impacts to cultural resources would occur (NRC, 2009). These impacts are anticipated to be MODERATE.

Cumulatively, the MODERATE impacts to historical and cultural resources from the proposed Nichols Ranch ISR Project discussed in Chapter 4 may contribute to a perceptible increase in the MODERATE potential impacts to nearby historical and cultural resources when added to past, present, and reasonably foreseeable future actions. However, mitigation would likely take place for the cultural resources in the proposed Nichols Ranch ISR Project area that are recommended as eligible to be included in the NRHP, as described in Chapter 4 of this SEIS. Additionally, any past, present, or future actions that occur on federal lands or require a federal permit would require a Section 106 Consultation, which would ensure that historical and cultural, resources are adequately considered.

5.10 Visual and Scenic Resources

Visual and scenic impacts from the proposed Nichols Ranch ISR Project are anticipated to be MODERATE and are discussed in detail in Chapter 4 of this SEIS.

Developments within the Powder River Basin region, in which the proposed Nichols Ranch ISR Project is situated, are expected to continue over the next 15 to 20 years and would involve construction of railroads, coal-fired power plants, major (230 kV) transmission lines, coal technology projects, oil and gas transportation pipelines and refineries, and CBM processing plants. Some of these facilities can be expected to be within the viewshed of the proposed Nichols Ranch ISR Project site. Because the proposed Nichols Ranch ISR Project is within close proximity to the Pumpkin Buttes traditional cultural property (TCP), and a programmatic agreement (PA) for this cultural resource has been developed, visual impacts within a 3.2-km (2-mi) radius of the Pumpkin Buttes TCP can be expected to be mitigated during future land developments, which would limit some visual impacts within the proposed Nichols Ranch ISR Project viewshed.

Cumulatively, the MODERATE impacts to visual and scenic resources from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not likely to contribute to a perceptible increase in the MODERATE potential impacts to the proposed Nichols Ranch ISR Project viewshed when added to past, present, and reasonably foreseeable future actions.

5.11 Socioeconomics

Socioeconomic impacts from the proposed Nichols Ranch ISR Project are anticipated to be SMALL to MODERATE depending on the specific issue and are discussed in detail in Chapter 4 of this SEIS. As mentioned in Section 4.11 of this SEIS, the GEIS socioeconomic analysis is based on 2000 U.S. Census Bureau data. The socioeconomic analysis presented in this SEIS for the proposed Nichols Ranch ISR Project region of influence (ROI) is based on a combination of 2000 U.S. Census Bureau data, U.S. Census Bureau 2005-2007 American Community Survey 3-Year Estimates, and U.S. Census Bureau 2009 State and County QuickFacts.

Though, specific numbers may differ, the analysis of socioeconomics presented in Section 4.3.10 of the GEIS remains valid for the proposed Nichols Ranch ISR Project.

Wyoming's population is projected to grow modestly from 2010 to 2020 (from 519,886 to 530,948 respectively) then decrease to 522,979 by 2030 (USCB, 2009). These relatively flat population projections do not take into account the current recession, climate change legislation (including cap and trade components) and future technological changes (e.g., clean coal innovations). Projected increases in employment in the Powder River Basin from increases in the coal mining operations and oil and gas development range from a gain of 2,300 to 11,563 jobs by 2010. Most of this incremental gain is expected to take place in Campbell County (BLM, 2009b). While Campbell County and the entire Powder River Basin have been described as possessing an enhanced capacity to respond to and accommodate growth, periods of rapid growth have been known to stress communities and their social structures, housing resources, and public infrastructure and service systems (BLM, 2005a, 2005b, 2005c). Both projections analyzed in the South Gillette Draft EIS indicate a strong demand for housing resources through the year 2020. This demand is anticipated to exert substantial pressure on housing markets, prices, and the real estate development and construction industries, all at a time when demand for labor and other resources would be high overall. Short-term school capacity shortages are also anticipated to be a result of the increase in population, as well as limitations in public services.

Beneficial or non-adverse impacts that are anticipated include water supply and wastewater systems, which are anticipated to meet projected needs, and thus are not considered to be adversely impacted. Ad valorem taxes are anticipated to provide a beneficial impact, and beneficial social effects are also anticipated to follow the expanding economy and employment opportunities associated with project energy development increases.

Cumulative impacts to socioeconomics could be more severe if extractive industries and power production were to increase above average historic levels of growth. These impacts would be both adverse and beneficial. Cumulative adverse impacts to the local housing inventory and real estate market could occur if demand for labor in the extractive industries were to increase during the economic life of the proposed project. There could be long-term adverse impacts to local schools, health care facilities, fire and police services, and infrastructure, including waste management facilities, if large industrial projects create a demand for labor in the Powder River Basin. However these impacts would be met by over 40 years of experience in dealing with rapid population changes, a more sophisticated planning system and a taxing system that helps capture tax revenue during construction, operation, and decommissioning of most all industrial facilities.

If the population remains stable or grows within an annual rate of growth that area has managed well in the past (approximately 2 percent per year), the local economy could be positively affected by multiple mining operations that would bring in local and state economic revenue.

Cumulatively, the MODERATE impacts to socioeconomics from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not likely to contribute to a perceptible increase in the MODERATE potential impacts to local socioeconomics when added to past, present, and reasonably foreseeable future actions.

5.12 Environmental Justice

No concentrations of people living below the poverty level and no concentrated minority populations are located near the proposed project area; therefore, no disproportionately high and adverse environmental impacts would result to minority populations or those living below the poverty level from the proposed Nichols Ranch ISR Project. Environmental justice impacts related to the proposed Nichols Ranch ISR Project are discussed in more detail in Section 4.12 of this SEIS.

The GEIS identified no minority populations in the Wyoming East Uranium Million Region, but did identify Albany County as a low-income population (NRC, 2009). Northern Albany County is predominantly rural with no population centers or towns identified by the U.S. Census Bureau (USCB) in the portion of the county that lies within the Wyoming East Uranium Milling Region. For this reason, the GEIS determined that there were no environmental justice considerations expected for the portion of Albany County located within the Wyoming East Uranium Milling region (NRC, 2009).

The relative homogeneity of Wyoming despite 40 years of energy/natural resource development indicates that environmental justice issues would not be a problem. Because the economic base of the study area is largely ranching and resource extraction, low-income areas are dispersed within the study area. People with incomes below the poverty status may reside within the study area, but not disproportionately. At the present time, there is no significant concentration of people living below the poverty level and no significant concentration minority populations located near the proposed project and there are no high and adverse impacts are predicted throughout the life cycle of the proposed project, and therefore, there are no disproportionately high and adverse impacts to these populations from the proposed project.

5.13 Public and Occupational Health and Safety

Public and occupational health and safety impacts from the proposed Nichols Ranch ISR Project are anticipated to vary from SMALL to MODERATE, depending on the specific issue, and are discussed in detail in Chapter 4 of this SEIS. During all phases of normal operation, health and safety impacts are expected to be SMALL. Annual doses to the population within 80 km (50 mi) of the proposed project are expected to be far below applicable NRC regulations. For accidents, impacts are expected to range from SMALL to MODERATE. Impacts could be MODERATE in the unlikely event that mitigation measures and other procedures intended to ensure worker safety are not followed.

The proposed Nichols Ranch ISR Project site is located in the Wyoming East Uranium Milling Region as identified by the GEIS, which contains 21 previous, current, or potential uranium handling sites. Two of the 21 sites are operating uranium mines (Smith Ranch-Highland) and two are DOE disposal sites (Shirley Basin South and Spook). The remaining sites are either actively in decommissioning or in a terminated or standby status. The GEIS (NRC, 2009) identified eight draft or final EISs submitted from January 2005 to February 2008 for projects that could contribute to a cumulative impact on public and occupational health and safety within the Wyoming East Uranium Milling Region. In addition, the GEIS identified ten large-scale, programmatic EISs for projects that have an impact over the entire state of Wyoming. A review for this SEIS of any additional projects since February 2008 that were not addressed by the GEIS did not identify any projects that would likely increase cumulative impacts on radiological public health and safety. The SMALL impacts to health and safety associated with the proposed Nichols Ranch ISR Project would not significantly contribute to the cumulative public and occupational health and safety effects from the identified projects.

Studies of the existing radioactivity levels in the environment have been conducted and presented in Section 3.12 of this SEIS. The identified radioactivity concentrations in the soil, air, and water are consistent with other background concentrations in the region. This indicates that no prior public and occupational health and safety concerns exist at the proposed Nichols Ranch ISR Project site. The past, present, and reasonably foreseeable future activities mentioned above are anticipated to have a SMALL impact on radiological public health and safety in the vicinity of the proposed Nichols Ranch ISR Project site.

The maximum expected exposure to any member of the public from the proposed Nichols Ranch ISR Project, as with other operating ISR facilities in the U.S., is expected to be on the order of less than 10 mrem per year at the site boundary (NRC, 2009). This exposure, combined with exposures from other facilities, is expected to remain far below the regulatory public limit of 100 mrem/year and have a negligible contribution to the 620 mrem average yearly dose received by a member of the public. Cumulatively, the public health and safety impacts from the proposed Nichols Ranch ISR Project combined with the past, present and reasonably foreseeable future activities in the vicinity of the proposed Nichols Ranch ISR Project site are anticipated to be SMALL.

5.14 Waste Management

Waste management impacts from the proposed Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

Past, present, and reasonably foreseeable future activities in the vicinity of the proposed Nichols Ranch ISR Project site that could generate solid, hazardous, or radioactive wastes include uranium mining/milling activities, CBM activities, and oil and gas exploration. Each of these facilities would be responsible for complying with applicable regulations and site-specific license agreements that manage generated wastes. Because hazardous and radioactive wastes are so closely monitored throughout the United States, the impact from these activities is anticipated to be SMALL.

Within an 80-km (50-mi) radius of the proposed Nichols Ranch ISR Project, there are at least six either operating or planned ISR facilities that would generate waste volumes consistent with that projected for the proposed project. The past, present, and reasonably foreseeable actions that would contribute to the cumulative impact on either waste management or disposal capacity would be expected to be SMALL.

Cumulatively, the SMALL impacts to waste management from the proposed Nichols Ranch ISR Project discussed in Chapter 4 are not likely to contribute to a perceptible increase in the SMALL potential impacts to waste management in the vicinity of the proposed Nichols Ranch ISR Project site when added to past, present, and reasonably foreseeable future actions.

5.15 References

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 Introduction

As discussed in Section 8.0 of NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS) (NRC, 2009), monitoring programs, in general, are developed for in-situ uranium recovery (ISR) facilities to verify compliance with standards for the protection of worker health and safety in operational areas and for protection of the public and environment beyond the facility boundary. Monitoring programs provide data on operational and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected. In this regard, these programs help to limit potential environmental impacts at ISR facilities.

Required monitoring programs can be modified to address unique site-specific characteristics by the addition of license conditions resulting from the conclusions of the U.S. Nuclear Regulatory Commission (NRC) safety and environmental reviews.

The discussion of monitoring programs for the proposed Nichols Ranch ISR Project is organized in the following manner:

- Radiological monitoring (Section 6.2);
- Physiochemical monitoring (Section 6.3); and
- Ecological monitoring (Section 6.4).

6.2 Radiological Monitoring

This section describes Uranerz Energy Corporation's (Uranerz) proposed radiological monitoring program as described in its license application (Uranerz, 2007). The purpose of this monitoring program is to characterize and evaluate the radiological environment, to provide data on measurable levels of radiation and radioactivity, and to provide data on the principal pathways of radiological exposure to the public (NRC, 2003).

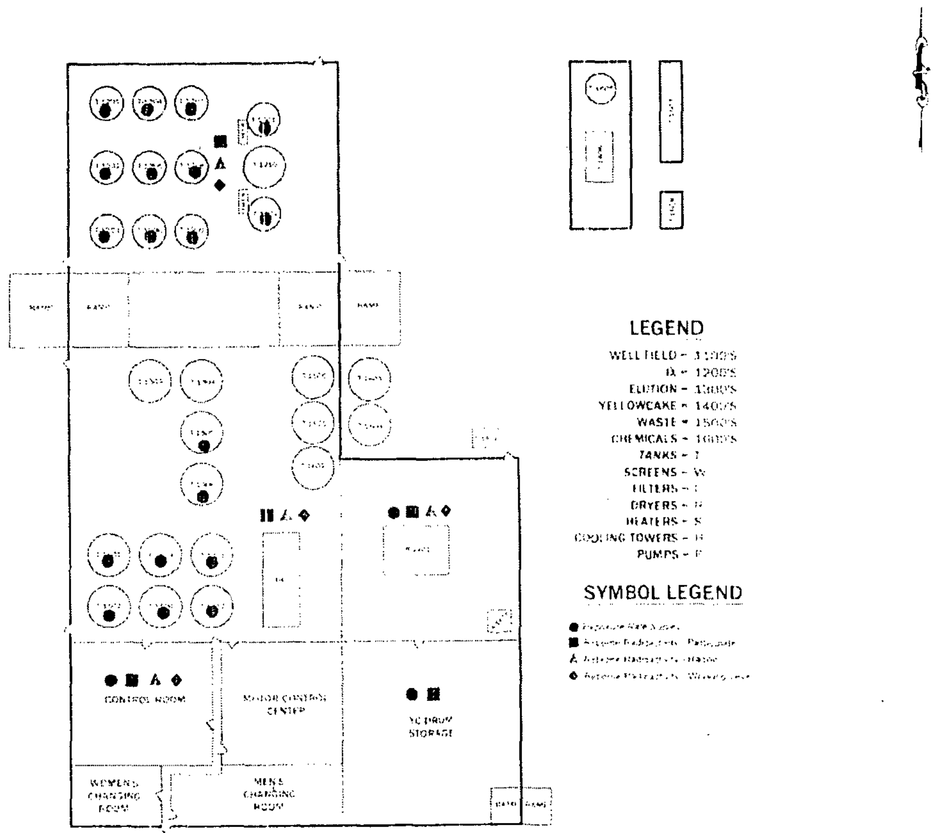
In accordance with NRC regulations contained in the *Code of Federal Regulations*, Title 10, Part 40 (10 CFR Part 40), Appendix A, Criterion 7, a preoperational monitoring program is required for establishing facility baseline conditions. Following this baseline program, operators of ISR facilities are required to conduct an operational monitoring program to measure or evaluate compliance with standards and to evaluate environmental impact of operations. Although not a requirement, NRC Regulatory Guide 4.14 (NRC, 1980) provides a monitoring program that is acceptable to the NRC staff for establishing a radioactive effluent and environmental monitoring program for uranium mills, which includes ISR facilities.

The results of Uranerz's baseline monitoring program are presented in Chapter 3. The following provides a brief description of Uranerz's proposed operational monitoring program.

6.2.1 Airborne Radiation Monitoring

Uranerz proposes to implement an airborne radiation monitoring program that includes routine and non-routine operations, maintenance, and cleanup. The results from the program would be used to calculate personnel exposure and to ensure radioactive releases and exposures due to airborne radiation are as low as reasonably achievable (ALARA). Uranerz would implement this program in conjunction with the respiratory protection program. Figures 6-1 and 6-2 show the routine airborne radioactivity sampling locations within the Nichols Ranch Unit and Hank Unit. Figures 6-3 and 6-4 show the radon, gamma, and air particulate monitoring locations near and on the Nichols Ranch and Hank Units. Air sampling would be conducted in accordance with or equivalent to NRC Regulatory Guide 8.25, *Air Sampling in the Workplace* (NRC, 1992), and would be consistent with NRC Regulatory Guide 8.30, *Health Physics in Uranium Recovery Facilities* (NRC, 2002).

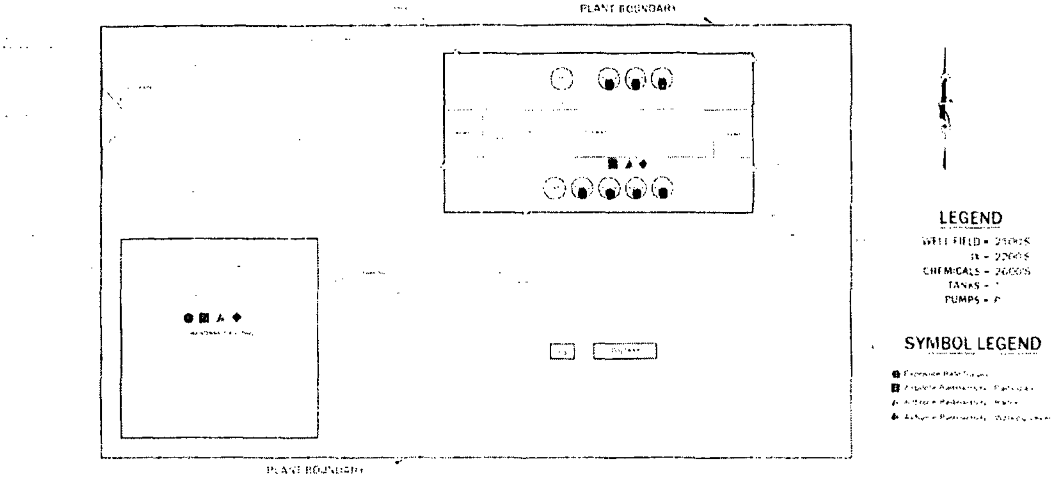
Figure 6-1. Nichols Ranch Unit Routine Airborne Radioactivity Sampling Locations



Source: modified from Uranerz, 2007

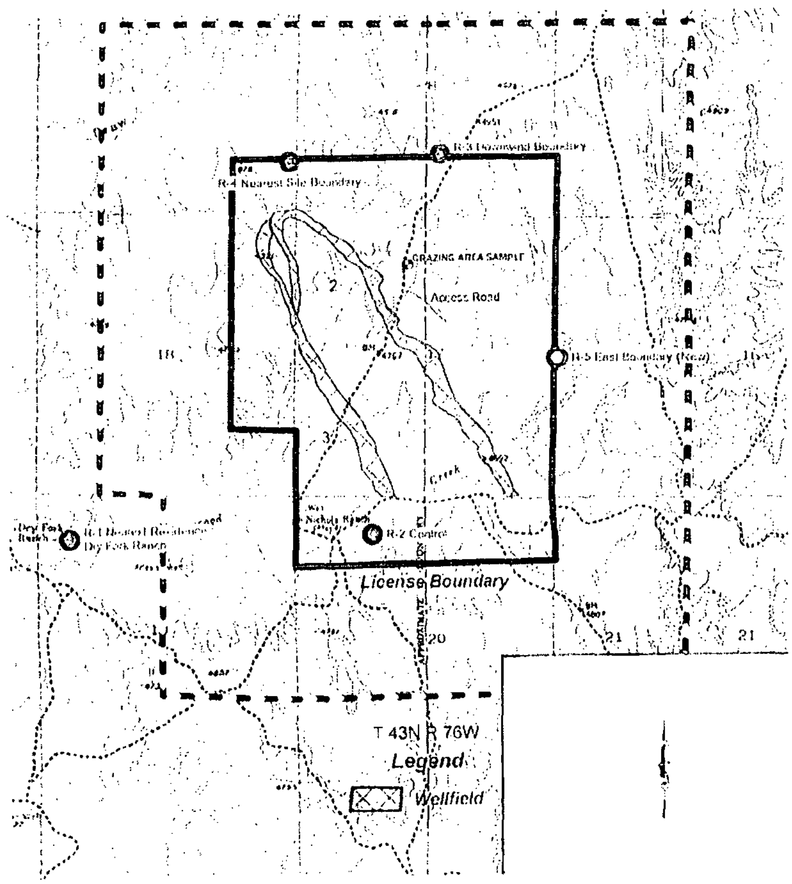
Airborne uranium particulate monitoring would include both breathing zone (lapel air sampler worn by worker) and area sampling (portable air sampler or fixed location sampler). The breathing zone air samplers would measure the worker's intake of uranium. Area samplers would be placed in areas where there is the potential for generation of airborne radioactive materials. These samplers would verify the effectiveness of confinement or containment and provide warning of elevated concentrations for planning or response actions. Area sampling frequency would be conducted in accordance with NRC Regulatory Guide 8.30 (NRC, 2002). Breathing zone air and area samples would be used for both routine (drying and packaging activities, maintenance, cleanup) and non-routine operations as required by operating procedure and/or Radiation Work Permit.

Figure 6-2. Hank Unit Routine Airborne Radioactivity Sampling Locations



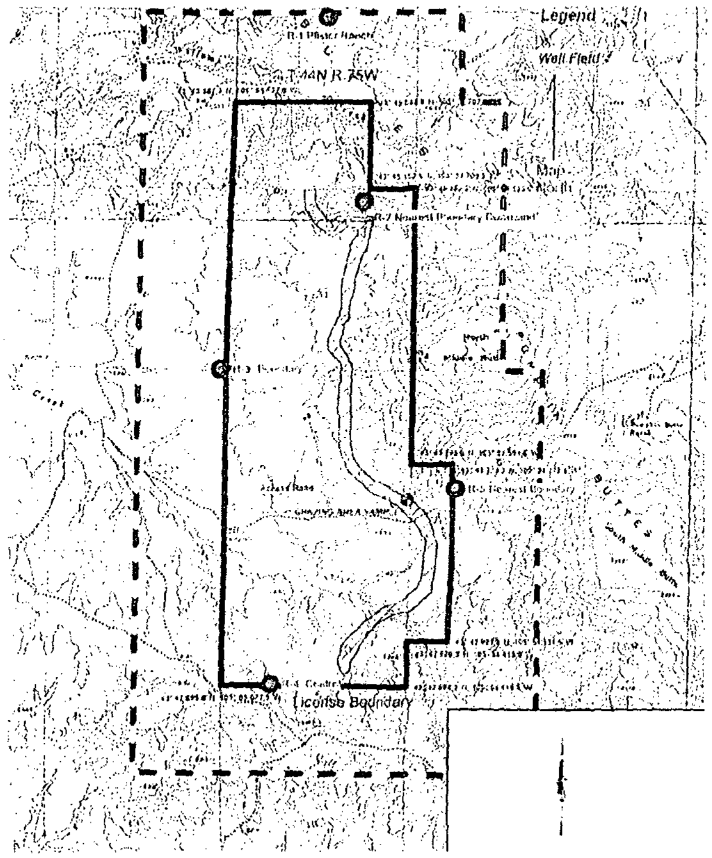
Source: modified from Uranerz, 2007

Figure 6-3. Nichols Ranch Unit Radon, Gamma, and Air Particulate Monitoring Locations



Source: modified from Uranerz, 2007

Figure 6-4. Hank Unit Radon, Gamma, and Air Particulate Monitoring Locations



Source: modified from Uranerz, 2007

Radon monitoring with the use of track-etch type radon detectors would be conducted in the general work areas. The radon detectors would be exchanged quarterly and analyzed for total radon. Radon daughter concentration monitoring would also be conducted in the process areas. Sampling frequency and action levels would be conducted in accordance with NRC Regulatory Guide 8.30 (NRC, 2002).

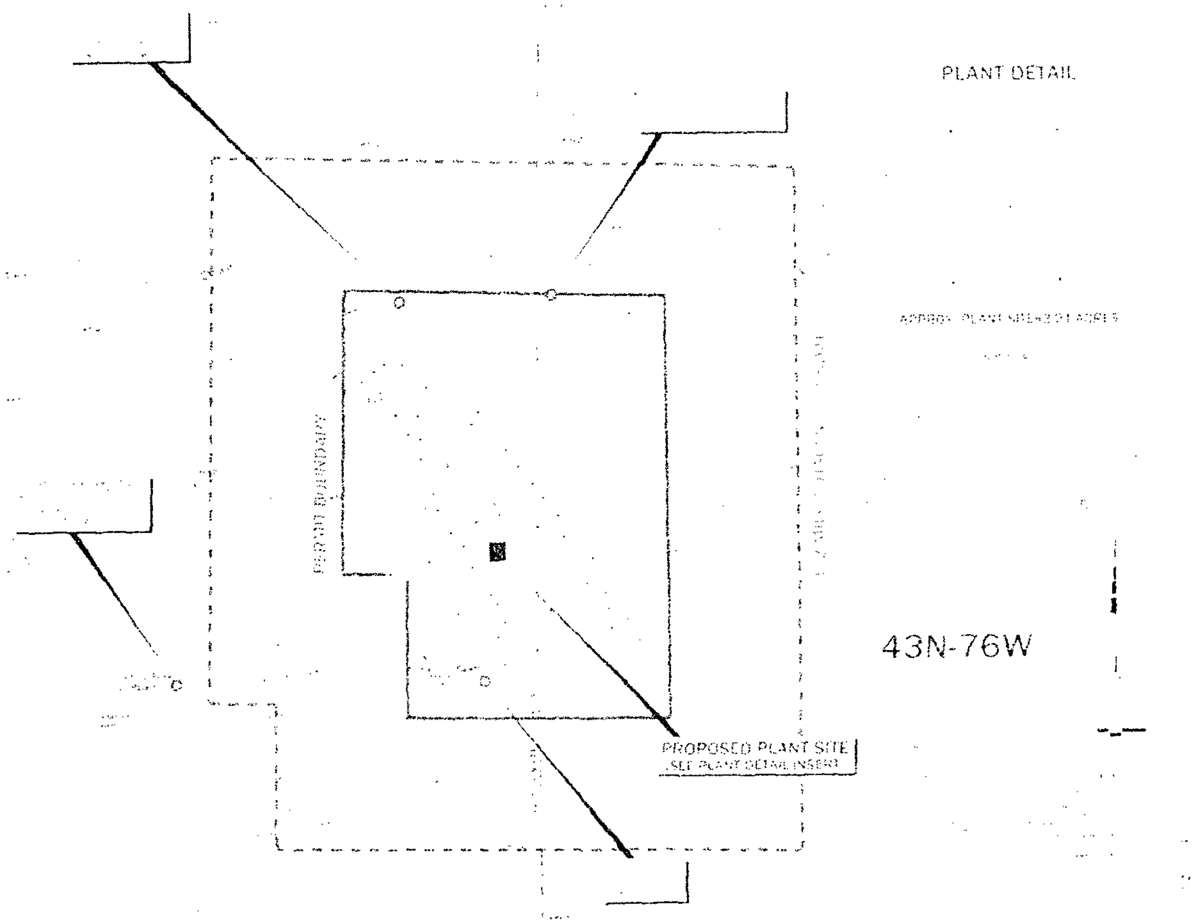
Continuous gamma monitoring would also be conducted at the same locations as the radon sampling. The gamma measurements would be taken with passive integrating detectors and would be changed once per calendar quarter.

Uranerz conducted baseline monitoring of radium-222 and direct gamma exposure rates. The one-year radon monitoring results showed that the annualized average at the Nichols Ranch and Hank Units are 1.2 pCi/L and 1.0 pCi/L, respectively. These values are higher than the U.S. outdoor average radon concentration of 0.4 pCi/L but are within the expected range as compared to historic radon levels at the site. The resulting background gamma exposure rates from the one-year monitoring program showed that the annualized average at the Nichols Ranch and Hank Units are 42.5 and 45.4 mrem, respectively. These values are within the range of typical background exposure rates in the Western United States.

6.2.2 Soils and Sediment Monitoring

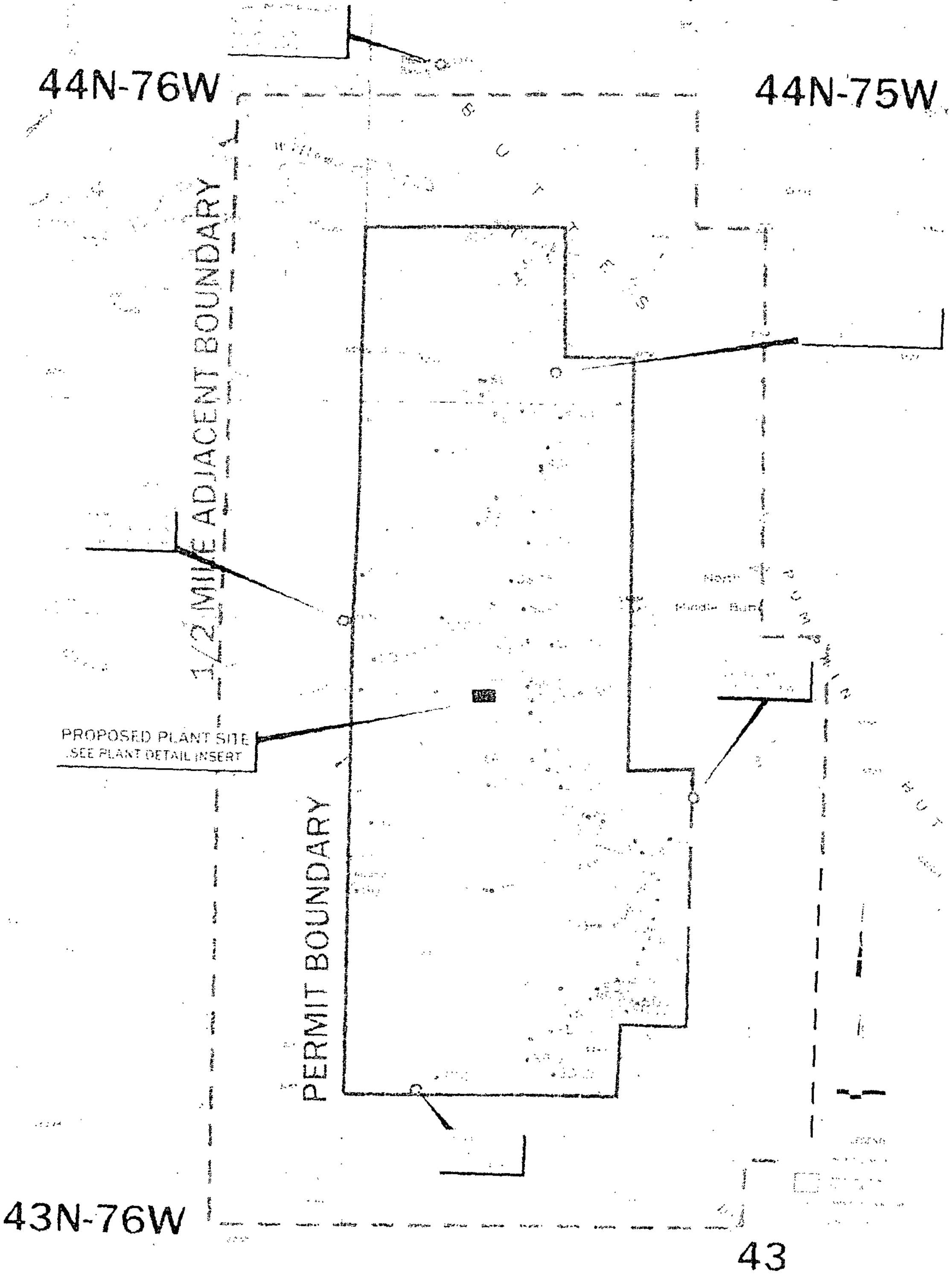
Surface soil and sediment samples would be collected annually at the same locations as the radon sampling identified in Section 6.2.1. The surface soil samples would be taken at the same locations as the radon sampling is performed (Figures 6-3 and 6-4) and the same locations used for pre-operational sediment sampling (Figures 6-5 and 6-6). All samples would be analyzed for total uranium, thorium-230, radium-226, and lead-210.

Figure 6-5. Nichols Ranch Unit Surface Soil Sample Locations



Source: modified from Uranerz, 2007

Figure 6-6. Hank Unit Surface Soil Sample Locations



Source: modified from Uranerz, 2007

6.2.3 Vegetation, Food, and Fish Monitoring

Uranerz does not plan on conducting vegetation, food, or fish sampling. Uranerz deemed the ingestion pathway to be insignificant to warrant a monitoring program because the predicted dose to an individual would be less than five percent of the applicable radiation protection standard, as stated in Regulatory Guide 4.14 (NRC, 1980).

6.2.4 Surface Water Monitoring

Surface water samples would be collected annually or on a quarterly basis, if water is present, at the same locations sampled for pre-operational surface water sampling. Based on the ephemeral and intermittent nature of the onsite streams, the samples would be taken only if water is present. The samples would be taken either as a grab sample or by self samplers. The samples would be analyzed for total uranium, thorium-230, radium-226 and lead-210. The locations of the surface water self samplers are shown on Figure 6-7.

6.2.5 Groundwater Monitoring

Private wells within 1 km (0.6 mi) of the well field area boundary would be sampled on a quarterly basis. These samples would be analyzed for natural uranium and radium-226.

6.3 Physiochemical Monitoring

This section describes Uranerz's proposed physiochemical monitoring program as described in its license application (Uranerz, 2007). The purpose of this monitoring program is to provide data on operational and environmental conditions so that prompt corrective actions can be taken when adverse conditions are detected and to comply with environmental requirements or license conditions. In this regard, this monitoring program helps to limit potential environmental impacts at an ISR facility. The physiochemical monitoring program proposed by Uranerz includes groundwater monitoring and well field and pipeline flow and pressure monitoring.

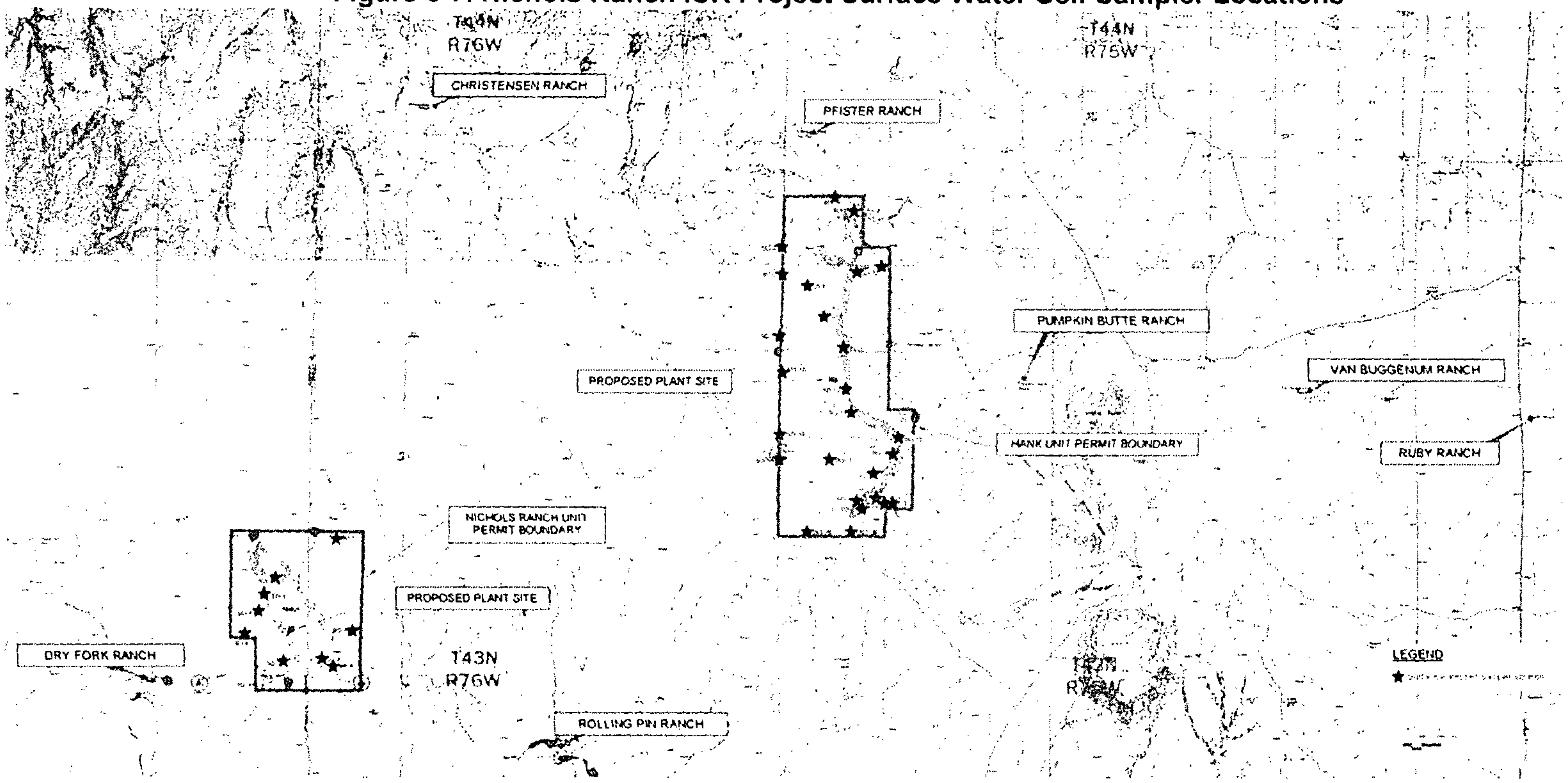
6.3.1 Well Field Groundwater Monitoring

As discussed in Section 8.3 of the GEIS, the ISR production process directly affects the groundwater near the operating well field. For this reason, groundwater conditions are extensively monitored both before and during operations. The pre-operational groundwater monitoring that would occur as part of the proposed Nichols Ranch ISR Project is discussed below in Section 6.3.1.1. The groundwater quality monitoring that would occur during operation is discussed in Section 6.3.1.2.

6.3.1.1 *Pre-Operational Groundwater Sampling*

As indicated in the Section 8.3.1.1 of the GEIS, a licensee must establish baseline groundwater quality before beginning uranium production in a well field. This is done to characterize the water quality in monitoring wells that are used to detect lixiviant excursions from the productions zone, to recover excursions, and to establish standards for aquifer restoration after uranium recovery is complete. The requirements and details of sampling programs to establish pre-operational groundwater quality are described in Section 8.3.1.1 of the GEIS.

Figure 6-7. Nichols Ranch ISR Project Surface Water Self Sampler Locations



Source: modified from Uranerz, 2007

Uranerz would install monitoring wells in the ore zone (A Sand at the Nichols Ranch Unit; F Sand at the Hank Unit) at a density of 1 well per 1.6 ha (4 ac). During operation, these ore zone monitoring wells would be sampled twice per month at intervals of approximately two weeks. Horizontal monitoring wells would be installed on the edge of the well field, approximately 150 m (500 ft) from the well field and spaced 150 m (500 ft) apart, in the same zone as the ore zone. This distance takes into consideration that if an excursion were to occur, processing fluids could be controlled within 60 days as required by the Wyoming Department of Environmental Quality (WDEQ). Vertical monitoring wells would also be installed in the overlying (B Sand at the Nichols Ranch Unit; G Sand at the Hank Unit) and underlying (1 Sand at the Nichols Ranch Unit; B or C Sand at the Hank Unit) aquifers at a density of one underlying and one overlying well per every 1.6 ha (4 ac). The density and spacing of these wells is dependent on the presence and thickness of the confining units above and below the ore zone and Uranerz would consult with NRC and WDEQ to determine the appropriate well density and spacing in these instances. The locations of these monitoring wells are shown in Figures 6-8 and 6-9.

During the pre-operational baseline water quality assessment, the ore zone monitoring wells would be sampled four times with a minimum of two weeks between sampling. The first and second sampling events would be analyzed for all parameters found in WDEQ-Land Quality Division (WDEQ-LQD) Guideline No. 8 (WDEQ, 2005), including uranium parameters. Those parameters are as follows:

- Ammonia nitrogen as N
- Nitrate + nitrite as N
- Bicarbonate
- Boron
- Carbonate
- Fluoride
- Sulfate
- Total Dissolved Solids (TDS) @ 82 °C (180 °F)
- Radium-226 (pCi/L)
- Radium-228 (pCi/L)
- Dissolved arsenic
- Dissolved cadmium
- Dissolved calcium
- Dissolved chloride
- Dissolved chromium
- Total and dissolved iron
- Dissolved magnesium
- Dissolved manganese
- Dissolved molybdenum
- Dissolved potassium
- Dissolved selenium
- Dissolved sodium
- Dissolved zinc
- Gross Alpha (pCi/L)
- Gross Beta (pCi/L)
- Uranium
- Vanadium

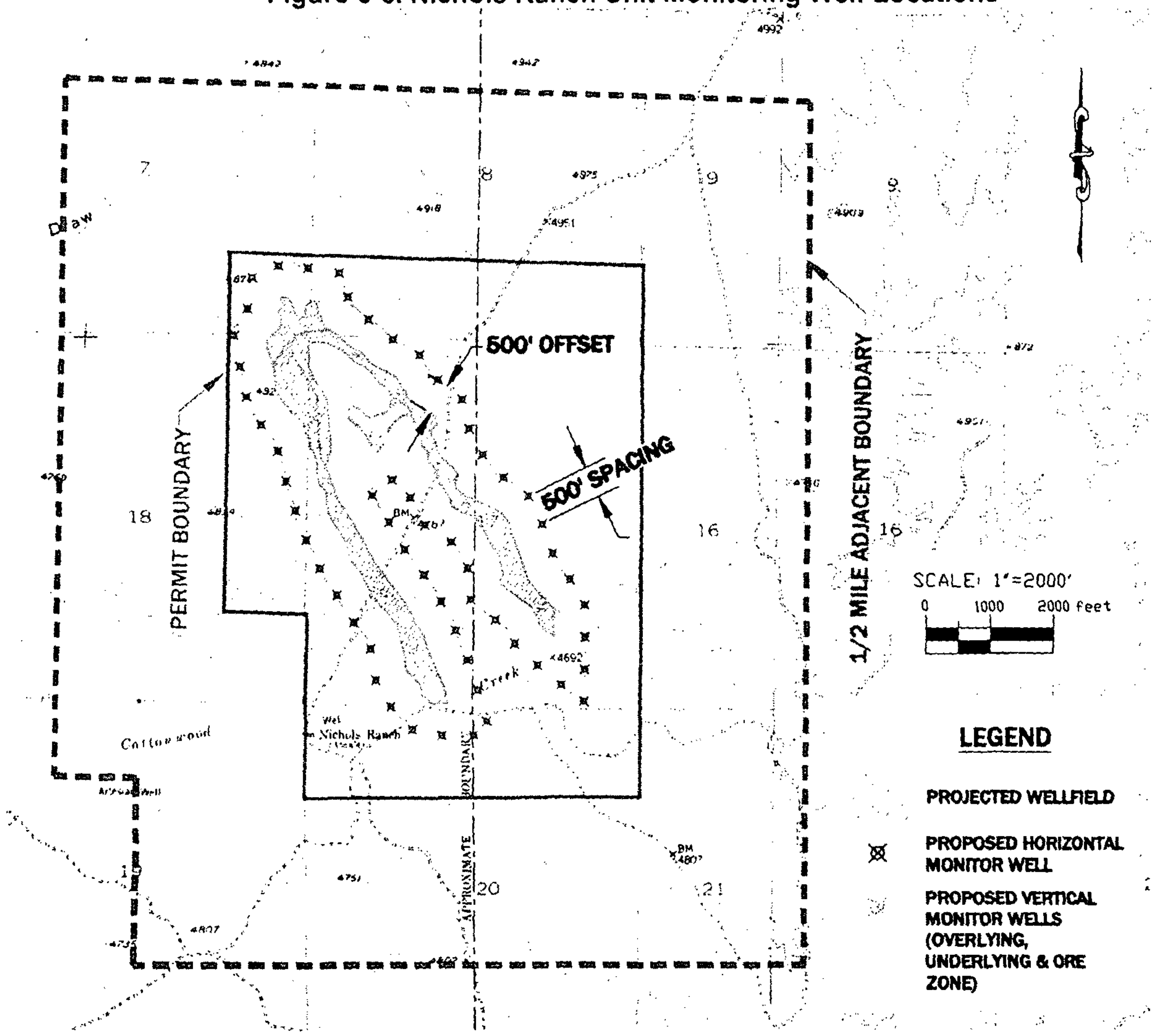
Those parameters that were not detected during the first and second sampling events could be eliminated from the third and fourth sampling events. The ore zone monitoring ring wells would be sampled four times with at least two weeks between sampling. The first sampling event would include the analyses for the parameters found in WDEQ-LQD Guideline No. 8 (WDEQ, 2005) including uranium parameters. The remaining three sampling events would be tested for the potential Upper Control Limit (UCL) parameters of chloride, total alkalinity, and conductivity. Overlying and underlying aquifer wells would be sampled four times with at least two weeks between sampling events. The first and second sampling events would be analyzed for the following parameters:

- Alkalinity
- Ammonium
- Arsenic
- Barium
- Copper
- Electrical conductivity @ 25 °C (77 °F)
- Fluoride
- Iron
- Nitrate
- pH
- Potassium
- Radium-226

- Bicarbonate
- Boron
- Cadmium
- Calcium
- Carbonate
- Chloride
- Chromium
- Lead
- Magnesium
- Manganese
- Mercury
- Molybdenum
- Nickel
- Selenium
- Sodium
- Sulfate
- Total dissolved solids
- Uranium
- Vanadium

The third and fourth sampling events would be analyzed only for the possible UCL parameters of chloride, total alkalinity, and conductivity.

Figure 6-8. Nichols Ranch Unit Monitoring Well Locations

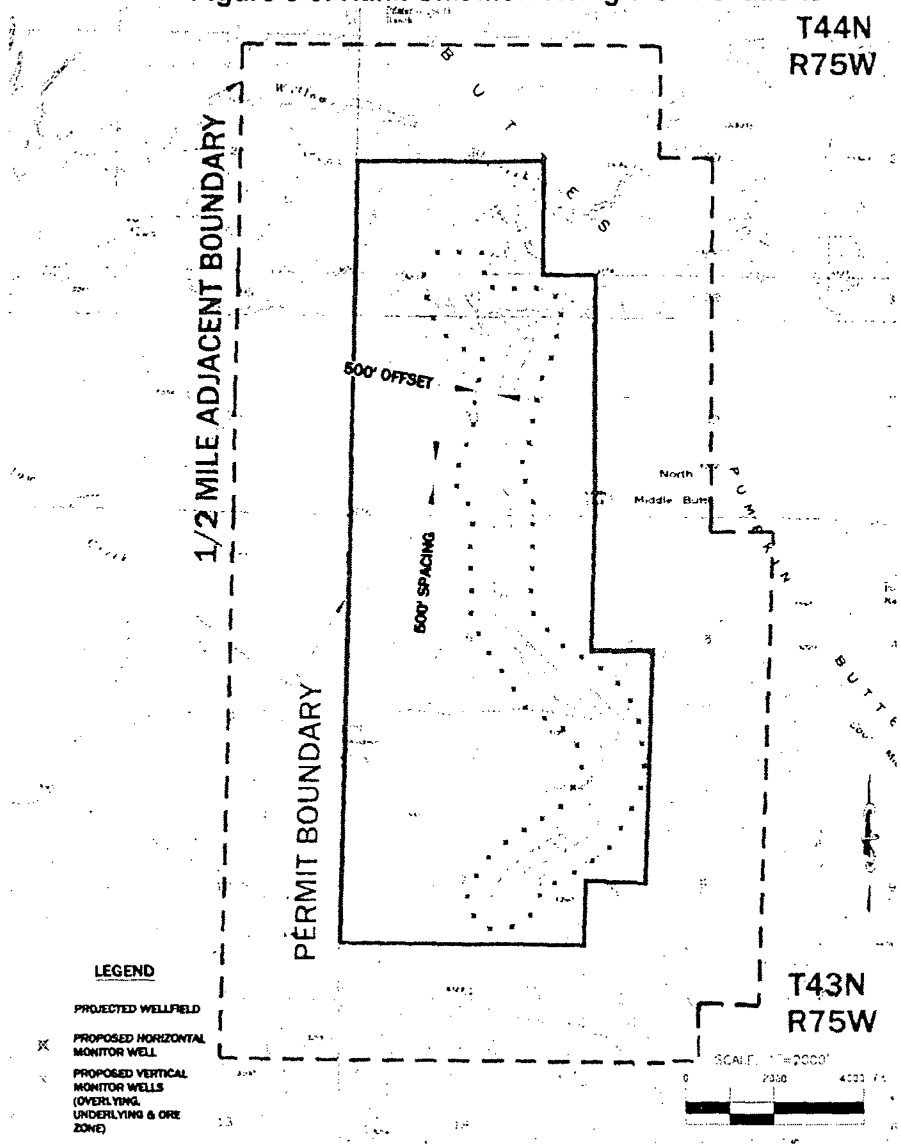


Source: modified from Uranerz, 2007

6.3.1.2 *Groundwater Quality Monitoring*

As discussed in Section 8.3.1.2 of the GEIS, monitoring wells are situated around the well fields, in the aquifers overlying and underlying the ore-bearing production aquifers, and within the well fields for the early detection of potential horizontal and vertical excursions of lixiviants. Monitoring well placement is based on what is known about the nature and extent of the confining layer and the presence of drill holes, hydraulic gradient and aquifer transmissivity, and well abandonment procedures used in the region. The ability of a monitoring well to detect groundwater excursions is influenced by several factors, such as the thickness of the aquifer monitored, the distance between the monitoring wells and the well field, the distance between the adjacent monitoring wells, the frequency of groundwater sampling, and the magnitude of changes in chemical indicator parameters that are monitored to determine whether and

Figure 6-9. Hank Unit Monitoring Well Locations



Source: modified from Uranerz, 2007

excursion has occurred. As a result, the spacing, distribution, and number of monitoring wells at a given ISR facility are site specific and established by license conditions. The factors that control the spacing, distribution and number of monitoring wells are discussed in greater detail in Section 8.3.1.2 of the GEIS.

During operation, the ore zone monitoring wells and the overlying and underlying aquifer monitoring wells would be sampled twice per month at intervals of approximately two weeks. These samples would be analyzed for and compared against the UCL parameters of chloride, total alkalinity, and conductivity. Static water levels would also be noted. Chloride was chosen due to its low natural levels in the native groundwater and because chloride is introduced into the lixiviant from the ion exchange process. Chloride is also a very mobile constituent in groundwater. Conductivity was chosen because it is an indicator of overall groundwater quality. Total alkalinity concentrations should be affected during an excursion as bicarbonate is the major constituent added to the lixiviant.

Uranerz's operational groundwater monitoring program would detect and correct for any condition that could lead to an excursion affecting groundwater quality near the well fields. These excursions can be caused by improper water balance between injection and recovery rates, undetected high permeability strata or geological faults, improperly abandoned exploration of drill holes, discontinuity within the confining layers, poor well integrity, or hydrofracturing of the ore zone or surrounding units. The program would include monitoring process variable such as flow rates and operating pressures of operating wells (injection, production, and monitoring) and the main pipelines going to and from the central processing plant and satellite facility. The monitoring program is required per 10 CFR Part 40 Appendix A, Criterion 7.

Uranerz would adequately maintain all of the analytical data from the monitoring wells and submit the data to the WDEQ quarterly. In addition, Uranerz would maintain copies onsite of all of the analytical data from the monitoring wells in case of an NRC inspection. If an excursion is detected, Uranerz would notify the NRC and WDEQ verbally within 24 hours and in writing within 7 days of a verified excursion. Additional and more frequent sampling may be warranted to confirm that an excursion occurred. Corrective actions such as adjusting the injection and recovery flow rates in the affected area would be implemented as soon as practical and as long as it takes the excursion to be mitigated. Within 60 days of the confirmed excursion, Uranerz would have to file a written report to the NRC describing the event and corrective actions taken.

The final number of monitoring wells and production pattern would be determined during final well field planning and submitted to the WDEQ in the well field package. Uranerz must demonstrate the hydraulic interconnection between the monitoring wells and production pattern, in both the Nichols Ranch and Hank Units, before ISR activities begin. Such a demonstration would be particularly important at the Hank Unit where limited drawdowns due to the unconfined nature of the F Sands may limit the spacing between the production well pattern and the outer monitoring ring. After a proposed well field is found feasible for ISR activities, a Production Area Pump Test is developed and conducted to determine information on the hydrologic characteristics of the production area and the underlying and overlying aquifers within the production zone. Uranerz would submit the test plan to the WDEQ prior to conducting the test. After the test, Uranerz would compile a summary report to submit to the WDEQ and NRC for review and approval.

6.3.2 Well Field and Pipeline Flow and Pressure Monitoring

As indicated in Section 8.3.2 of the GEIS, the operator typically would monitor injection and production well flow rates to manage water balance for the entire well field. Additionally, the pressure of each production well and the production trunk line in each well field header house is monitored. Unexpected losses of pressure may indicate equipment failure, a leak, or a problem with well integrity.

Uranerz's program would include monitoring of the injection well and production well flow rates and pressures at each header house. Individual well flow readings would be recorded during each shift and the overall well field flow rates would be balanced daily. Flow and totalizer data would be transferred to and checked automatically at the central processing plant or satellite facility. The recovery and injection trunk lines would have electronic pressure gauges. Information from these gauges would be monitored from each unit's control room. The control system would have both high and low alarms for pressure and flow. If the pressure and/or flow are out of range, the alarms would sound, alerting personnel to make adjustments. Certain high or low readings would signal automatic shutoffs or shutdowns. Activation of the flow alarms would prompt Uranerz to take corrective actions which include inspections for leaks and spills.

6.3.3 Surface Water Monitoring

Uranerz does not plan on conducting any physiochemical monitoring of surface water. However, NRC evaluates surface water monitoring in detail as part of its review for the Safety Evaluation Report (SER). To ensure the protection of surface water systems, each injection and production well would have a monitoring device that sounds an alarm in the event of a change in flow pressure that might indicate a leak or rupture in the system. In the event of this occurring, the system would be shut down to repair the leak, and actions to remediate the damage caused by a leak would be implemented.

6.3.4 Meteorological Monitoring

Uranerz does not plan on conducting any meteorological monitoring at the site. However, NRC evaluates meteorological monitoring in detail as part of its review for the SER. To describe the affected environment and assess air quality impacts resulting from the proposed project, Uranerz used meteorological data from the Antelope meteorological station located approximately 77 km (48 mi) southeast of the proposed site. The Antelope meteorological station has a similar climate to that of the proposed Nichols Ranch ISR Project site because it is located in an open rolling hill area and elevation.

6.4 Ecological Monitoring

This section describes Uranerz's proposed ecological monitoring program as described in its license application (Uranerz, 2007). As discussed in Section 8.4 of the GEIS, ecological monitoring may include surveys of habitat, species counts, or other measures of the health of endangered, threatened, and sensitive species. Uranerz does not plan on conducting any vegetation monitoring; however, Uranerz is proposing to conduct wildlife monitoring as part of its ecological monitoring program. The results of the baseline vegetation and wildlife studies are discussed in Chapter 3.

6.4.1 Vegetation Monitoring

Uranerz does not plan to conduct any vegetation monitoring. The NRC does not have the authority to mandate vegetation monitoring; it is the responsibility of the WDEQ or BLM, as applicable, to impose any monitoring requirements as a requirement of the reclamation plan or other required programs or procedures.

As mentioned in Chapter 3, only one designated noxious weed species, Canada thistle (*Cirsium avense*) was found during the baseline vegetation studies conducted by Uranerz. The species was found in small numbers in disturbed areas. As mentioned in Chapter 4, Uranerz proposes mitigation by spraying the weed species during all phases of the project and washing vehicles to avoid introduction and spread of the weed species onsite.

6.4.2 Wildlife Monitoring

Uranerz would conduct annual monitoring at the project site during the lifespan of the project, which would include annual raptor and sage-grouse surveys between late April and early May, as required by the WDEQ. During monitoring, Uranerz will record activity at identified raptor nests and record the number of sage-grouse and activity on known leks within a 1.6-km (1-mi) radius of the permit boundary. Any new nests or leks within a 1.6-km (1-mi) radius would also be recorded.

As mentioned in Chapter 3, wildlife inventories conducted by Uranerz for the Nichols Ranch ISR Project identified 10 leks within a 3.2-km (2-mi) radius of the site; however, none of these leks are on the project site. Additionally, 40 raptor nests were found within a 3.2-km (2-mi) radius of the site, of which 10 were determined to be active. No active nests would be affected by well field or plant activities and would be monitored for continued activity. In the unlikely event that Uranerz determines it necessary to disturb a raptor nest, Uranerz would develop a mitigation plan and consult with the WDEQ, the Wyoming Game and Fish Department (WGFD), and the U.S. Fish and Wildlife Service (FWS). At this time, any applicable permits would be obtained from the appropriate agencies.

6.5 References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material."

NRC (U.S. Nuclear Regulatory Commission). 2009. NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*. Washington, DC: June 2009.

NRC (U.S. Nuclear Regulatory Commission). 2003. NUREG-1569, *Standard Review Plan for In-Situ Leach Uranium Extraction License Applications – Final Report*. Washington, DC: June 2003.

NRC (U.S. Nuclear Regulatory Commission). 2002. Regulatory Guide 8.30, *Health Physics Surveys in Uranium Recovery Facilities*, Revision 1. Washington, DC: May 2002.

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NRC (U.S. Nuclear Regulatory Commission). 1980. Regulatory Guide 4.14, *Radiological Effluent and Environmental Monitoring at Uranium Mills*, Revision 1. Washington, DC: April 1980.

Uranerz (Uranerz Energy Corporation). 2007. "Nichols Ranch ISR Project U.S.N.R.C. Source Material License Application," Technical Report and Environmental Report. Casper, Wyoming. Accession Nos. ML080080594. ML083230892. ML091000572. ML090850289. ML090850370. ML090970719. ML090850597. ML090840186. ML090820583. ML091610148. November 2007. Revisions submitted August 2008, November 2008, December 2008, February 2009, March 2009, and May 2009.

WDEQ (Wyoming Department of Environmental Quality). 2005. Guideline No. 8 Hydrology, Coal and Non Coal. March 2005. <http://deq.state.wy.us/lqd/guidelns/Guideline8.pdf> (13 October 2009).

7 COST-BENEFIT ANALYSIS

7.1 Introduction

This chapter summarizes benefits and costs associated with the proposed action and the No-Action alternative. Chapter 4 of this Supplemental Environmental Impact Statement (SEIS) discusses the potential socioeconomic impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Nichols Ranch In-Situ Uranium Recovery (ISR) Project by Uranerz Energy Corporation (Uranerz).

The implementation of the proposed action primarily would generate regional and local benefits and costs. The regional benefits of constructing and operating the proposed Nichols Ranch ISR Project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Campbell County, Wyoming, and the City of Gillette. Other benefits may extend to the neighboring Wyoming counties of Johnson and Natrona. Costs associated with the proposed Nichols Ranch ISR Project are, for the most part, limited to the area surrounding the site. Examples of these environmental impacts would include changes to current land use, water use, and increased road traffic.

7.2 No-Action Alternative

Under the No-Action alternative, the NRC would not approve the license application for the proposed Nichols Ranch ISR Project. The No-Action alternative would result in Uranerz not constructing, operating, restoring the aquifer, or decommissioning the proposed Nichols Ranch ISR Project. No facilities, road, or well fields would be built; no pipeline would be laid as described in Section 2.1.1.2. No uranium would be recovered from the subsurface ore body; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced in the subsurface and no buildings would be constructed to process extracted uranium or store chemicals involved in that process. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. As a result, the proposed site would not be disturbed by the proposed project activities and ecological, natural, and socioeconomic resources would remain unaffected. All potential environmental impacts from the proposed action would be avoided. Similarly, all project-specific socioeconomic impacts (e.g., related to employment, economic activity, population, housing, local finance) would be avoided.

7.3 Benefits from the Proposed Action in Campbell County

Under the proposed action, Uranerz would construct, operate, and decommission and conduct aquifer restoration at the proposed Nichols Ranch ISR Project site in Campbell and Johnson Counties, Wyoming. Construction of the central processing plant, access roads, and initial development of the well fields for the proposed Nichols Ranch ISR Project would take place over nine months to a year. The well fields at the Nichols Ranch Unit would have a six-month period to ramp up to full annual production. Following the Nichols Ranch Unit ramp up, the well fields at the Hank Unit would start a six-month ramp up phase to full annual production (Uranerz, 2007). Uranerz estimates three to four years to extract the uranium from the Nichols Ranch Unit and an estimated four to five years to extract the uranium for the Hank Unit

(Uranerz, 2007). The principal socioeconomic impact or benefit from the proposed Nichols Ranch ISR Project would be a slight increase in the jobs in the region.

The construction and operation of the proposed Nichols Ranch ISR Project is expected to provide jobs to approximately 45 to 55 employees during the life of the project (Uranerz, 2007). It is expected that workers are likely to locate in larger population centers such as Gillette and some may also commute from towns such as Casper and Buffalo. Additionally, some workers may locate in the Town of Wright. If it is assumed that the majority of employment requirements is filled by a workforce from outside the region, assuming a multiplier of about 0.7[8], there could be an influx of 32 to 39 jobs (i.e., 45 jobs x 0.7 = 32 jobs and 55 jobs x 0.7 = 49 jobs).

Based on the current population of the region, the additional jobs resulting from the proposed project would have a MODERATE beneficial impact to the Town of Wright (population of 1,462 [USCB, 2008]) and a SMALL to MODERATE beneficial impact to Campbell County. The influx of these jobs along with the reduction of unemployment should have a MODERATE beneficial impact to the businesses of the town of Wright and a SMALL to MODERATE beneficial impact to the Campbell County businesses.

In addition to job creation, the project's operations 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. Additionally, severance taxes associated with uranium mining in Campbell County are levied by the Mineral Tax Division of the State of Wyoming Department of Revenue. This is a 4% uranium severance tax of taxable market value coming from mining operations (Wyoming Department of Revenue, 2009). Uranerz estimates the uranium (as U_3O_8) content for the Nichols Ranch Unit is 1,145,000 kg (2,521,000 lb) and 841,100 kg (1,852,000 lb) for the Hank Unit (Uranerz, 2007). If Uranerz is able to fully recover this resource and sell it at a nominal market price of $45 per pound of U_3O_8, the severance tax would yield approximately $7,871,400 in net economic benefits over the life of the operation. This figure excludes potential reserve resources and does not include potential benefits derived from taxes on royalties or lease payments to local landowners stemming from the operation of the proposed Nichols Ranch ISR Project.

7.3.1 Benefits from Potential Production

Both the employment generated and the taxes paid by Uranerz would depend on the production of yellowcake. The amount of yellowcake produced would depend on the market price for yellowcake (as U_3O_8) and the cost of production. Since 2007, the spot-market price for U_3O_8 has fluctuated significantly, from a high of over $130 in 2007 to as low as $40 in 2009. As of September 8, 2009, the price was $46 per pound.

The project's potential benefits to the local community depend on Uranerz's operating costs being lower than the future price of U_3O_8. If the price of U_3O_8 is less than the costs of operation, then operations may be suspended and/or discontinued.

7.3.2 Costs to the Local Communities

Table 7-1 identifies the towns within 40 km (25 mi) and and towns within commuting distance from the proposed project site. The table also presents the towns' population and distance from the proposed project site.

[8] The economic multiplier is used to summarize the total impact that can be expected from change in a given economic activity. It is the ratio of total change to initial change. The multiplier of 0.7 was used as a typical employment multiplier for the milling/mining industry (Economic Policy Institute, 2003).

Table 7-1. Towns Near the Nichols Ranch ISR Project

Town	Population	Distance from Project in km (mi)
Towns within 40 km (25 mi) from the project site		
Wright	1,462	35 (22)
Edgerton	176	37 (23)
Midwest	435	40 (25)
Towns greater than 40 km (25 mi) from the project site		
Kaycee	290	56 (35)
Gillette	26,871	74 (46)
Buffalo	4,832	92 (57)
Casper	54,047	98 (61)
Source: USCB, 2008		

As stated in Section 7.3, the proposed project is expected to employ 45 to 55 workers during the period of operations, and if the majority of these workers came from outside the region, there could be an influx of 32 to 39 jobs (using an economic multiplier of 0.7). Given the expectation that workers during operations would tend to relocate closer to the site, these new jobs potentially could involve an influx of 79 to 97 people, based on 2.48 persons per household for the State of Wyoming (USCB, 2000). As stated previously, it is expected that workers are likely to locate in larger population centers such as Gillette, that some may also commute from towns such as Casper and Buffalo, and that some workers may locate in the Town of Wright. Therefore, the influx of these jobs along with the reduction in unemployment would have a MODERATE increase in the economic activity, housing demand, construction of new homes, and increase demand in public services. This would have a MODERATE impact to costs of infrastructure related to population growth in Campbell County.

The local communities would require minimal increase in emergency response and medical treatment capabilities because of the small risk of industrial accident due to the proposed project.

7.4 Evaluation of Findings of the Proposed Nichols Ranch ISR Project

Implementation of the proposed action would have a SMALL to MODERATE overall economic impact on the region of influence. The implementation of the proposed action would generate primarily regional and local benefits and costs. The regional benefits of building the proposed Nichols Ranch ISR Project would be increased employment, economic activity, and tax revenues in the region around the site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Campbell County. Other benefits may extend to neighboring counties in the State of Wyoming. Costs associated with the proposed Nichols Ranch ISR Project are, for the most part, limited to the area surrounding the site and the communities within commuting distance. Table 7-2 summarizes the costs and benefits.

Table 7-2. Summary of Costs and Benefits of the Nichols Ranch ISR Project

Cost- Benefit Category	Proposed Action
BENEFITS	
Capacity Produced	4.3 million pounds of U_3O_8
Other Monetary	$7.9 million (estimated)
Non-Monetary (50% of jobs will be from Campbell County)	45-55 jobs – during construction, operation, aquifer restoration, and decommissioning 32-39 jobs - local jobs from economic multiplier during operation and aquifer restoration
COSTS	
Education Infrastructure	SMALL
Health and Social Services	SMALL
Housing Demand	MODERATE
Emergency Response	SMALL

7.5 References

Economic Policy Institute. 2003. "Updated Employment Multipliers for the U.S. Economy." Washington, DC. August 2003. < http://www.epi.org/page/-/old/workingpapers/epi_wp_268.pdf> (13 October 2009).

NRC (U.S. Nuclear Regulatory Commission). 2009. NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*. Washington, DC: June 2009.

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USCB (U.S. Census Bureau). 2008. 2008 Population Estimates for Wright, Edgerton, Midwest, Kaycee, Gillette, Buffalo, and Casper in Wyoming. <http://factfinder.census.gov> (16 October 2009). ADAMS No. ML092940144.

USCB (U.S. Census Bureau). 2000. State & County Quick Facts for Wyoming. <http://quickfacts.census.gov/qfd/states/56000.html> (13 October 2009). ADAMS No. ML092940077.

Wyoming Department of Revenue. 2009. State of Wyoming Department of Revenue 2009 Annual Report. < http://revenue.state.wy.us/PortalVBVS/uploads/Department%20of%20Revenue%20%2010.29.2009.pdf> (11 November 2009).

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the potential environmental impacts and consequences of the proposed action and reasonable alternatives, including the No-Action alternative. In doing so, the potential impacts and consequences are discussed in terms of (1) the unavoidable adverse environmental impacts, (2) the relationship between local short-term uses of the environment and the maintenance of long-term productivity, and (3) the irreversible and irretrievable commitment of resources. The information is presented for the proposed action and each alternative for the 13 resource areas and discussed by stage of the proposed facility's lifecycle (i.e., construction, operation, aquifer restoration and decommissioning). These conclusions are provided in the tables below.

The U.S. Nuclear Regulatory Commission's (NRC's) NUREG-1748 (NRC, 2003) defines the following terms:

- **Unavoidable adverse environmental impacts**: impacts that cannot be avoided and for which no practical means of mitigation are available;
- **Irreversible**: commitments of environmental resources that cannot be restored;
- **Irretrievable**: applies to material resources and will involve commitments of materials that, when used, cannot be recycled or restored for other uses by practical means;
- **Short-term**: represents the period from pre-construction to the end of the decommissioning activities, and therefore generally affect the present quality of life for the public; and
- **Long-term**: represents the period of time following the termination of the site license, with the potential to affect the quality of life for future generations.

As discussed in Chapter 4, the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeable alter any important attribute of the resource;

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

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

These alternatives and their environmental impacts are summarized as follows:

8.1 Proposed Action (Alternative 1)

Uranerz Energy Corporation (Uranerz) is seeking an NRC source material license for the construction, operation, aquifer restoration, and decommissioning of facilities for in-situ recovery (ISR) uranium milling and processing at the proposed Nichols Ranch ISR Project site as proposed in the license application and related submittals.

The potential environmental impacts of this alternative are summarized in Table 8-1.

8.2 No-Action (Alternative 2)

Uranerz would not construct and operate ISR facilities related to the proposed Nichols Ranch ISR Project. As a result, no uranium ore would be recovered from this site under the Uranerz license application. Alternative 2 would result in no impacts to any of the 13 resources areas. Therefore, no unavoidable adverse environmental impacts would occur, no relationship between local short-term uses of the environment and the maintenance of long-term productivity irreversible or irretrievable commitments would result, and there would be no irreversible and irretrievable commitment of resources.

8.3 Modified Action – No Hank Unit (Alternative 3)

Uranerz would construct and operate facilities for ISR uranium milling and processing as proposed by Uranerz, but only for the Nichols Ranch Unit and not the Hank Unit. The potential environmental impacts for Alternative 3 on each of the 13 resource areas are similar to, or smaller than, the impacts from Alternative 1 (summarized in Table 8-1). A smaller area of land would be disturbed, which would remove any impact to geology and soils or ecological resources at the Hank Unit. Generally, less equipment and workers would be needed, which would reduce impacts to transportation, air quality, noise, visual/scenic resources, and socioeconomics. Three identified archaeological sites (48CA6146/6147, 48CA6148, and 48CA6927), which are located on top or between the ore body and within areas for proposed monitoring wells, would not be affected if the Hank Unit was not licensed. Impacts to the Pumpkin Buttes Traditional Cultural Property (TCP), though they would be mitigated with measures such as those described in the Pumpkin Buttes Programmatic Agreement (PA) (BLM, 2009) for Alternative 1, would be virtually removed in Alternative 3.

Table 8-1. Summary of Environmental Consequences of the Proposed Action

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Land Use **4.2.1**	During construction, there would be a SMALL impact from use of earth-moving equipment, removal of topsoil, grading and clearing of land to create access roads, and creation of wells. Impacts during other phases would be similar.	During all phases, there would be a SMALL commitment of energy resources and water resources to project activities.	During all phases, there would be a SMALL impact from temporary alteration of rangeland leases, and short-term restricted access to neighboring lands. During decommissioning, there would be a SMALL impact from land disturbances from earth-moving equipment, re-grading, and reseeding of land.	During all phases, there would be a SMALL long-term impact from altered land contouring. During decommissioning, wells, though abandoned, would remain on the site.

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Transportation **4.3.1**	During all phases, there would be a SMALL increase in local traffic counts and dust and noise associated with project-related traffic	Not applicable	During all phases, there would be a SMALL increased risk of chemical spills.	Because no project-related transportation impacts would persist after the life of the project, no long-term impacts would result.
Geology and Soils **4.4.1**	During construction, disturbance of soil would cause SMALL impacts. Temporary contamination or alteration of soils during other project phases would result in SMALL impacts.	During all phases, disturbance to the soil layers would be irreversible, though SMALL. Reseeding and contouring would mitigate this impact.	During construction, disturbance of soil would cause SMALL impacts. Temporary contamination or alteration of soils during other project phases would result in SMALL impacts.	Because the proposed project area would be returned to its original condition during decommissioning, no long-term impacts to geology and soils are expected.
Surface Waters and Wetlands **4.5.1.1**	During all phases, erosion, runoff, and fuel or chemical leaks would cause SMALL impacts.	Not applicable	During all phases, changes in stream flow from altered gradients and infiltration of drilling fluids into aquifers would result in SMALL impacts.	During all phases, changes in stream flow from altered gradients would result in SMALL impacts.
Groundwater **4.5.2.1**	Groundwater would be impacted from ISR operations by consumption of groundwater and degradation of water quality in the production zone.	During the operations, most groundwater would be treated and re-injected via the deep injection wells. However, 1 to 3 percent of the groundwater would be consumed. Stock wells in the area may be affected by drawdown from the aquifer, particularly during operation and restoration.	Short-term impacts to groundwater would include degradation of water quality in the production zone during operations and the potential drawdown in private wells completed in the same aquifer as the production zone.	Because restoration standards would have to be met and be protective of human health and safety, no long-term impacts to adjacent aquifers are expected.

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Ecological Resources **4.6.1**	During construction, removal of vegetation and clearing of land, possible introduction of invasive species, and displacement of wildlife species would result in SMALL impacts. During all other phases, limited access of wildlife to wintering habitat would result in SMALL impacts.	Not applicable	Impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL. Reseeding after decommissioning would restore native vegetation.	During all phases, altered wildlife patterns and changes to the vegetative community would result in SMALL impacts.
Air Quality **4.7.1**	During all phases, fugitive dust and vehicle emissions would result in SMALL impacts.	Not applicable	During all phases, impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL.	Because emissions are expected to be SMALL, no long-term impacts are expected.
Noise **4.8.1**	During construction, noise levels would be elevated on and in the vicinity of the site, but would result in SMALL impacts. During other phases, noise levels would be elevated, but to a lesser extent than during construction.	Not applicable	During all phases, impacts would be similar to those described as unavoidable adverse environmental impacts and SMALL.	Because noise impacts would not persist past the life of the project, no long-term impacts would result.

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Historical, Cultural, and Paleontological Resources **4.9.1**	During construction, potential disturbance of archaeological sites could result in MODERATE impacts unless mitigated.	If archaeological sites are not avoided during construction, this would result in an irreversible and irretrievable commitment of resources and could result in MODERATE to LARGE impacts.	During all phases, restricted access to the Pumpkin Buttes TCP and other historical sites would be short-term and would result in a SMALL impact.	If potential impacts from construction activities are not mitigated, then long-term MODERATE to LARGE impacts to archaeological sites would likely result.
Visual and Scenic Resources **4.10.1**	During construction, visual impacts from equipment and dust/diesel emissions could result in a MODERATE impact. Impacts to the Pumpkin Buttes TCP would be mitigated.	Not applicable	During all phases, all impacts associated with visual/scenic resources would be short-term.	Because project area would be returned to its original condition after during decommissioning, no long-term impacts would result.
Socioeconomics **4.11.1**	During operation, increased demand for housing may increase housing costs in the local area and would result in a MODERATE impact. During all phases, increased demand for education and health and social services could put a strain on these resources and would result in a SMALL impact.	Not applicable	During all phases, increased demand for housing, educational services, and health and social services would result in a short-term and SMALL impact.	No long-term socioeconomic impacts are expected.
Environmental Justice **4.12.1**	Not applicable(1)	Not applicable(1)	Not applicable(1)	Not applicable(1)

Impact Category	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term impacts and uses of the environment	Long-term impacts and the maintenance and enhancement of productivity
Public and Occupational Health **4.13.1**	During all phases, the radiological and non-radiological impacts would be SMALL. Construction activities could disturb the topsoil and create fugitive dust; however, the impacts are small because radionuclide concentrations in the soils are low. Public and occupational exposure rates at ISR facilities during normal operations are historically well below regulatory limits	Not applicable	During all phases, all impacts associated with public and occupational health would represent a short-term and SMALL impact.	No long-term public and occupational health impacts are expected.
Waste Management **4.13.1**	During all phases, generation of low volumes of wastes would result in a SMALL impact. Construction wastes would be mostly solids, operations wastes would include solids and liquids (brine, plant washdown water, and others), and decommissioning wastes would include some radioactive wastes.	During all phases, energy and space used to properly handle and dispose of all types of waste would represent an irretrievable commitment of resources resulting in a SMALL impact.	During all phases, hazards associated with handling and transport of wastes would represent a short-term and SMALL impact.	During all phases, permanent disposal or storage of wastes would represent a long-term and SMALL impact.

(1) Section 4.12.1 of this SEIS concluded that there are no disproportionately high and adverse impacts to minority or low-income populations from the proposed Nichols Ranch ISR Project..

8.4 References

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9 LIST OF PREPARERS

This section documents all individuals who were involved with the preparation of this draft Supplemental Environmental Impact Statement (SEIS). Contributors include staff from the U.S. Nuclear Regulatory Commission (NRC) and consultants. Each individual's role, education, and experience are outlined below.

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The Clark Group, LLC

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10 DISTRIBUTION LIST

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Michael Thomas

Uranerz Energy Corporation
Casper, WY

Pam Viviano

Ranchers & Neighbors Protecting Our Water
Sheridan, WY

APPENDIX A

Consultation Correspondence

A. Consultation Correspondence

The *Endangered Species Act of 1973*, as amended, and the *National Historic Preservation Act of 1966* require that federal agencies consult with applicable state and federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historical and archaeological resources, respectively. This appendix contains consultation documentation related to these federal acts.

Table A-1. Chronology of Consultation Correspondence

Author	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming State Historic Preservation Office (M. Hopkins)	July 1, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	U.S. Fish and Wildlife Service (B. Kelly)	July 3, 2008
Wyoming State Parks and Cultural Resources (R. Currit)	U.S. Nuclear Regulatory Commission (G. Suber)	July 25, 2008
U.S. Fish and Wildlife Service (B. Kelly)	U.S. Nuclear Regulatory Commission (G. Suber)	August 15, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming Game and Fish Department (T. Christiansen)	October 29, 2008
Wyoming Game and Fish Department (T. Christiansen)	U.S. Nuclear Regulatory Commission (I. Yu)	November 3, 2008*
Northern Cheyenne Tribal Historic Preservation Office (C. Fisher)	U.S. Nuclear Regulatory Commission (I. Yu)	February 12, 2009
U.S. Nuclear Regulatory Commission (I. Yu, B. Shroff, and A. Bjornsen)	U.S. Nuclear Regulatory Commission (A. Kock)	March 2, 2009
U.S. Nuclear Regulatory Commission (A. Kock)	Advisory Council on Historic Preservation (C. Vaughn)	August 24, 2009
U.S. Nuclear Regulatory Commission (A. Kock)	Wyoming State Historic Preservation Office (M. Hopkins)	August 26, 2009
U.S. Nuclear Regulatory Commission (B. Balsam and I. Yu)	File (teleconference summary of phone call with U.S. Fish and Wildlife Service [P. Ramirez])	November 10, 2009

*This correspondence is non-public due to sensitive information on sage-grouse.

July 1, 2008

Ms. Mary Hopkins
State Historic Preservation Officer
Wyoming State Historic Preservation Office
Department of State Parks
& Cultural Resources
2301 Central Avenue, Barrett Building
3rd Floor
Cheyenne, Wyoming 82002

SUBJECT: INITIATION OF SECTION 106 PROCESS FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT LICENSE REQUEST (Docket 040-09067)

Dear Ms. Hopkins:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* leach operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently licensed *in-situ* leach facilities, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an environmental assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural resources. To support the environmental review, the NRC is requesting information from the State Historical Preservation Officer to facilitate the identification of historic and cultural resources that may be affected by the Nichols Ranch Uranium Recovery Project license application. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all the information collected, the NRC will prepare a draft EA and will provide your office an opportunity to comment.

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents

M. Hopkins - 2 -

access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Ms. Kellee Jamerson of my staff by telephone at 301-415-7649 or by email at kellee.jamerson@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure:
Uranerz Energy Corporation Figure 1-4

1

July 3, 2008

Brian T. Kelly, Field Supervisor
U.S. Fish and Wildlife Service
Mountain-Prairie Region
Wyoming Field Office
5353 Yellowstone Road
Cheyenne, WY 82009

SUBJECT: REQUEST FOR INFORMATION REGARDING ENDANGERED OR THREATENED SPECIES AND CRITICAL HABITAT FOR THE PROPOSED LICENSE APPLICATION FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT (Docket 040-09067)

Dear Mr. Kelly:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently-licensed *in-situ* recovery projects, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an environmental assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 7 of the Endangered Species Act, the EA will include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC is requesting information from the U.S. Fish and Wildlife Service to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is

1

B. Kelly - 2 -

accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the US Nuclear Regulatory Commission, Attention: Mr. Gregory Suber, Mail Stop T8F05, Washington, DC 20555. If you have any questions, please contact Ms. Kellee Jamerson of my staff by telephone at 301-415-7649 or by email at kellee.jamerson@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure: Uranerz Energy Corporation Figure 1-4

1

ARTS. PARKS. HISTORY.
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July 25, 2008

Mr. Gregory Suber
U.S. Nuclear Regulatory Commission
Mail Stop T-8F05
Washington, DC 20555

re: Uranerz Energy Corporation, Nichols Ranch Uranium Recovery Project License Request (Docket 040-09067) (SHPO File # 0708RLC009)

Dear Mr. Suber:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project.

A search of our records shows that a cultural resource survey has not been conducted for the entire area of potential effect. Following 36 CFR Part 800, and prior to any ground disturbing activities, we recommend the U.S. Nuclear Regulatory Commission carry out appropriate efforts necessary for identification of historic properties, which may include a file search, background research, consultation, consideration of visual effects, sample field investigations or field survey. The identification efforts must be conducted by a consultant meeting the Secretary of the Interior's Professional Qualification Standards (48 FR 22716, Sept. 1983). A report detailing the results of these efforts must be provided to SHPO staff for our review and comment.

Also be aware that National Register of Historic Places eligible site 48CA268, the Pumpkin Buttes Traditional Cultural Property (TCP), is of interest to numerous Native American tribes. Consultation with the tribes regarding the effects of this project on this TCP, as well as any needed mitigation will be required.

We have enclosed a copy of a cultural resource consultants list for your use. Please refer to SHPO project control number #0708RLC009 on any future correspondence dealing with this project. If you have any questions, please contactme at 307-777-5497.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

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WYOMING SHPO
CULTURAL RESOURCE CONSULTANTS
2008

The Wyoming State Historic Preservation Office (SHPO) does not permit or license consultants and makes no endorsement of any particular consultant.

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OCT-09-2008 THU 07:56 AM USFWS FAX NO. 3077722358 P. 02

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

AUG 15 2008

In Reply Refer To:
ES-61411/W.26/WY08SL0251

Gregory F. Suber, Branch Chief
US Nuclear Regulatory Commission
Mail Stop T8F05
Washington, District of Columbia 20555

Dear Mr. Suber:

Thank you for your letter (Docket No.: 040-09067) of July 3, received in our office on July 11, regarding the Nichols Ranch Uranium Recovery Project.

This project is for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an in-situ recovery operation) located in Campbell and Johnson Counties, Wyoming. The proposed project will include two areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West, Sections 30 and 31, and Township 43 North, Range 75 West, Section 5, 6, 7, and 8.

You have requested information regarding species listed under the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). In response to your request, the U.S. Fish and Wildlife Service (Service) is providing you with recommendations for protective measures for threatened and endangered species in accordance with the Act. We are also providing recommendations concerning migratory birds in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j".

In accordance with Section 7(c) of the Act, we have determined that the following species or their designated habitat may be present in the proposed project area. We would appreciate receiving information as to the current status of each of these species within the proposed project area.

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Listed, Proposed, Candidate Species and their Designated and Proposed Critical Habitat that may be in the proposed Project Area

SPECIES	STATUS	Expected Occurrence
Black-footed ferret (*Mustela nigripes*)	Endangered	Prairie dog towns
Blowout Penstemon (*Penstemon haydenii*)	Endangered	Sand dunes
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000 feet

Black-footed ferret: Black-footed ferrets (*Mustela nigripes*) may be affected if prairie dog towns are impacted. Please be aware that black-footed ferret surveys are no longer recommended in black-tailed prairie dog towns statewide. If white-tailed prairie dog towns or complexes greater than 200 acres will be disturbed, surveys for ferrets may be recommended in order to determine if the action will result in an adverse effect to the species. Surveys are recommended even if only a portion of the white-tailed prairie dog town or complex. According to the Black-Footed Ferret Survey Guidelines (USFWS 1989), a prairie dog complex consists of *two or more neighboring prairie dog towns less than 7 km (4.3 miles) from each other.* If a field check indicates that white-tailed prairie dog towns or complexes may be affected, you should contact this office for guidance on ferret surveys. We encourage project proponents to protect all prairie dog towns or complexes for their value to the prairie ecosystem and the many species that rely on them. We further encourage you to analyze potentially disturbed prairie dog towns for their value to future black-footed ferret reintroduction.

Blowout penstemon: Blowout penstemon (*Penstemon haydenii*) is a perennial herb with stems less than 12 inches tall. The inflorescence is 2-6 inches long and has 6-10 compact whorls of milky-blue to pale lavender flowers. Blowout penstemon was listed as endangered on October 1 1987. The plant's current known range in Wyoming consists of the Ferris dunes area in northwest Carbon County where the plant is restricted to two habitat types: steep, northwest facing slopes of active sand dunes with less than 5 percent vegetative cover; and on north facing sandy slopes, on the lee side of active blowouts with 25-40 percent vegetative cover. Recent surveys have indicated that systematic surveys are warranted in all lower elevations (below 6700 feet) in Wyoming where sand blowout features are located.

Blowouts are formed as strong winds deposit sands from the windward side of a dune to the leeward side and result in a sparsely vegetated crater-like depression. Associated vegetation includes blowout grass, thickspike wheatgrass, lemon scurfpea, Indian ricegrass and western wheatgrass. Threats to the plant occur when sand dunes are removed or overly disturbed by vehicular traffic. Known populations in Wyoming are found between 6680-7440 feet (Fertig 2001). However, recent surveys by Blomquist and Heidel (June 2002) indicate that surveys may be warranted in some lower elevations where active sand blowout features occur. Surveys should be conducted from mid-June to early-July when flowering occurs by knowledgeable botanists trained in conducting rare plant surveys. The Service does not maintain a list of "qualified" surveyors, but we can refer those wishing to become familiar with the blowout penstemon to experts who can provide training/services.

Ute ladies'-tresses: Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens. The Service does not maintain a list of "qualified" surveyors but can refer those wishing to become familiar with the orchid to experts who can provide training or services.

Species of Concern

Greater sage-grouse: The Service is currently conducting a review to determine if the greater sage-grouse (*Centrocercus urophasianus*) warrants listing. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations rangewide (Braun 1998, Wisdom et al. 2002). Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting or brood rearing habitat) is present in the project area, the Service recommends no project-related disturbance March 1 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage- grouse persistence within these areas. Likewise, if important winter habitats are present, we recommend no project-related disturbance November 15 through March 14.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the project area, and appropriate mitigative measures to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning, to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats.

Migratory Birds: The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it

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shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken. Removal or destruction of such nests, or causing abandonment of a nest could constitute violation of one or both of the above statutes. Removal of any active migratory bird nest or nest tree is prohibited. For golden eagles, inactive nest permits are limited to activities involving resource extraction or human health and safety. Mitigation, as determined by the local Service field office, may be required for loss of these nests. No permits will be issued for an active nest of any migratory bird species, unless removal of an active nest is necessary for reasons of human health and safety. Therefore, if nesting migratory birds are present on, or near the project area, timing is a significant consideration and needs to be addressed in project planning.

If nest manipulation is proposed for this project, the project proponent should contact the Service's Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for this project. No nest manipulation is allowed without a permit. If a permit cannot be issued, the project may need to be modified to ensure take of a migratory bird or eagle, their young, eggs or nest will not occur.

Wetlands/Riparian Areas: Wetlands may be impacted by the proposed project. Wetlands perform significant ecological functions which include: (1) providing habitat for numerous aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

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Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

***In situ* Uranium Mining**

High selenium concentrations can occur in wastewater from in situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of a grassland irrigated with wastewater from an *in situ* uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the *in situ* wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving *in situ* wastewater. Waterborne selenium concentrations ≥ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994), which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 µg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 µg/L.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and streambanks.

For our internal tracking purposes, the Service would appreciate notification of any decision made on this project (such as issuance of a permit or signing of a Record of Decision or Decision Memo). Notification can be sent in writing to the letterhead address or by electronic mail to FW6_Federal_Activities_Cheyenne@fws.gov.

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act and/or other authorities or resources described above, please contact Pedro Ramirez of my office at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,

Scott Hicks

for Brian T. Kelly
Field Supervisor
Wyoming Field Office

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (V. Stelter)

Literature Cited

Boon, D.Y. 1989. Potential selenium problems in Great Plains soils. In L.W. Jacobs, ed. Selenium in agriculture and the environment. American Society of Agronomy, Inc, and Soil Science Society of America. SSSA Special Pub. No. 23. Madison, WI. pp: 107-121.

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Skorupa, J.P., and H.M. Ohlendorf. 1991. Contaminants in drainage water and avian risk thresholds. Pages 345-368 *in* A. Dinar and D. Zilberman (eds.). The economics and management of water and drainage in agriculture. Kluwer Academic Publishers, Boston, MA.

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October 29, 2008

Tom Christiansen
Sage Grouse Coordinator
Wyoming Game and Fish Department
Green River Field Office
351 Astle Avenue
Green River, WY 82935

SUBJECT: REQUEST FOR INFORMATION REGARDING SAGE GROUSE HABITATS FOR THE PROPOSED LICENSE APPLICATION FOR URANERZ ENERGY CORPORATION'S NICHOLS RANCH URANIUM RECOVERY PROJECT (Docket 040-09067)

Dear Mr. Christiansen:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranerz Energy Corporation for a new radioactive source materials license to develop and operate the Nichols Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell and Johnson Counties, WY. The proposed project will consist of two project areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20 and 2) the Hank Satellite Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the main uranium processing facility with the Hank Satellite Unit being a satellite operation. The location of the Nichols Ranch project is within 5 miles of two currently-licensed *in-situ* recovery projects, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. A map showing the proposed project location is enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 7 of the Endangered Species Act, the EA will include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area. To support the environmental review, the NRC requested information from the U.S. Fish and Wildlife Service (FWS) to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. According to a letter sent to the NRC from the FWS dated August 1, 2008, the FWS indicated that they are currently conducting a review to determine if the greater sage-grouse warrants listing and that you may have more information on the greater sage-grouse habitats within the project area and appropriate mitigative measures to minimize potential impacts to the species. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

T. Christiansen - 2 -

The Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML080080594.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission, Attention: Mr. Gregory F. Suber, Mail Stop T8F05, Washington, DC 20555. If you have any questions, please contact Ms. Irene Yu of my staff by telephone at 301-415-1951 or by email at Irene.Yu@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection and
Performance Assessment Directorate
Division of Waste Management and
Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09067

Enclosure: Uranerz Energy Corporation Figure 1-4

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From: Conrad Fisher [conrad.fisher@cheyennenation.com]
Sent: Thursday, February 12, 2009 4:20 PM
To: Irene Yu
Subject: RE: Nichols Ranch consultation letter

Dear Ms. Yu:

First, thank you for contacting our office on the Proposed license application for Uranerz Energy Corporation's Nichols Ranch Uranium Recovery Project in Campbell and Johnson counties, Wyoming (Docket No. 040-09067). Second, Northern Cheyenne Tribal Historic Preservation Office is concerned with number of issues. Third, Pumpkin buttes are considered spiritual and ceremonial areas that have tangible evidence of various activities and natural resources used or those activities. Also, the idea of having such energy development close to the buttes may have an affect on the integrity of the buttes. Contaminants from extraction, traffic, noise and dust pollution may effect the overall condition of the area.

Having such a development can do irreparable harm to the Pumpkin buttes. I would like to see a plan that would minimize impact to this area.

Conrad Fisher
Northern Cheyenne Tribal Historic Preservation Office

From: Irene Yu [mailto:Irene.Yu@nrc.gov]
Sent: Tuesday, February 10, 2009 10:53 AM
To: conrad.fisher@cheyennenation.com
Subject: Nichols Ranch consultation letter

Hi Mr. Fisher,

Thanks for talking to me earlier. Per our conversation, attached is the consultation letter I sent to you and Mr. Spang back in December 2008. As you can see from the letter, the same letter was sent to points of contact at 8 other tribes. If you could please let me know if you have any comments, that would be very helpful for me. Thanks.

Irene W Yu
U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs
Division of Waste Management and Environmental Protection
301-415-1951

E-mail Properties

Mail Envelope Properties (20090212211 9.n1CLJwei007974)
Subject: RE: Nichols Ranch consultation letter
Sent Date: 2/12/2009 4:20:00 PM
Received Date: 2/12/2009 4:20:00 PM
From: Conrad Fisher
Created By: conrad.fisher@cheyennenation.com
Recipients: Irene.Yu@nrc.gov (Irene Yu)
Tracking Status: None
Post Office: omr15.networksolutionsemail.com

Files	Size	Date & Time
MESSAGE	16928	2/12/2009

Options
Expiration Date:
Priority: olImportanceNormal
ReplyRequested: False
Return Notification: False
Sensitivity: olNormal
1 Recipients received:

March 2, 2009

MEMORANDUM TO: Andrea Kock, Chief
Environmental Review Branch
EPPAD/DWMEP/FSME

FROM: Irene W. Yu, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Behram Shroff, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Alan Bjornsen, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

SUBJECT: INFORMAL MEETINGS WITH LOCAL, STATE, AND FEDERAL AGENCIES IN WYOMING REGARDING THE ENVIRONMENTAL REVIEWS BEING CONDUCTED ON THE MOORE RANCH, NICHOLS RANCH, AND LOST CREEK IN-SITU LEACH APPLICATIONS FOR SOURCE MATERIAL LICENSES (DOCKET NOS. 040-09073, 040-09067, 040-09068, RESPECTIVELY)

During the week of January 12, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff and their contractor staff informally met with various local, state, and federal agencies in Wyoming regarding the environmental reviews being conducted on the Moore Ranch, Nichols Ranch, and Lost Creek In-Situ Leach (ISL) applications for Source Material Licenses. The purpose of these meetings was to discuss any comments or concerns they may have on these projects and to better understand the agency's procedures and regulations and how they fit in with NRC's obligations under the National Environmental Policy Act (NEPA). The following is a summary of each meeting and a list of participants.

CONTACT: Irene Yu, DWMEP/FSME
(301) 415-1951

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A. Kock - 2 -

State Historic Preservation Office (SHPO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

Regarding the Nichols Ranch Project, we discussed the proximity to the Pumpkin Buttes, which is designated as a Traditional Cultural Property, and the tribal interest in the Pumpkin Buttes. The SHPO is currently working on a programmatic agreement (PA) with the Bureau of Land Management (BLM) pertaining to the Pumpkin Buttes. We discussed potential best management practices (BMPs) and mitigation strategies to be included in the PA such as painting the buildings a certain color to mitigate the visual effect, keeping the buildings a low profile, and adding a public education component. Regarding the Lost Creek Project, we discussed the presence of tribal artifacts with cultural significance in the nearby town of Bairoil. We also discussed the potential presence of paleontological artifacts in the Great Divide Basin because it was at one time covered with water. The mitigation strategies discussed included data recovery (where a discovery plan would be needed) and a public education component. No tribal concerns were discussed for the Moore Ranch Project. For all three projects, we discussed cumulative impacts and the importance of assessing the impacts of ISL in addition to those for coal-bed methane (CBM), oil and gas (O&G), wind, and/or coal, which are all actively underway in Wyoming. We also discussed the Section 106 process and verified NRC's responsibilities and process to submit the cultural resources information to the SHPO.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Richard Currit, SHPO

Follow-up Items

NRC to talk to BLM about how they want to comment when BLM lands are involved in the Section 106 process. NRC spoke to BLM following the trip about how they want to comment when BLM lands are involved in the Section 106 process. NRC will provide BLM with a copy of the complete cultural resources section of the application for discussion and concurrence prior to submitting the information to the SHPO.

State Engineer's Office (SEO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

We discussed the importance of the ISL wells being constructed well to prevent cross-contamination between aquifers and that the applicant's provide adequate means for the closure of these wells once the facilities are decommissioned so as not to leave a conduit for cross-contamination. We discussed the differences in the roles and responsibilities of the SEO (focused on water quantity) and of the Department of Environmental Quality (DEQ, focused on water quality). The SEO is responsible for well permitting, which is typically done in permit blocks which allow for a certain number of wells to be constructed within a certain tract of acres. The SEO also issues permits for stormwater management impoundments.

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Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
John Harju, SEO
Harry Labonde, SEO

Follow-up Items

None

Bureau of Land Management State Office, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

NRC staff provided an overview of how and why the draft Memorandum of Understanding (MOU) between NRC headquarters and BLM headquarters was developed and the current status of the draft MOU. Having not reviewed the draft MOU, BLM staff expressed their interest in reviewing the MOU and having the MOU signed at the state level instead of at the headquarter level. BLM has an MOU in place with the DEQ and briefly explained how the MOU specifies the roles and responsibilities of each agency and the points of contact. BLM staff provided NRC staff with a copy of their MOU with DEQ and a copy of the new Department of Interior regulations on implementing NEPA to help NRC in their development of an MOU with BLM. BLM staff also stressed the importance of increased communication between them and the NRC. We discussed both BLM and NRC's NEPA responsibilities for the three ISL projects and whether an environmental assessment (EA) or an environmental impact statement (EIS) is more appropriate. BLM staff sees the main issues with ISL to be related to groundwater quality and cumulative impacts. Specifically, they raised the concern of the possible conflict between the reducing nature of CBM and the oxidizing nature of ISL.

Meeting Participants

Patrice Bubar, NRC (via phone)
Irene Yu, NRC
Nancy Barker, VHB
Larry Claypool, BLM
Ed Heffern, BLM
Larry Jensen, BLM
Bob Janssen, BLM
Janet Kurman, BLM
Pam Stiles, BLM

Follow-up Items

NRC to continue to pursue an MOU with BLM.

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Department of Environmental Quality, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

DEQ staff stressed the importance of increased communication between them and the NRC and requested the development of an MOU with the NRC. Since the DEQ issues the permits for the underground injection wells and the aquifer exemption related to ISL, we discussed in great detail DEQ's requirements from the applicant and the issues they have seen thus far in their review of the three project applications. DEQ Land Quality Division staff will coordinate the comments from all other DEQ divisions for their review of NRC's environmental documents. DEQ Water Quality Division staff provided background on the stormwater and groundwater concerns. Specifically, we discussed the different classes of injection wells and which ones apply to ISL facilities, the construction of wells and how important the construction is to minimizing cross-contamination between aquifers, the viability of ISL in an unconfined aquifer, and groundwater restoration. DEQ Air Quality Division staff provided information on air quality issues in the state. DEQ Industrial Siting Division staff provided information related to the sage grouse core areas and provided NRC with a map showing those areas. DEQ Solid and Hazardous Waste Division staff provided background on radioactive/hazardous waste disposal in the state. Regarding the Lost Creek Project, we discussed the need for increased federal and state agency interaction because the site consists primarily of federal lands. Also, DEQ staff raised some wildlife concerns as the Lost Creek Project site is located near a sage grouse core area.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Carl Anderson, DEQ Solid & Hazardous Waste Division
Mark Conrad, DEQ Water Quality Division
John Corra, DEQ Administration Division
Kevin Frederick, DEQ Water Quality Division
Andrew Keyfaurer, DEQ Air Quality Division
Brian Lovett, DEQ Water Quality Division
Don McKenzie, DEQ Land Quality Division
Darla Potter, DEQ Air Quality Division
Barb Sahl, DEQ Water Quality Division
Chad Schlichtemeier, DEQ Air Quality Division
Tom Schroeder, DEQ Industrial Siting Division
Paige Smith, DEQ Air Quality Division
Lowell Spackman, DEQ Land Quality Division
Ed Heffern, BLM

Follow-up Items

NRC to discuss internally on possible MOU with DEQ. Internal discussions have been held and a call is scheduled with DEQ to discuss this request.

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A. Kock -5-

Governor's Planning Office (GPO), Cheyenne, Wyoming – January 13, 2009

Meeting Summary

GPO staff provided an overview of their assistance to several BLM field offices in updating their Resource Management Plans. In addition, we discussed the location of sage grouse core areas and sage grouse conservation initiatives that are being developed or are already underway.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Tom Blickensderfer, GPO

Follow-up Items

None

Bureau of Land Management Field Office, Rawlins, Wyoming – January 13, 2009

Meeting Summary

The status of the Draft Generic EIS for environmental reviews for ISL facilities (GEIS) and the MOU were discussed. It was explained that the NRC would be the lead agency because of their regulation over milling (not mining) operations. The BLM inquired whether the DEQ should be a cooperating agency. The BLM indicated the state has created an MOU format for federal agencies. Typically, an MOU is made with the state and separate agencies are assigned, as applicable. Shirley Basin & Red Desert, where the Lost Creek site is located, has been extensively explored. The effects of ISLs on freshwater aquifers are critical and applicants need to show that leaching will not occur between aquifers. The Cheyenne Office of the DEQ (Steve Engle-hydrologist) will scrutinize the Lost Creek EA for groundwater issues. The Battle Springs aquifer is a major aquifer in the area. ISLs operate under BLM mining laws and these laws address land use issues. A Plan of Operations will be required by BLM for the Lost Creek site. Currently, they are functioning (exploring) under a Notice (<5 acres of disturbance). An issue of concern is fencing. If fencing of the site is proposed, there are public access issues and wild horse routes that may be impacted. In addition, applicants (ISL operators) need to address effects of their ISL operation on grazing leases. The U.S. Fish & Wildlife Service (FWS) recommends that standard BMPs be used. Their principal concerns are for cattle and raptors. Netting would be required over waste ponds, and over mud pits. The BLM plans on meeting with UR-Energy (applicant) on January 27th on the Lost Creek site.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Mark Newman, BLM
Clare Miller, BLM
Patrick Madigan, BLM
Travis Sanderson, FWS

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A. Kock -6-

Follow-up Items

NRC to keep BLM Field Offices up to date on status of MOU; BLM to send Environet a copy of the Land Status Map for Wyoming.

Bureau of Land Management Casper Field Office, Casper, Wyoming – January 13, 2009

Meeting Summary

Topics discussed included cumulative impacts, existing coal-related analyses, and hydrology at ISL sites. Specifically, with regards to cumulative impacts, BLM, U.S. Environmental Protection Agency (EPA), and DEQ cooperated on a study of the effects of coal, O&G, CBM, uranium, and wind development in the Powder River Basin. There are several existing coal-related analyses: five coal-related EISs either final or in progress (West Antelope, Wright, and three physical groupings: North, Middle, and South Pods). Chapter 4 in these EISs was recommended as a good resource for NRC's cumulative impacts analysis. Another EIS with good information on cumulative impacts was for Pacific Corporation/Rocky Mountain Corporation's Wind Farm in the northeastern part of the state. BLM's concerns with respect to ISL impacts were about the cross-contamination of groundwater between CBM and ISL and whether NRC was going to require groundwater monitoring. BLM is working on a reliable groundwater model for ISL projects.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Patrick Moore, BLM
Tom Foertsch, BLM
Mike Karbs, BLM

Follow-up Items

None

Sweetwater County (SC), Green River, Wyoming – January 13, 2009

Meeting Summary

Safety and emergency issues were the top concerns raised by Sweetwater County (SC). Site access, particularly on the narrow county roads, was of concern with the Bairoil representatives (trucks, dust, noise, etc.). The proposed routes were of concern, along with road improvements, maintenance, and signage. Of special interest was the amount of radiation that could be expected from trucks carrying product from the facility to the next processing facility. The Sweetwater County Fire Department (SCFD) and emergency personnel were concerned with radiation and potential exposure, construction of the facility, access, materials and waste storage, and emergency plans that the applicant would prepare. The SCFD specifically requested that plans of the facility be available to them in case of an actual emergency. Waste

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A. Kock -7-

disposal was an issue of great importance: what types of waste would be generated; how much would be generated; where would the waste be disposed; and what routes would be used to get there. There is also a limited workforce that is available in the SC area. Even unskilled workers are hard to come by. Other issues that were raised included: impacts to Bairoil's municipal water supply well, potential storm water discharges, waste water ponds, utilities, and air quality (dust).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
John Radosevich, SC
Steve Horton, SC
John Barton, SC
Dennis Washam, SC
Wayne Silvers, SC
Judy Valentine, SC
Dennis Claman, SC
Robert Robinson, SC
Tony Riga, Bairoil
Sue Ann Riganco, Bairoil

Follow-up Items

NRC to find out what roads are being proposed for access to the facility. NRC to find out the levels of radiation at various locations throughout the facility, as well as during transportation. NRC to inform applicant that the SCFD would like a hazardous materials inventory.

Fremont County Planning Department, Fremont County, Wyoming – January 13, 2009

Meeting Summary

The county has no zoning laws in effect. Reviews are performed for residential subdivisions. Regarding solid waste disposal, the county operates a transfer station and landfill in Riverton. Regarding highway maintenance in the vicinity of Lost Creek (SC), the county only maintains about ten miles of the Crooks Gap-Wamsutter Road south of Jeffrey City. Beyond that point, the road is poorly maintained.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Price, Fremont County Planning Department

Follow-up Items

None

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Casper Planning Department, Casper, Wyoming – January 13, 2009

Meeting Summary

The main points drawn from this discussion were that rental housing is very scarce, especially affordable housing, and that less expensive housing would be available to ISL workers and families in Glenrock, Douglas, and Wright. However, those cities also have a shortage of affordable housing. Also, the Powder River Basin has good roads and the school capacity and retail establishments are sufficient for the present. Fire and police departments are adequately staffed. Medical and hospital facilities are able to provide good service. Additionally, the industry boom-bust cycles are typical, making it hard to maintain available and affordable housing. The population of Casper is about 53,000 (75,000 including suburbs) and the current economic downturn will likely make housing more affordable. Developers are currently building housing for both upper and lower income families.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Craig Collins, Casper Planning Department
Robin Mundell, Casper Planning Department

Follow-up Items

None

Wyoming Community Development Authority (WCDA), Casper, Wyoming – January 13, 2009

Meeting Summary

Discussions centered around the impact of resource extraction, including ISL, on housing. The WCDA was able to provide extensive data on existing housing statewide, and future projections. The main points raised were that rental housing is scarce in the Powder River Basin and Great Divide Basin; single family housing tends to be out of the affordable range; those seeking to move to Wyoming from economically hard-hit areas have a difficult time selling their homes; and the Wyoming economy is doing very well compared to the nation as a whole. Most Moore Ranch and Nichols Ranch workers are expected to live in Casper, Gillette, and other smaller communities such as Wright. The level of healthcare, education, and commercial facilities is generally good. Rawlins would likely be the main base for Lost Creek employees (possibly Wamsutter). There is no office of state planning.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
David Haney, WCDA
Cheryl Gillam, WCDA

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Follow-up Items

None

Lander Chamber of Commerce, Lander, Wyoming – January 13, 2009

Meeting Summary

Inquiries were made regarding housing and workforce. There is some limited housing available in Fremont County (Lander Area), but it's pricey. Jeffrey City may be a better bet as there are still houses there from the oil boom in the late 80s/early 90s. The thought was that there would be sufficient skilled labor available due to the slowdown in the oil industry.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Chamber of Commerce Director
Chamber of Commerce Receptionist

Follow-up Items

None

Bureau of Land Management Field Office, Buffalo, Wyoming – January 14, 2009

Meeting Summary

BLM staff explained their responsibilities under NEPA and their review and approval process of Plans of Operations submitted by ISL applicants. BLM staff also provided details on the update to the Buffalo Resource Management Plan, in which they just completed the scoping process. Since no BLM lands are present on the Moore Ranch Project site, BLM staff is not likely to review that application. Regarding the Nichols Ranch Project, BLM staff will provide comments on NRC's environmental documents and request frequent communication with the NRC throughout the environmental review process. BLM staff sees the main issues for the Nichols Ranch Project to be related to cultural resources and tribal concerns since the Pumpkin Buttes was designated a Traditional Cultural Property (TCP) in June 2007. The BLM is in the process of developing a PA for the TCP. BLM staff emphasized the importance of good construction of injection wells and did not seem concerned with CBM operations and ISL operations occurring simultaneously in the same area because of the large distances between CBM wells. BLM has prepared Plan of Development (POD) EISs and a 2003 EIS on CBM and natural gas, which have solid cumulative impacts analyses for the Powder River Basin. FWS staff discussed the locations of sage grouse core areas in the Powder River Basin, the possible need for avoidance of these areas, and the candidate conservation assurances program. FWS staff stated that additional information on sage grouse is present in the Northeast Wyoming Management Plan. FWS staff raised a concern over migratory birds, specifically related to the electrocution of raptors on power poles and they recommended buried power lines or aboveground lines conforming to the requirements set by the Avian Power Line Interaction Committee.

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Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Buck Dumone, BLM
Jerry Queen, BLM
Clint Crago, BLM
Tom Bills, BLM
Paul Beels, BLM
Brad Rogers, FWS
Pete Ramirez, FWS

Follow-up Items

NRC to review BLM's POD EISs and 2003 EIS on CBM and natural gas to see if the cumulative impacts analyses can be incorporated into the NRC documents. NRC to also review the Northeast Wyoming Management Plan for sage grouse.

Department of Environmental Quality District 3 Office, Sheridan, Wyoming – January 14, 2009

Meeting Summary

DEQ staff explained their two tier review process of applications, which consists first of a completeness review and then a technical review (150 days to complete). Both the Moore Ranch and Nichols Ranch ISL applications have been through the completeness review and are undergoing the technical review with Moore Ranch to be completed first. DEQ staff's initial assessment of both applications is that additional information is necessary from the applicant and inconsistencies arise in both applications. DEQ staff's main concerns with both projects are cumulative impacts (whether ISL, CBM, and O&G can all occur simultaneously), groundwater quality resulting from unconfined aquifer conditions (effects on drawdown, ability to limit excursions, restoration), and underground injection well viability (which formation to drill into).

Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Mark Rogaczewski, DEQ Land Quality Division District 3
Don Fischer, DEQ Water Quality Division
Glenn Mooney, DEQ Land Quality Division District 3

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Follow-up Items

None

Department of Environmental Quality District Office, Lander, Wyoming – January 14, 2009

Meeting Summary

A brief update was presented on the status of the GEIS and the EA for Lost Creek. The topic of requests for additional information (RAIs) was discussed. It was found that the DEQ, in addition to the list of RAIs submitted last summer on UR-Energy's application, was currently preparing a much larger list (200 in addition to the initial 45). The DEQ's primary concern is groundwater impact. The Water Quality Division (WQD) determines the class of use of an aquifer, but the EPA determines the exemption boundary. For deep well injection of wastes, the contact at the WQD identified was John Passehl. The DEQ is the agency that issues the actual mining permit, with the BLM concurring. DEQ, however, is also concerned with surface disturbance. If the total amount of disturbance is less than 5 acres, the DEQ issues a Drilling Notification (similar to the BLM's Notice). If the disturbance exceeds 5 acres, a License to Explore is issued (similar to the BLM's Plan of Operation). Bonding is also required by the DEQ and, in fact, the DEQ is the bond holder, even when BLM land is involved. For bond release, 2 years of successive growing seasons must occur after reclamation. Issues, besides groundwater that were raised during the meeting included the need to address solid waste disposal. This includes a complete characterization of the various waste streams, the disposal facilities intended to be used, and if there is to be any hazardous waste generated. The U.S. Department of Game & Fish (DGF) is concerned with the potential impacts to sage grouse. In particular, there appears to be a lek within the boundary of the Lost Creek site. There is a 1/4-mi exclusion area, as well as a 2-mi limited activity area surrounding each lek. The DGF also has an issue with the installation of overhead utility lines (as roosts for raptors). In addition to groundwater quality, groundwater drawdown is an issue. DEQ is asking the applicant to address potential drawdown outside the boundary of the site (up to 3 mi), and to identify users. The DEQ is also concerned with the fault running through the site, and if the potentiometric surface differs either side of it. Regional (outside the permit boundary) well data is also being asked of the applicant by the DEQ. The DEQ questions the need for such a large permit boundary if the ore body only occupies a portion of the site. A new requirement of the DEQ is the need for the applicant to submit data (including well, and GW data) for the first mine unit to operate at an ISL. This seems to be problematic, in that this information is not normally available until after the NRC issues its license. The DEQ is also requesting the applicant to submit additional cross-sections for the Lost Creek site. DEQ is also requesting a more detailed description of the hydrogeology of the site: thicknesses of the confining units, the multiple sands within the primary production zone in the Battle Spring Formation HJ unit, and deep well injection. Stability monitoring is required after uranium recovery is complete (quarterly monitoring for 12 months, then annually, thereafter).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Amy Boyle, DEQ
Melissa Bautz, DEQ

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Carrie Dobey, DGF

Follow-up Items

DEQ WQD to determine the class of aquifer for the HJ unit, as well as the appropriate monitoring well distribution.

<u>Bureau of Indian Affairs (BIA) Wind River Agency, Fort Washakie, Wyoming – January 15, 2009</u>

Meeting Summary

NRC provided a status of the GEIS, the environmental review process the NRC is undertaking, and proposed ISLs in Wyoming. There was more concern over legacy sites than the proposed new uranium recovery facilities in Wyoming. In particular, the conventional mill near Riverton was discussed because of the groundwater plume. While there are no ISL facilities proposed for the Wind River Reservation, it was told us that anytime a new facility is proposed, all the tribes in Wyoming should be notified. The names of two cultural resource contacts were given to us: Amanda White (Northern Arapaho) and Reed Tidzump (Eastern Shoshone). The counties within the state generally send letters to the tribes for concurrence on cultural matters. It was suggested that when cultural resource studies are performed, tribal elders be contacted so that items other than physical features (e.g., spiritual/sacred views) may be identified. The Wind River Reservation has its own environmental commissions (air, water, etc.).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Nation, BIA
Tony Pingree, BIA
Kelly Ferris, BIA
Trisha Cachelin, BIA
John Enos, Shoshone
Steve Babbitts, BIA
Kassel Weeks, WREQC
Don Aragon, WREQC

Follow-up Items

NRC to send copies of draft GEIS (CD) to BIA and Wind River Agency. NRC to send letters to Northern Arapaho and Eastern Shoshone tribes regarding the licensing of the Lost Creek project. The CD and letters were sent in February 2009.

<u>Bureau of Land Management Field Office, Casper, Wyoming – January 15, 2009</u>

Meeting Summary

NRC gave a status of the GEIS and BLM MOU. BLM explained the difference in the types of BLM land. Leasable land, also known as acquired land, is land that the US has bought back the mineral rights. This represents only a small portion of BLM lands. Locatable land is land that

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was originally federal-owned, and represents most of BLM lands. BLM was concerned that the GEIS does not distinguish between the two types of land. BLM was pleased to hear that there is progress being made on the MOU, but has a concern about how field office personnel working jointly on a NEPA document with the NRC would be reimbursed for their effort. BLM was also questioning whether the state or field office would participate in the development of the MOU.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Tom Foertsch, BLM
Patrick Moore, BLM

Follow-up Items

NRC to send copies of the proposed ISL Wyoming site map to the Casper Field Office and the State BLM Office. NRC sent the copies of the map in February 2009.

Buffalo Chamber of Commerce (COC), Buffalo, Wyoming – January 15, 2009

Meeting Summary

The COC Board raised the issues of impacts to wildlife (specifically to sage grouse) and socioeconomics (specifically housing capacity) in regards to the potential Nichols Ranch Project. The COC Board stated that Kaycee does not have the housing capacity and services that Buffalo has. The COC Board stated that the County school system has the capacity to handle additional students. RV parks and motels still have ample space in the county for workers who choose not to permanently relocate into the County. The COC Board emphasized that like most of the state, the county's population fluctuates with the industry cycles of booms and busts.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Margaret Dunfee, COC
Various members from the COC Board

Follow-up Items

None

Johnson County Commissioners, Buffalo, Wyoming – January 15, 2009

Meeting Summary

The County Commissioners raised the issues of impacts to socioeconomics, both positive and negative, in regards to the potential Nichols Ranch Project. Specifically, the County

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Commissioners mentioned the shortage of housing in Kaycee, the shortage of housing for low-moderate income families in the County, and the poor conditions of Trabing Road (also known as Iragary Road), which is a likely commuter path from Buffalo and Kaycee to the Nichols Ranch Project site. Trabing Road has been heavily utilized by CBM operators and although it is a county-maintained road, the County does not have enough funding currently to upgrade the road. The County Commissioners requested that the path of transport for the yellowcake be described in the NRC's environmental document. We also discussed positive economic impacts from new ISL projects such as the creation of new jobs and the addition to tax base. The County Commissioners stated that emergency response services needed for the Nichols Ranch Project would come from either Buffalo or Kaycee. The County Planner stated that the only local permitting required of the applicant would be for a septic system leach field up to 2,000 gallons in size.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Smokey Wildeman, Commissioner
Gerald Fink, Chairman
Rob Yingling, County Planner

Follow-up Items

None

Campbell County Economic Development Corporation (CCEDC), Gillette, Wyoming – January 15, 2009

Meeting Summary

The discussion focused on the impact of resource extraction, including ISL, on housing, schools and other community facilities, and socioeconomics. The vacancy rate for rental housing has been close to zero for the last four years; 850 rental units in Gillette have recently been built and fully occupied. The local economy is mineral-based and has gone through boom and bust cycles which have discouraged investment in housing. Local government has extended water and sewer lines well beyond city limits to encourage development. Land is being annexed aggressively by the city as a spur to foster residential development. Two new elementary schools have been built and two more are planned.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Michael Surface, CCEDC
Susan Yerke, CCEDC
Brandi Beecher, CCEDC

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Follow-up Items

None

Town of Wright, Wright, Wyoming – January 15, 2009

Meeting Summary

A new power plant is being built nearby. O&G extraction and coal mining are active in the vicinity. Almost 200 single family houses have just been built and the town has purchased 113 acres, some of which will be for housing; the land includes water service. It is hard to get developers to come out to a small town of under 5,000 people, although tax credits exist for rural development. There are several private apartments in the community and many employers are building motels and renting rooms to their workers. A new shopping center has been built and the town has one medical clinic. The junior and senior high schools have been combined and capacity is adequate.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Lyle Murdock, Wright Building Official

Follow-up Items

None

Converse County Planning Department Douglas, Wyoming – January 15, 2009

Meeting Summary

In discussing where workers from the Powder River Basin may live, Converse County Planning Department Douglas, Wyoming staff thought that the cities of Glenrock and Douglas would likely home bases for workers for the Nichols Ranch and Moore Ranch projects; Midwest and Wright were also mention as possibilities. Some trailer parks might have vacancies but rental apartments are scarce and expensive. There is the potential for new hotels/motels to be built. There are 130 zoned and platted lots for housing but they are without services. The state has a loan program for first-time home buyers. The current population is about 6,000 people, but the city could accommodate a total of 10,000. Schools are close to capacity in Douglas but Glenrock may have some room.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Forrest Neuerberg, CCPD
Paul Musselman, CCPD

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Follow-up Items

None

Converse Area New Development Organization (CANDO) – January 15, 2009

Meeting Summary

CANDO deals primarily with workforce concerns, local economic development, business recruitment and training, and housing. Ranchers are seeking information about energy companies looking for leases on their property. There is a shortage of workers with uranium mining experience. Locally, there is limited housing and Nichols Ranch and Moore Ranch workers would likely face a 1.5 hour commute, which is typical for the area.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Joe Coyne, CANDO
Ed Werner, Consultant to CANDO

Follow-up Items

None

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August 24, 2009

Ms. Charlene Dwin Vaughn
Assistant Director
Advisory Council on Historic Preservation
Office of Federal Agency Programs
1100 Pennsylvania Ave, NW, Suite 803
Washington, DC 20004

SUBJECT: NICHOLS RANCH IN-SITU LEACH URANIUM RECOVERY APPLICATION

Dear Ms. Vaughn:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by Uranerz Energy Corporation in December 2007 for a new radioactive source material license to construct and operate the Nichols Ranch In-situ Uranium Recovery project located in Campbell and Johnson Counties, Wyoming. The proposed project will consist of two areas: 1) the Nichols Ranch Unit located in Township 43 North, Range 76 West, Sections 7, 8, 17, 18, and 20; and 2) the Hank Unit located in Township 44 North, Range 75 West Sections 30 and 31, and Township 43 North, Range 75 West Sections 5, 6, 7, and 8. The Nichols Ranch Unit will be the location of the central uranium processing plant with the Hank Unit being the satellite operation.

The NRC has established that, as part of the staff's review of any license application to possess and use source material for uranium milling, a site-specific Supplemental Environmental Impact Statement (SEIS) to its *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*, NUREG-1910, will be prepared under the provisions of 10 CFR Part 51, the NRC's regulations that implement the National Environmental Policy Act of 1969. In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is November 2009.

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If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Irene Yu, at 301-415-1951 or by e-mail at irene.yu@nrc.gov.

Sincerely,

/RA/

Andrea L. Kock, Branch Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

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August 26, 2009

Mr. Richard L. Currit
Senior Archaeologist
Wyoming State Historic
Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: URANERZ ENERGY CORPORATION, NICHOLS RANCH IN-SITU URANIUM RECOVERY PROJECT – SECTION 106 CONSULTATION – STATE HISTORIC PRESERVATION OFFICE FILE #0708RLC009

Dear Mr. Currit:

By letter dated July 1, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff initiated consultation with the Wyoming State Historic Preservation Office concerning the proposed Nichols Ranch In-situ Uranium Recovery (ISR) project by Uranerz Energy Corporation (Uranerz) in Campbell and Johnson Counties, Wyoming. As part of its application to the NRC, Uranerz conducted a Class I literature search, two Class III cultural resource surveys, and a paleontological survey. In accordance with the provisions in 10 CFR Part 51, NRC's regulations that implement the National Environmental Policy Act of 1969 and 36 CFR 800.8(c) of the National Historic Preservation Act, the NRC is currently developing a Supplemental Environmental Impact Statement (SEIS) of Uranerz's request to construct and operate ISR operations, which includes a central processing plant, satellite facility, well fields, and access roads.

As part of its environmental review and development of SEIS for the proposed Nichols Ranch ISR project, NRC staff discussed with the Bureau of Land Management (BLM) concerning the inventoried cultural sites in the vicinity of the proposed project. Mr. Clint Crago, Archaeologist from the BLM-Buffalo Field Office, reviewed the cultural surveys for the project and concluded that "the project will be an adverse effect to the setting of the Pumpkin Buttes traditional cultural property and mitigation measures must be developed to lessen the visual impact." In addition, Mr. Crago acknowledged that "there are a few (recommended) eligible sites in the lease boundary, as well as on top of the ore locations."

NRC staff also corresponded with several Native American tribes concerning the inventoried cultural sites in the vicinity of the proposed project. The NRC received a response from Mr. Conrad Fisher of the Northern Cheyenne Tribal Historic Preservation Office (dated February 12, 2009). Mr. Fisher noted that the "Pumpkin [B]uttes are considered spiritual and ceremonial areas" and that "contaminants from extraction, traffic, noise and dust pollution may effect [sic] the overall condition of the area." To date, no other responses have been received.

After a review of the information provided by Uranerz, potential impacts from the proposed project, and discussed/corresponded with the BLM and Native American Tribes, NRC staff has determined that the proposed action has the potential to adversely impact four cultural sites in the vicinity of the proposed project. Specifically, these are as follows:

R. Currit 2

- Site 48CA5391 (identified in the Class III survey conducted by Western Land Services for the Tex Draw CBM POD);
- Sites 48CA6146/6147 (identified in the Class III survey by James A. Brunette for Uranerz);
- Site 48CA6148 (identified in the Class III survey by SWCA for the Dry Willow 1 POD and in the Class III survey by James A. Brunette for Uranerz); and
- Site 48CA6927 (identified in the Class III survey by Russell Richard for Uranerz).

NRC staff also concurs with BLM's assessment that the proposed action has the potential to adversely impact the setting of the Pumpkin Buttes.

The cultural resource survey and paleontological survey reports provided by Uranerz in their application to the NRC are enclosed. As part of these survey reports, mitigation measures such as avoidance and/or development of a recovery plan were recommended by the contractor.

NRC staff requests your comments and recommendations on mitigation and the path forward within 30 days of receipt of this letter and associated materials. If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Irene Yu at (301) 415-1951, or at irene.yu@nrc.gov.

Sincerely,

/RA/

Andrea L. Kock, Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-9067

Enclosure: Uranerz Cultural Resource
Survey and Paleontological Survey Reports

cc w/o enclosure: D. McKenzie, DEQ, Cheyenne
G. Mooney, DEQ, Sheridan
C. Crago, BLM, Buffalo
P. Beels, BLM, Buffalo
M. Thomas, Uranerz
C. Fisher, Northern Cheyenne THPO

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November 10, 2009

MEMORANDUM TO: File

FROM: Briana Balsam, Project Manager... /RA/
Environmental Review Branch
Environmental Protection
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Division of Waste Management
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Office of Federal and State Materials
and Environmental Management Programs

Irene Yu, Project Manager /RA/
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Office of Federal and State Materials
and Environmental Management Programs

SUBJECT: SUMMARY OF TELECONFERENCE WITH PEDRO RAMIREZ, WYOMING FIELD OFFICE, U.S. FISH AND WILDLIFE SERVICE, REGARDING ENDANGERED SPECIES ACT INFORMAL CONSULTATION FOR THE PROPOSED NICHOLS RANCH ISR PROJECT (DOCKET NO. 040-09067)

On November 6, 2009, The U.S. Nuclear Regulatory Commission (NRC) staff held a teleconference with Pedro Ramirez of the Wyoming Field Office of the U.S. Fish and Wildlife Service (FWS) to discuss the status of informal consultation under the Endangered Species Act (ESA) as part of the review for the Supplemental Environmental Impact Statement (SEIS) for the Nichols Ranch In-situ Uranium Recovery (ISR) Project. The following is a summary of the teleconference and a list of participants.

Background

On and within the vicinity of the Nichols Ranch ISR Project site, potential suitable habitat (a black-tailed prairie dog complex totaling 941.8 acres) for the black-footed ferret (*Mustela nigripes*) exists; however, no black-footed ferret population occurs near the site. The black-footed ferret is a federally endangered species that is closely associated with prairie dog habitat. The FWS relieved the requirement for black-footed ferret surveys to be conducted in black-tailed prairie dog habitat within the State of Wyoming for the purpose of identifying previously unknown ferret populations in 2004 (FWS, 2004). However, the FWS continues to direct Federal agencies to assess whether a proposed action could have an adverse effect on the value of prairie dog habitat as a

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future reintroduction site for the black-footed ferret for prairie dog complexes 1,000 acres or greater in size. Due to the presence of black-tailed prairie dog habitat of nearly 1,000 acres, the NRC has continued informal consultation with the FWS to ensure that the provisions of the ESA are upheld regarding the black-footed ferret.

Meeting Summary

NRC staff updated Mr. Ramirez on the project status for the proposed Nichols Ranch ISR Project SEIS and discussed the expected conclusions on impacts to federally threatened and endangered species. NRC described the occurrence of black-tailed prairie dog (*Cynomys ludovicianus*) habitat on and in the vicinity of the proposed Nichols Ranch ISR Project site and sought clarification as to whether the habitat was sufficiently large to initiate formal consultation regarding the black-footed ferret.

Mr. Ramirez said that, consistent with the 2004 FWS letter block-clearing the State of Wyoming from conducting black-footed ferret surveys in black-tailed prairie dog habitat less than 1,000 acres in size, the black-tailed prairie dog habitat on the proposed Nichols Ranch ISR Project site does not need to be surveyed. Mr. Ramirez informed the NRC that initiating formal consultation and submitting a Biological Assessment (BA) for the black-footed ferret to the FWS would not be necessary for this proposed project.

Meeting Participants

Pedro Ramirez, FWS
Briana Balsam, NRC
Nathan Goodman, NRC
Irene Yu, NRC

References

FWS (U.S. Fish and Wildlife Service) 2004. Letter to Interested Parties from B.T. Kelly, Field Supervisor, Wyoming Field Office, U.S. Fish and Wildlife Service. Subject: Block Clearance for Black-Footed Ferret Surveys. February 2, 2004. ADAMS No. ML092780370.

NRC FORM 335 (9-2004) NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER **(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)**

NUREG-1910
Supplement 2

2. TITLE AND SUBTITLE

Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming
Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities
Draft Report for Comment

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

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

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

By letter dated November 30, 2007, Uranerz Energy Corporation (Uranerz) submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Nichols Ranch in-situ uranium revovery (ISR) Project. Uranerz is proposing to construct, operate, conduct aquifer restoration, and decomission an ISR facility at the Nichols Ranch ISR Project site, to be located in Campbell and Johnson Counties, Wyoming. In this draft Supplemental EIS (Draft SEIS), the NRC staff evaluates the potential environmental impacts of the proposed action and its reasonable alternatives, describes the environment potentially affected by Uranerz's proposed site activities, and describes Uranerz's environmental monitoring program and proposed mitigation measures.

In preparing this Draft SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS). The NRC staff then determined findings and conclusions in the GEIS and relevant sections of the GEIS that could be incorporated by reference in this Draft SEIS, and areas that needed additional analysis.

This Draft SEIS was prepared in compliance with the National Enviornmental Policy Act of 1969 and NRC regulations for implementing the Act found at Title 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 (10 CFR Part 51).

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

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