Miller, Debra

From: Yu, Irene -FSME
Sent: Tuesday, September 22, 2009 3:50 PM
To: Pete_Sokolosky@blm.gov
Subject: preliminary final draft of the Nichols Ranch ISR Project SEIS
Attachments: NR draft SEIS 092109.doc

Dear Pete,

This is to let you know that I as the project manager for the Nichols Ranch ISR Project SEIS, have attached the preliminary final draft of the SEIS to this email. I tried to upload my file to the FTP site but was unable to do so.

In doing so, I am requesting BLM review and comments on these documents, with particular focus on Chapters 3 (Affected Environment), 4 (Impacts), and 5 (Cumulative Impacts). It is important for the BLM reviewers to understand that the document(s) is/are in the preliminary final draft stage prior to final NRC management and legal review and concurrence. After management and legal concurrence, we will be publishing the draft SEIS for public comment.

The NRC staff is still in process of revising this draft and as such, is still closing any remaining data gaps, confirming references cited, and finalizing document formatting. Our current schedule has this draft SEIS entering our agency publication review and printing processes by November 23, 2009.

Therefore, to allow for document revision and review/concurrence prior to that date, I ask that any comments from the BLM be provided by October 5, 2009. However, depending on the extent of BLM's comments, I may not be able to completely address those comments in the draft SEIS.

Additionally, I would like the opportunity to discuss by phone the BLM reviewers' main comments so that, again to the extent possible, I can address these comments in the draft SEIS. I would like to have this phone call on or prior to October 5th.

Thank you for helping with this.

Irene W Yu, P.E.
Project Manager
U.S. Nuclear Regulatory Commission
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301-415-1951

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an in-situ leach uranium recovery (ISR) facility in four specified regions in the western United States in NUREG-1910, Volumes 1 and 2, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (hereafter referred to as the GEIS). In the GEIS, the NRC staff determined which impacts would be essentially the same for all ISL facilities and which ones would result in varying levels of impacts for different facilities, thus requiring further site-specific information to determine the potential impacts. As such, the GEIS provides a starting point for NRC's National Environmental Policy Act (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) has been prepared in response to an application submitted by Uranerz Energy Corporation (Uranerz) to the NRC for a new source material license for the Nichols Ranch ISR Project. The Nichols Ranch ISR Project is located in the Powder River Basin in Campbell and Johnson Counties, Wyoming, which is in the Wyoming East Uranium Milling Region identified in the GEIS. 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 Nichols Ranch ISR Project site and provides mitigation measures for the reduction or avoidance of potential adverse impacts. It also includes the NRC staff's preliminary recommendation regarding the proposed action.

The NRC staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the source material license be issued as proposed. This recommendation is based on (1) the license application, including the Environmental Report (ER), submitted by Uranerz; (2) consultation with Federal, State, Tribal, and local agencies; (3) the NRC staff's independent review; (4) the assessments and conclusions summarized in the GEIS; and (5) the assessments summarized in this draft SEIS, including the potential mitigation measures identified in the ER and this draft SEIS.

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EXECUTIVE SUMMARY

Background

By letter dated July 1, 2008, 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 Leach Uranium Recovery (ISR) Project. The Nichols Ranch ISR Project is located in the Pumpkin Buttes Mining District of the Powder River Basin in Campbell and Johnson Counties, Wyoming. The 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 NRC is evaluating the potential environmental impacts of the activities proposed by Uranerz for the Nichols Ranch ISR Project located in Campbell and Johnson Counties, Wyoming.

The Atomic Energy Act of 1954 and 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 statues require NRC to license facilities, including ISR operations, which 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 Part 51), which implement the National Environmental Policy Act (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 (10 CFR 51.20(b)(8)).

In June 2009, NRC staff prepared NUREG-1910, Volumes 1 and 2, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (hereafter referred to as the GEIS) in which the environmental impacts were considered for the construction, operation, aquifer restoration, and decommissioning of an ISR facility in four specified regions in the western United States. The Nichols Ranch ISR Project site lies within the Wyoming East Uranium Milling Region identified in the GEIS. This draft Supplemental Environmental Impact Statement (SEIS) for the Nichols Ranch ISR Project uses information from various sources including the GEIS and the license application, including the Environmental Report (ER), to fulfill the requirements set in 10 CFR 51.20(b)(8).

Purpose and Need and Proposed Action

Uranerz is seeking an NRC source material license to authorize commercial-scale ISR uranium recovery at the Nichols Ranch ISR Project site. This would enable Uranerz to meet the needs of its customers for yellowcake, which is the uranium oxide product of the milling process that will eventually become used in fuel for commercially-operated nuclear power reactors. The proposed action considered in this SEIS is Uranerz's license application 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.

Alternatives

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, consideration of which is required by the regulations of the Council on Environmental Quality (CEQ) which implement NEPA (40 CFR 1502.14), Uranerz would not be issued a license to construct and operate ISR facilities at the proposed site. The other alternative considered is a modification of the proposed action whereby NRC would issue Uranerz a license for ISR activities at the Nichols Ranch Unit and not the Hank Unit. Alternatives considered but eliminated from detailed analysis due to economic and environmental reasons include conventional mining/milling, conventional mining/heap leaching, and obtaining yellowcake from an alternate site.

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 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 stated in the GEIS, the significance of 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 Nichols Ranch ISR Project. A summary of this evaluation by environmental resource area and the phase of the ISR facility lifestyle is provided below.

Land Use

Construction: Impacts would be SMALL. Approximately 121 ha (300 ac) would be disturbed for construction. Topsoil would be stripped and stockpiled and land would be graded for construction of access roads and processing facilities. Current rangeland leases would be modified during the life of the project, and access to other existing land uses would be restricted for safety enforcement, though agreements with individual land owners with respect to leases could minimize this impact.

Operation: Impacts would be SMALL. Impacts would be similar to, or less than, those during the construction phase. 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 the three to four year operations phase.

Aquifer Restoration: Impacts would be SMALL. Land use impacts would be similar to, or less than, those during the operations 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 with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Upon completion of well abandonment, seeded soil would be returned to the areas where it was stripped near header houses and roads that would be removed. 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. Some dust, noise, and incidental wildlife or livestock kills would occur.

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.

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.

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.

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 top soil and land grading. Drilling and installation of piping would occur. Implementation of best management practices (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; howver. the rock matrix and structure will remain, which will not cause any significant matrix compression or ground subsidence. Spills from moving uranium-bearing lixiviant to and from the 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. Aquifer water pressure would be decreased during restoration to ensure proper water flow into well fields; however, the change in pressure is not expected to reactivate any local faults.

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 project area, and regrading 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. Implementation of an emergency response plan (ERP) and observance of applicable NRC and State regulations regarding spills would minimize the risk of chemicals being introduced to water ways. 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 project.

Operation: Impacts would be SMALL. Spills and leaks could impact surface waters, but would be properly managed as in the construction phase. A storm water management plan would detain or treat runoff. 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. Recontouring 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 maintenance of wells.

Groundwater

Construction:
Operation:
Aquifer Restoration:
Decommissioning:

Ecology

Construction: Impacts would be SMALL. Approximately 121 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 Fish and Game Department (WFGD) guidelines regarding noise, vehicular traffic, and human proximity would be observed. No threatened or endangered species are known to occur in the project area.

Operation: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during construction. Disturbed areas would be reseeded with Wyoming Department of Environmental Quality (WDEQ)- or U.S. Bureau of Land Management (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.

Decommissioning: Impacts would be SMALL. Temporary disturbances to land and soils may displace vegetation and wildlife species that have recolonized the project area since the construction phase. Revegetation and recontouring would restore habitat previously altered during construction and operations.

Meteorology, Climatology, and Air Quality INSERT CLIMATE CHANGE IMPACTS

Construction: Impacts would be SMALL. Fugitive dust and combustion from vehicles and diesel equipment during construction would create some emissions. The impacts of carbon monoxide and particulate matter, the primary emissions during construction,

would be expected to be reduced to background levels within 610 to 914 m (2,000 to 3,000 ft) from the point of generation.

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 SMALL. Impacts would be similar in type and degree as those experienced during construction. The use of existing infrastructure and reduced volume of traffic would reduce fugitive dust and emissions.

Decommissioning: Impacts would be SMALL. Impacts would similar those experienced during construction. Emissions would decrease as decommissioning proceeds.

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. The nearest residential receptor would experience a minimal increase in noise.

Operation: Impacts would be SMALL. Traffic noise would be the primary noise impact as all noise-generating activities in the central uranium processing facility would be indoors and well field equipment would be contained within structures. OSHA regulatory limits would be maintained, and the nearest residential receptor would experience virtually no increase in noise levels.

Aquifer Restoration: Impacts would be SMALL. Noise impacts would be similar to, or less than, those experienced during the operation phase. Cement mixers, compressors, and pumps would be used for the plugging and abandonment of production and injection wells; however noise generated from aquifer restoration activities would be localized. OSHA regulatory limits would be maintained, and the nearest residential receptor would experience virtually no increase in noise levels.

Decommissioning: 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 , and the nearest residential receptor would experience a minimal increase in noise similar to the increase during construction.

Historic and Cultural Resources

Construction: Impacts would be SMALL to 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 operation 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 the operation 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 operation 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 SMALL. 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. Mitigation measures specified in the PA for the Pumpkin Buttes TCP would apply to construction activities in the Hank Unit because it lies within the 3.2-km (2-mi) radius of the cultural resource. Similar mitigation such as avoiding dense vegetation stands and painting buildings and structures to blend into the landscape would be followed in the Nichols Ranch Unit, as well.

Operation: Impacts would be SMALL. Visual impacts would be similar to, but less than, those experienced during construction. Less heavy machinery and fugitive dust would result during the operation 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, 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: Impacts would be SMALL to MODERATE. 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 would increase in areas that already have very low vacancy rates, which would result in a MODERATE impact to housing. 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: Impacts would be SMALL to MODERATE. Relocation of workers and their families in nearby towns for an extended period of time (approximately 9 years) wiould 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 Nichols Ranch ISR Project would create new jobs, but most are likely to be filled by people moving into the area, which would have a MODERATE 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 construction equipment and other construction-related activities. An increased demand for schools would have a MODERATE impact on education as more workers would be expected to relocate with their families during the operation phase. 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 operation 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 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 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

Construction: Impacts would be SMALL. The impacts from inhalation of fugitive dust would be SMALL because radionuclide concentrations in the soil are low.

Operation: The radiological impacts from normal operations would be SMALL. The radiological impacts from accidents would be SMALL to MODERATE for workers and SMALL to the public. The non-radiological impacts from normal operations would be SMALL. The non-radiological impacts from accidents would be SMALL.

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.

Waste Management

Construction: Impacts would be SMALL. Small-scale and incremental well field development would generate low volumes of construction waste. Waste would primarily consists of building materials, piping, and other soild wastes. The nearby landfill and associated construction and demolition pit are not at capacity and will be able to continue receiving municipal solid waste and construction and demolition waste for several more years.

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 1 deep disposal wells would be constructed on site for disposal of liquid effluent wastes. 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 operation 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 cumulative impacts to most resources would be MODERATE or LARGE, 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 national, regional, and local costs and benefits. The primary national benefit of the proposed Nichols Ranch ISR Project would be a greater assurance of a stable domestic supply of low-enriched uranium. 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 will have accrued benefits that outweigh the economic, environmental, and social costs.

Comparison of Alternatives

NRC analysis indicates that the adverse impacts of likely alternatives will differ from those of the proposed action.

For Alternative 2, the no action alternative, Uranerz Energy Corporation (Uranerz) would not be issued a license for the construction and operation of ISR facilities at Nichols Ranch. As a result, no uranium ore would be recovered from this site under the Uranerz

license application. This alternative would result in neither positive nor negative impacts to any resource area.

For Alternative 3, NRC would issue 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. The potential environmental impacts for Alternative 3 on each of the resource areas are similar to, or smaller than, the impacts from Alternative 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 TCP, though they would be mitigated with measures such as those described in the Pumpkin Buttes MOA for Alternative 1, would be virtually removed in Alternative 3.

Preliminary Recommendation

The NRC staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the source material license be issued as proposed. This recommendation is based on (1) the license application, including the Environmental Report (ER), submitted by Uranerz; (2) consultation with Federal, State, Tribal, and local agencies; (3) the NRC staff's independent review; (4) the assessments and conclusions summarized in the GEIS; and (5) the assessments summarized in this draft SEIS, including the potential mitigation measures identified in the ER and this draft SEIS.

ABBREVIATIONS/ACRONYMS

AADT	annual average daily traffic count
ADAMS	Agency Wide Documents Access and Management System
ACHP	Advisory Council on Historic Preservation
ACL	Alternate Concentration Limit
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
AMSL	above mean sea level
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
AQD	Air Quality Division
ARPA	Archaeological Resources Protection Act of 1979
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	best management practice
CAA	Clean Air Act
CBM	coal bed methane
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CO	carbon monoxide
CPP	central processing plant
CRUP	Cultural Resource Use Permit
CWA	Clean Water Act
dBA	decibels
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
FHWA	Federal Highway Administration
FONSI	finding of no significant impact
FWS	U.S. Fish and Wildlife Service

GEIS	Generic Environmental Impact Statement
GIS	geographic information system
GPS	global positioning system
HDPE	high-density polyethylene
ISL	in-situ leach
ISR	in-situ recovery
LQD	Land Quality Division
Lpm	liters per minute
MBHFI	Migratory Birds of High Federal Interest
MCL	Maximum Contaminant Level
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSDS	material safety data sheets
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NCDC	National Climatic Data Center
NCRP	National Council for Radiation Protection
n.d.	no date
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966, as amended
NMSS	Nuclear Materials Safety and Safeguards
NO_2	nitrogen dioxide
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
O_3	ozone
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
Pb	lead
PDR	Public Document Room
PEL	Permissible Exposure Level
PM	particulate matter
PRI	Power Resources Inc.
PRRCT	Powder River Regional Coal Team
PSD	Prevention of Significant Deterioration
PSM	Process Safety Management
PVC	plastic polyvinyl chloride

RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act
RFFA	reasonably feasible future actions
RMPA	Resource Management Plan Assessment
ROD	Record of Decision
ROI	region of influence
RQ	Reportable Quantity
RTV(s)	Restoration Target Value(s)
SDWA	Safe Drinking Water Act
SER	Safety Evaluation Report
SERP	Safety and Environmental Review Panel
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
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(r)
TLV	Threshold Limit Value
TNM	Traffic Noise Model Version 2.5
TPQ	Threshold Planning Quantity
TQ	Threshold Quantity
TR	Technical Report
TSS	total suspended solids
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
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USC	United States Code
USGS	United States Geological Survey
VRM	Visual Resource Management
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WLS	Western Land Services
WNDD	Wyoming Natural Diversity Database
WQD	Water Quality Division

W.S.	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WYDOT	Wyoming Department of Transportation
WYPDES	Wyoming Pollutant Discharge Elimination System

DRAFT

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 lb)	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,2009) and as detailed in Section 1.4.1 of this chapter. The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, "Energy," of the *U.S. Code of Federal Regulations* (10 CFR) Part 51. These regulations implement the requirements of the *National Environmental Policy Act of 1969* (NEPA), as amended (Public Law 91-190) which requires the Federal Government to assess the potential environmental impacts of actions that may significantly affect the human environment.

1.2 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. This would enable Uranerz to meet the needs of its customers for yellowcake, which is the uranium oxide product of the milling process that will eventually become used in fuel for commercially-operated nuclear power reactors.

1.3 Proposed Action

The proposed action considered in this SEIS is Uranerz's license application 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. Uranerz's proposal is discussed in detail in Section 2.1.1 of the SEIS.

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 will supplement the GEIS, published as a final report in June 2009 (NRC, 2009). 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, 2009).

The GEIS was prepared to fulfill the requirement at 10 CFR 51.20(b)(8) to prepare either an EIS or supplement to an EIS for the issuance of a source material license for an ISR uranium recovery facility (NRC, 2009). In preparing this SEIS, the NRC plans to tier from the GEIS by incorporating by reference applicable GEIS background information and by adopting, as appropriate, GEIS conclusions concerning potential environmental impacts. The extent to which NRC adopts GEIS impact conclusions will depend on the consistency between Uranerz's proposed facility and activities and conditions at the Nichols Ranch ISR Project site 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 adopted 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 Nichols Ranch ISR Project site and vicinity in January 2009. The purpose of 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* on June 16, 2008 related to the Nichols Ranch ISR Project license application (73 FR 34052). NRC also published a Notice of Intent to prepare this SEIS on August 5, 2009 (74 FR 39116).

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 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 ISL uranium milling facilities, (2) identified and assessed impacts that are expected to be generic (the same or similar) at all ISL 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 would receive this more detailed analysis:

- Land Use
- Historic and Cultural Resources
- Transportation
- Surface Water
- Groundwater
- Terrestrial Ecology
- Threatened and Endangered Species
- Noise
- Socioeconomics
- 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 be considered in this SEIS.

Table 1-1 Summary of Expected Impacts in 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	L 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 to L	S to L	S to L
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S to M	S to M
Public 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, 2009				

1.4.4 Issues outside the Scope of the SEIS

Some issues and concerns raised during the scoping process on the GEIS (NRC, 2009; 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 (June 2009).** 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 Moore Ranch Project is located. The environmental analysis in this SEIS tiers from the GEIS.

- **Final Environmental Impact Statement for the West Antelope II Coal Lease Application WYW163340 (BLM, 2008).** The Bureau of Land Management has prepared this EIS for the West Antelope Coal Lease Application WYW163340, located approximately x miles east of the Nichols Ranch ISR Project. The document evaluates the environmental impacts of leasing and mining coal on approximately 4,109 acres.

- **Draft Environmental Impact Statement for the Wright Area Coal Lease Applications (BLM, 2009)**

- **Environmental Assessments for Anadarko Petroleum Corporation, Dry Willow Phase I and Dry Willow Phase II (BLM, 2007)**

- **Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project (BLM, 2003)**

- **Fortification Creek Area Draft Resource Management Plan Amendment/Environmental Assessment (BLM, 2008)**

- **Draft Environmental Impact Statement for the South Gillette Area Coal Lease Applications WYW172585, WYW173360, WYW172657, WYW161248 (BLM, 2008)**

- **NRC's Safety Evaluation Report.** The NRC staff is preparing an SER for the Nichols Ranch ISR Project. In the SER, the NRC staff evaluates whether the licensee's proposed action can be accomplished in accordance with the criteria in 10 CFR Part 20 and 10 CFR Part 40, Appendix A. The SER evaluates the licensee's proposed facility design, operational procedures, and radiation protection program to ensure that the requirements in 10 CFR Parts 20 and 40 would be met by the applicant. The SER also provides the staff's analysis of the initial estimate from the applicant of the funding needed to complete site decommissioning and reclamation.

1.5 Applicable Regulatory Requirements

The National Environmental Policy Act of 1969, as amended (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. A more detailed tabulation of these authorities, agencies, and permits is provided in Appendix __ of the SEIS.

1.6 Licensing and Permitting

NRC has statutory authority through the *Atomic Energy Act* and *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 through1.7.5 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 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. As discussed in Section 1.7.1 of the GEIS, NRC initial 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, 2008).

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 Part 40, Appendix A. The environmental review is conducted in accordance with the regulations in 10 CFR Part 51.

The NRC hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with the proposed action. 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 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 mining zone aquifer from regulation of the aquifer under the Safe Drinking Water Act; 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
Wyoming Department of Environmental Quality 122 West 25th St Herschler Building Cheyenne, Wyoming 82001	Underground Injection Control Class III Permit (WDEQ Title 35-11)	Class III UIC Permit application under review; anticipated approval by WDEQ in June 2010
	Aquifer Exemption (WDEQ Title 35-11)	Aquifer exemption application under preparation; anticipated approval by WDEQ in June 2010.
	Underground Injection Control Class I (WDEQ Title 35-11)	Class I UIC Permit application under review; anticipated approval by WDEQ in fourth quarter 2009
	Industrial Stormwater NPDES Permit (WDEQ Title 35-11)	An Industrial Stormwater NPDES will be required for the Central Plant Area. Expected submittal in second quarter 2011

Table 1-2: Environmental Approvals for the Nichols Ranch ISR Project		
Issuing Agency	**Description**	**Status**
	Construction Stormwater NPDES Permit (WDEQ Title 35-11)	Construction Stormwater NPDES authorizations are applied for and issued annually under a general permit based on projected construction activities. The Notice of Intent will be filed at least 30 days before construction activities begin in accordance with WDEQ requirements.
	Mineral Exploration Permit (WDEQ Title 35-11)	Mineral Exploration Permit 342DN Approved: August 22, 2006
	Air Quality Permit	Not needed
U.S. Nuclear Regulatory Commission Washington, DC 20555	Source Materials License (10 CFR 40)	Application submitted herein
U.S. Environmental Protection Agency 1200 Pennsylvania Ave, NW, Washington, DC 20460	Aquifer Exemption (40 CFR 144, 146)	Aquifer exemption application will be forwarded to EPA following WDEQ action
Source: Uranerz, 2007		

BLM? SEO, County?

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, and Section 106 of the *National Historic Preservation Act of 1966*, as amended. The GEIS took a programmatic look at the environmental impacts of ISL uranium mining 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 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 Endangered Species Act 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 (USFWS) 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 USFWS, requesting information on endangered or threatened species or critical habitat in the Nichols Ranch ISR Project area. NRC received a response from the Ecological Services Wyoming Field Office of the USFWS, dated August 15, 2008, that: 1) provided a list of the T&E species that may occur in the 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, such as the mountain plover and sage grouse.

NRC staff also met with the USFWS Buffalo office on January 14, 2009 to discuss site-specific issues. The main concern expressed by the Buffalo office was potential impacts to sage grouse and typical mitigation measures were discussed.

1.7.2 National Historic Preservation Act of 1966 Consultation

Section 106 of the NHPA requires that federal agencies take into account the effects of their undertakings on historic properties and allow the Wyoming 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 historic and cultural resources that could be affected by the proposed project. 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 historic properties.

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 historic sites, and best management practices (BMPs). The NRC staff will continue to consult with the Wyoming SHPO throughout the environmental review process regarding a determination of effects on cultural and historic resources.

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 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, the WDEQ, the WSEO, and local organizations.

1.7.3.1 Coordination with the U.S. Department of the Interior, 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. As such, the NRC has coordinated with the BLM during preparation of this Draft SEIS. Several conference calls and meetings have been held and a Memorandum of Understanding (MOU) between NRC and BLM is also being negotiated. 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 conducted 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). Based on the 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 that have expressed interest in the Pumpkin Buttes.

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. The BLM provided clarification on how they administer mineral 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 sites, and the potential impacts to socioeconomics in the communities surrounding the proposed ISR sites. The BLM provided guidance on typical mitigation measures to protect cultural resources and sage grouse.

1.7.3.2 Coordination with the U.S. Department of the Interior, Bureau of Indian Affairs

The Bureau of Indian Affairs' (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. BIA is responsible for the administration and management of 66 million acres of land held in trust by the United States for American Indian, Indian tribes, and Alaska Natives.

The NRC staff met with staff from the BIA in Fort Washakie, Wyoming on January 15, 2009. The NRC staff briefed the BIA on potential IRS facilities proposed in Wyoming, and the two staffs discussed how the BIA and Indian tribes would be involved in the environmental review process. The BIA stated that tribal governments should be

consulted for any projects in the state. BIA also recommended that tribal elders be involved in cultural and historic surveys.

1.7.3.3 Interactions with Tribal Governments

In response to guidance from Wyoming SHPO and to carry out E.O. 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 Moore Ranch Project:

- Eastern Shoshone
- Northern Arapaho
- Northern Cheyenne
- Blackfeet
- Three Affiliated Tribes
- Ft. Peck Assinboine/Sioux
- Oglala Sioux
- Crow
- Cheyenne River Sioux

By e-mail dated February 12, 2009, Mr. Conrad Fisher of the Northern Cheyenne Tribal Historic Preservation Office provided comments, 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 the 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 Nichols Ranch ISR Project. Issues that were brought up during the meeting included the 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 requested early involvement in the NRC's review of applications for proposed ISR projects in the State. They also emphasized coordination with the BLM when ISR projects are located on BLM lands.

NRC staff also met with the WDEQ-LQD on January 14, 2009. The WDEQ-LQD explained the UIC Class III well application process, and noted that the WDEQ would require wellfield 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 USFWS have expressed concerns regarding the use of evaporation ponds.

1.7.3.5 Coordination with the Wyoming Game and Fish Department

The 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 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 USFWS, NRC staff initiated consultation with the WGFD via a letter sent on October 29, 2008 (NRC, 2008) requesting information on sage grouse habitats within the project area and appropriate mitigative measures to minimize potential impacts to the sage grouse. By e-mail dated November 3, 2008, Mr. Tom Christiansen provided information on sage grouse habitats.

1.7.3.6 Coordination with the Wyoming State Engineer's Office

NRC staff met with the Wyoming State Engineer's Office (WSEO) on January 12, 2009 to discuss well permitting. 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 the Wyoming Governor's Planning Office

NRC staff met with the Wyoming Governor's Planning Office on January 13, 2009 and again on June 25, 2009. 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 the Wyoming Community Development Authority

NRC staff met with the Wyoming Community Development Authority on January 13, 2009 to discuss housing availability for employees of future potential ISR facilities. 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 Nichols Ranch ISR Project. 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 SEIS incorporates by reference parts of the Generic Environmental Impact Statement for Uranium In-Situ Leach Milling Facilities (GEIS) (NRC 2009) as appropriate. The GEIS 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. The NRC staff evaluated whether information or conclusions in the GEIS could be adopted in full, only in part, or not at all. Where the GEIS conclusions could not be adopted, site-specific analyses of potential environmental impacts are provided.

Chapter 2 of this SEIS describes the proposed action and reasonable alternatives considered for the Nichols Ranch ISR Project site, Chapter 3 describes the affected environment for the 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 from the proposed action is tabulated in Chapter 8.

1.9 References

10 CFR Part 2. Code of Federal Regulations, Title 10, *Energy,* Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders."

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

10 CFR Part 40 Appendix A. Code of Federal Regulations, Title 10, *Energy*, Part 40 Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of

Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content."

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 1508. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index

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WDEQ. "Water Quality Rules and Regulations, Chapter 8, Quality Standards for Wyoming Groundwaters." Cheyenne, Wyoming: WDEQ, Water Quality Division. April 2005.

WDEQ. "Guideline No. 6, Noncoal; Application for a 'Permit To Mine' or an 'Amendment.'" Cheyenne, Wyoming: WDEQ, Land Quality Division. January 2003.

WDEQ. "Water Quality Rules and Regulations, Chapter 16, Class V Injection Wells and Facilities Underground Injection Control Program." Cheyenne, Wyoming: WDEQ, Water Quality Division. July 2001.

1.10 Figures

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2 Alternatives

This chapter describes the alternatives, including the proposed action, 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 (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

2.1.1 The Proposed Action (Alternative 1)

Under the Uranerz's proposed action, NRC would grant a license for construction, operation, aquifer restoration, and decommissioning of the ISR facilities at the Nichols Ranch ISR Project as described in the license application. The Nichols Ranch ISR Project includes several facilities and well fields, which are described in the following sections. The schedule for the proposed action is shown in Figure 2-1. The information contained in the following section was obtained either from the application (Uranerz, 2007) or from the ISR Generic Environmental Impact Statement (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 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 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 300 acres. The 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 Nichols Ranch project site would either be via State Route (SR 50) to Van Buggenum Road to T-Chair Livestock ranch roads or from U.S. 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).

2.1.1.2 Construction Activities

2.1.1.2.1 Site Preparation

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.

Earth-moving equipment such as rubber tire scrapers and front end loaders would be used during construction. The construction equipment will be used intermittently and are considered to have minimal diesel emissions. Other vehicles associated with the Nichols Ranch ISR Project will 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 project life.

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 and uranium-loaded resins that would 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 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 on-site 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.

Both the central processing plant and 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 would ensure that spills and leaks would 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 well would be located near the 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 Nichols Ranch ISR Project site is via highways and roadways. The 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 on 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 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 of 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/gas and CBM companies that are active in the region.

While the 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. Road width 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 will be wetted to reduce dust emissions.

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 desired production goals. The well fields and 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 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 Nichols Ranch Unit ore zone is approximately 91 to 213 m (300 to 700 ft) below the surface and located in the A Sand. The Hank Unit ore zone is approximately 61 to 183 m (200 to 600 ft) below the surface and located in the F Sand. Uranerz estimates the U_3O_8 content is 1,144,868 kg (2,521,000 lb) for the Nichols Ranch Unit and 841,054 kg (1,852,000 lb) for the Hank Unit. The average ore grade of the two units is above 0.1%.

2.1.1.2.4.1 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 is recovered, respectively. All wells would be drilled so they could be used for either injection or recovery. By doing this, well field flow patterns could be changed 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 will 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.

As part of the well fields, well header houses would be constructed which 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 15.24-cm (6-inch) 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 will 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.

2.1.1.2.4.2 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 would be located in a ring around the well fields, with approximate 122-m (500-ft) spacing between monitoring wells and screened in the production zone. 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 Unit and Hank Unit, respectively.

2.1.1.2.4.3 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.

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 ensure that the well does not allow hydraulic communication of lixiviant or aquifer water between aquifers. The test is designed to detect imperfections in the casing sections and inadvertent damage from underreaming (enlarging the exposed area), and to ensure that there are connections between sections and sealing materials. Uranerz's proposed test consists of pressurizing the casing and monitoring it for pressure loss. If leaks are detected, the seals and fittings of the well will be reset and/or checked and another test will be conducted. If the repaired well passes the test, it will be put in operation. If the repaired well cannot be fixed after several tries, the well will be plugged and abandoned. Results

of these tests are maintained on-site and available for inspection by NRC and WDEQ personnel. Results of these tests are also reported to the WDEQ on a quarterly basis.

2.1.1.2.4.4 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 20 feet of piping will 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 Unit's control room.

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 one would be located at the Hank Unit. Uranerz would have to obtain underground injection control (UIC) permits for the construction and use of these deep disposal wells from the WDEQ-Water Quality Division (WDEQ-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 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 55 employees at each site. Uranerz would have to obtain a permit to construct the on-site septic systems from the county in which they are located.

2.1.1.2.6 Construction Workers and Equipments

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. Uranerz estimates approximately 45 to 55 workers to be needed during the construction 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.

2.1.1.2.7 Schedule

Uranerz estimates that construction of the well fields and buildings will take approximately 9 months. 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 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. Uranerz estimates the U_3O_8 content is 1,144,868 kg (2,521,000 lb) for the Nichols Ranch Unit and 841,054 kg (1,852,000 lb) for the Hank Unit. The average ore grade of the two units is above 0.1%.

2.1.1.3.1 Uranium Mobilization

During ISR operations as part of the 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 2-9 shows the general flow of the ISR process.

2.1.1.3.1.1 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.

2.1.1.3.1.2 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 the flow rates to range from 3,788 to 13,258 liters per minute (LPM) (1,000 to 3,500 GPM) in the Nichols Ranch Unit and 3,788 to 9,470 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 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. 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.

2.1.1.3.1.3 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 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 detected, Uranerz would have to 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 2-9 shows the general flow of the ISR process.

2.1.1.3.2.1 Ion Exchange

For the 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 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 13,258 Lpm (3,500 gpm) for the ion exchange system for the Nichols Ranch Unit and up to 9,470 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 14.2 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.

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 grams per liter (g/L) of uranium. Once enough pregnant eluant is obtained, the final precipitation and drying circuit can begin, as shown in Figure 2-9.

2.1.1.3.2.3 Precipitation, Drying, and Packaging

The precipitation and drying circuit 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 out 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 165 to 190 degrees F and would be of similar design to the dryer used at PRI's 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 1,932 km (1,200 mi) away. Uranerz estimates the maximum annual production rate to be 908,265 kg (2,000,000 lb) of yellowcake per year from the Nichols Ranch Unit with an initial production rate of 227,066 kg (500,000 lb) per year and 136,240 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 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. The production bleed for the Nichols Ranch Unit would be approximately one percent of the overall flow rate or 152 LPM (40 GPM) and the production bleed for the Hank Unit would be approximately three percent of the overall flow rate or 284 LPM (75 GPM).

Other liquid waste streams would be produced as part of the 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 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 Unit and the Hank Unit 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 40, Appendix A, Criterion 5(B)(5) or another standard approved by NRC. After the uranium is recovered, the groundwater in the well field contains constituents that were mobilized by the lixiviant. 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. 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.

The aquifer restoration program for the 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 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 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 central processing plant and satellite facility for treatment and removal of any uranium, Radium 226, and other dissolved solids. 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 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 will 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*

The Nichols Ranch ISR Project would include sampling of the monitoring wells. Uranerz proposes a sampling frequency of once every two months. The samples would be analyzed for the excursion parameters chloride, total alkalinity, and conductivity. Well water levels would also be taken prior to sampling.

Uranerz has to determine when restoration is complete and has to provide four quarters of monitoring to demonstrate stability. Samples would be analyzed for the excursion parameters of chloride, total alkalinity, and conductivity. Once complete, Uranerz may apply to NRC and WDEQ for regulatory approval under the NRC's Uranium Mill Tailings Radiation Control Act (UMTRCA) program and the WDEQ's UIC program. NRC regulations require that the groundwater quality be returned to the standards identified in Criterion 5B(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 Alternate Concentration Limit (ACL) established by NRC in accordance with Criterion 5B(6).

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 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 following parameters:

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

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 Unit and the Hank Unit, as shown in Figure 2-1. Uranerz estimates approximately 20 workers to be needed during the restoration 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.

2.1.1.5 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 Nichols Ranch ISR Project would be based on an NRC-approved decommissioning plan. Unless otherwise specified, Uranerz would be required under 10 CFR 40.42 to complete sit decommissioning within two years from the time the decommissioning plan had been approved. Decommissioning activities proposed by Uranerz for the 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 on-site 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 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 the well abandonment gel used to fill the void to the top of the cut-off casing. 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 Wyoming, Envirocare in Utah, or White Mesa in Utah.

Uranerz will 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 limits. As mentioned earlier, Uranerz will 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. If the site access roads are reclaimed, the scoria or gravel on the road surface would be picked up and removed, top soil 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 serves 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. The proposed reclamation seed mix includes a combination of Western Wheatgrass, Revenue Slender Wheatgrass, Bozoisky Russian Wildrye, Greenleaf Pubescent, Gulf Annual Ryegrass, Yellow Blossom Sweet Clover, and Ladak 65 Alfalfa. The seed 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 Unit and the Hank Unit, 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 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 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.

2.1.1.6.1 Gaseous or Airborne Particulate Emissions

Gaseous emissions generated during the lifetime of the 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 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. 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, which should not affect ranching operations. 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 (135.9 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 Nichols Ranch project. Radon can be released in the well field when the pregnant lixiviant is brought to the surface from the ore zone aquifer. Radon gas will 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 Nichols Ranch ISR Project would generally blow in the northeast direction. As discussed in Section 2.7.1 of the GEIS, downwind radiation dose from ISR facility emissions vary due to effects of dispersion as a function of distance and the reduction in dose becomes less significant as downwind distance increases. 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 Nichols Ranch ISR Project. Such wastes include well development water, pumping test water, process bleed, process solutions, wash down water, and restoration water. 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 1,829 m (6,000 ft) deep or greater. 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 100 gallon per minute (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 on-site 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 55 employees at each site. Uranerz would have to obtain a permit to construct the on-site septic systems from the county in which they are located.

2.1.1.6.3 Solid Wastes

All phases of the 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 536 to 765 m^3 (700 to 1,000 yd^3) of non-radioactive solid waste would be generated by the Nichols Ranch project annually. Radioactive wastes are disposed of as 11e.(2) byproduct material at a NRC-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 Nichols Ranch project annually. As mentioned earlier, Uranerz has not yet selected a site. Options considered by Uranerz include the low-level waste disposal sites at Pathfinder-Shirley Basin in Wyoming, Envirocare in Utah, or White Mesa in Utah.

Based on the industrial nature of the operations, the 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 Nichols Ranch ISR Project. The 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.

2.1.2 No Action (Alternative 2)

No action means that "the proposed activity would not take place, and 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 the no action alternative, consideration of which is required by the regulations of the Council on Environmental Quality (CEQ) which implement NEPA (40 CFR 1502.14), 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 issue Uranerz a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing as proposed in the license application, but only 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 would only be conducted at a central processing plant located at the Nichols Ranch Unit. A satellite facility, well fields,

access roads, and related infrastructure would not be developed at the Hank Unit. Thus, the land surface area that would be affected by the modified action would range from approximately 150 to 200 acres instead of the 300 acres 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 wells would be installed and thus 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 heap leaching. This section provides the rationale for why these two alternatives, in addition to three other alternatives (obtaining yellowcake from an alternate site, alternate lixiviants, and alternate waste disposal methods) were considered but not carried forward for detailed analysis.

2.2.1 Conventional Mining and Milling

As discussed in Appendix C of the GEIS, a conventional mine and mill generates a number of radioactive and nonradioactive wastes of which tailings represent the overwhelming majority. Conventional mining can either be open pit or underground shaft and stope. Conventional mines and mills can generate 2,000 to 4,000 tons per day of waste disposed of in the form of a slurry composed of tailings, dissolved minerals, spent process reagents, and process water-bearing carbonate complexes (alkaline leaching) and sulfuric acid (acid leaching), sodium, manganese, and iron. Conventional mining and milling typically involves a large area of surface disturbance, which results in air pollution issues due to ore stock piles, overburden stock piles, tailings stockpiles, and crushing and grinding operations. The radiation exposure for workers associated with conventional mining and milling is typically higher than that for ISR facilities. The restoration efforts for conventional mining and milling operations are typically more involved and lengthier than that for ISR facilities. Also, water consumption for the conventional mining and milling processes is higher than that for the ISR process.

The higher economic costs and environmental impacts associated with conventional mining and milling are typically greater than the corresponding costs and impacts of an ISR facility. At the Nichols Ranch ISR Project site, the production zone where the uranium ore is located is too deep for conventional mining and milling to be feasible. For these considerations, this alternative is not carried forward for detailed analysis.

2.2.2 Conventional Mining and Heap Leaching

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 11e.(2) byproduct that must be placed in a tailings impoundment unless NRC grants an exemption for disposal in place. For the same considerations as listed in Section 2.2.1 (higher economic costs and environmental impacts, depth of ore), this alternative is not carried forward for detailed analysis.

2.2.3 Obtain Yellowcake from an Alternate Site

Obtaining yellowcake from an alternate site would be equivalent to the no action alternative in that ISR activities would not take place at the Nichols Ranch ISR Project site. This alternative would not meet the need for uranium recovery and processing at this project site and therefore, was not carried forward for detailed analysis.

2.2.4 Alternate Lixivants

Alternate lixiviants such as acid or ammonium carbonate solutions have been used in the past in ISR operations but are no longer in use 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.

2.2.5 Alternate Waste Disposal Methods

Alternate waste disposal methods such as evaporation ponds or land application (irrigation) have been used in the past in ISR operations. Evaporation ponds and land application facilities have additional environmental impacts as a result of additional land disturbance that ponds and irrigation have on a site. For these considerations, alternate waste disposal methods were not carried forward for detailed analysis.

2.3 Comparison of the Predicted Environmental Impacts

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

Table 2-1. Summary of Environmental Impacts of the Proposed Action				
Resource	**Construction**	**Operation**	**Aquifer Restoration**	**Decommissioning**
Land Use	SMALL	SMALL	SMALL	SMALL
Transportation	SMALL	SMALL	SMALL	SMALL
Geology and Soils	SMALL	SMALL	SMALL	SMALL
Surface Waters and Wetlands	SMALL	SMALL	SMALL	SMALL
Groundwater	?	?	?	?
Ecology	SMALL	SMALL	SMALL	SMALL
Meteorology, Climatology, and Air Quality	SMALL	SMALL	SMALL	SMALL
Noise	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resource	SMALL to MODERATE	SMALL	SMALL	SMALL
Visual/Scenic Resources	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL
Demographics	SMALL	MODERATE	SMALL	SMALL
Income	SMALL	SMALL	SMALL	SMALL
Housing	MODERATE	MODERATE	SMALL	SMALL
Employment	SMALL	MODERATE	SMALL	SMALL
Local Finance	SMALL	MODERATE	SMALL	SMALL
Education	SMALL	MODERATE	SMALL	SMALL
Health and Social Services	SMALL	SMALL	SMALL	SMALL
Environmental Justice	No Impact	No Impact	No Impact	No Impact
Public and Occupational Health	SMALL	SMALL to MODERATE	SMALL	SMALL
Waste Management	SMALL	SMALL	SMALL	SMALL

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, to approve Uranerz's proposed action. The NRC staff has concluded that the applicable environmental monitoring program described in Chapter 6 and the proposed mitigation measures discussed with the impacts in Chapter 4 would eliminate or substantially lessen any potential adverse environmental impacts associated with the proposed action.

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:

- The primary national benefit would be a greater assurance of a stable domestic supple of low-enriched uranium.
- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region.
- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

2.5 References

10 CFR Part 40 Appendix A. Code of Federal Regulations, Title 10, Energy, Part 40 Appendix A, "Criteria Relating to the Operation of Uranium Mills and to the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily from their Source Material Content."

NRC (U.S. Nuclear Regulatory Commission). 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. NUREG-1910, Vol. 1 and 2. June 2009.

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.

2.6 Figures

3 Affected Environment

3.1 Introduction

The 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). The total project area encompasses approximately 1,365 ha (3,371 ac) of semi-arid land, with the area of direct land disturbance from ISR construction and operation consisting of approximately 46 ha (113 ac) for the Nichols Ranch Unit and approximately 63 ha (155 ac) for the Hank Unit (Figures 2-3 and 2-4).

This chapter describes the existing site conditions of the 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 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, coal bed methane (CBM) extraction, and uranium recovery activities are all currently taking place on or near the project area. The immediate future land use for the project area and adjacent areas would be continued livestock grazing, ISR activities, CBM extraction, and oil and gas extraction.

The Nichols Ranch ISR Project includes approximately 1,364 ha (3,370 ac) of land located in the Powder River Basin. The 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. Sections within the 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 Nichols Ranch ISR Project includes approximately 1,251 ha (3,090 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, with the U.S. Government owning the area underlying the proposed central processing facility (Uranerz, 2007).

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 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 limiting access to the land. 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). In addition, cultural and recreational activities are also conducted near the project area and are discussed below.

3.2.1 Rangeland

Livestock grazing is the main activity at the 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 because of drought conditions over the last seven years, this crop has not been produced.

3.2.2 Hunting and Recreation

The 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, predominantly elk and deer.

Recreational activities within an 80 km (50 mi) radius of the 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 project area, are used for recreational activities. The Powder River, located approximately 14 km (9 mi) to the

west of the 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 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 Unit. In comparison, the typical depth to gas and oil-bearing strata generally ranges from 1220 m (4,000 ft) to 4116 m (13,500 ft), but some wells are as shallow as 76 m (250 ft) (ENSR, 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 41 billion cubic feet of conventional gas (ENSR, 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 project areas. 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.

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

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		

Three NRC-licensed ISR facilities are located within 129 km (50 mi) of the 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-Highland Ranch ISR facility is located approximately 72 km (45 mi) southeast of the Nichols Ranch ISR Project. Two of the licensed facilities; Christensen and Smith-Highlands currently have existing yellowcake processing plants with the latter in operation.

3.3 Transportation

The 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. I-90 enters northeastern Wyoming from South Dakota at Beulah, continues west through Gillette and turns north at Buffalo, exiting the state into Montana in a north central location 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 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 75 miles per hour (mph), with urban settings being 60 mph. State highways have a maximum posted speed limit of 65 mph.

The 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 and are crowned-and-ditched. They are currently wide enough to allow for two tractor trailers passing one another. 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 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 Energy Corporation (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 Nichols Ranch ISR Project. The speed limit on these roads is 30 mph.

The distance from the Hank Unit satellite facility to the nearest major road (SR 50), is approximately 16 km (10 mi). The distance from the Nichols Ranch 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 project ranged from 220 to 410 trucks in 2006, and the AADT for all vehicle types combined was 970 to 3,130 per day (NRC, 2009). Compared to the AADTs for roads in the Wyoming East Uranium Milling Region in Section 3.3.2 of NUREG-1910, *Generic Environmental Impact Statement* (GEIS) *for In-Situ Leach Uranium Milling Facilities*, Vol. 1 and 2 (NRC 2009), the AADT for SR 387 is on the lower end of the spectrum, which indicates that it is not as busy of a roadway as others in the region. For SR 50, the AADT for all vehicles was 550 in 1999 (BLM, 2003). 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 Nichols Ranch ISR Project area.

Table 3-2. Annual Average Daily Traffic Counts for State Routes Surrounding Nichols Ranch ISR Project Area

Route Name	Description	All Vehicles				Trucks	
		1998	1999	2005	2006	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, 2009; BLM, 2003							

3.4 Geology and Soils

The 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* (GEIS) *for In-Situ Leach Uranium Milling Facilities*, Vol. 1 and 2 (NRC, 2009). The Pumpkin Buttes Uranium District lies within the Powder River Basin. The GEIS (Section 3.3.3) 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 Pumpkin Buttes area and, more specifically, the Nichols Ranch ISR Project area based on the description provided in the GEIS and by Uranerz.

3.4.1 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 hectares (14 million acres) in size. As indicated in the GEIS, the dominant source of sediment in the Powder River Basin was Precambrian[1] 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[1]. 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[1] 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 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

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[1] The 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)

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 in this area is approximately 915 m (3,000 ft). The Fort Union contains significant uranium resources at various locations in the basin and is also the target formation for CBM extraction operations.

The 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 project area. The stratigraphy of the Wasatch in the 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, at an approximate average depth of 168 m (550 ft) and are depicted in Figure 3-4 (Uranerz, 2007). 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 bodies at the Nichols Ranch ISR Project site are typical Powder River Basin roll front deposits.

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 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 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 intervening shales that separate these sands have been identified by the overlying and underlying sands. For example the shale separating the H and G Sands has been labeled the HG Shale or Aquitard. While generally present throughout the project area, the nature and extent of these sands differ somewhat across the 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 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.

3.4.1.1 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. 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 project area, 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.

3.4.1.2 Hank Unit Geology

The applicant 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 project area. 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 feet) 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.

3.4.2 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 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 conducted a reconnaissance survey, which indicated that no prime farmland[2] is present in the project area.

3.4.3 Seismology

The Nichols Ranch ISR Project area is located in a relatively minor seismic region of the United States. Few earthquakes capable of producing damage have originated in the Powder River Basin. The nearest seismically active region to the site is the Intermountain Seismic Belt of the Western United States, which is located more than 250 km (200 mi) west of the project area. No surface faults or fault traces in the project area have been reported nor has faulting been evident in geophysical log interpretations.

3.5 Water Resources

3.5.1 Surface Waters and Wetlands

Surface water in the vicinity of the Nichols Ranch ISR Project site include 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 Yellowstone River in eastern Montana. The Powder River Basin, in which the Nichols Ranch ISR Project is located, includes the Powder River, Little Powder River, Clear Creek, Piney Creek, Crazy Woman Creek, and eight major reservoirs. The Wisconsin Department of

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[2] 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)

Environmental Quality (WDEQ) categorizes the channels within the Nichols Ranch Unit and Hank Unit 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 (80.2 mi^2; 51,300 ac) and has an elevation range of 1,400 m (4,590 ft) above MSL to 1,820 m (5,974 ft) above MSL (Uranerz, 2007). Cottonwood Creek is a tributary that flows west from the 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.

The Willow Creek and Dry Willow Creek drainage areas encompass about 3,420 ha (13.2 mi^2; 8,450 ac) and 3,160 ha (12.2 mi^2; 7,800 ac), respectively, and elevation ranges of 1,529 m (5,015 ft) to 1,536 m (5,040 ft) above MSL and 1,522 m (4,995 ft) to 1,550 m (5,084 ft) above MSL, 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. 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 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). Channels are deeply incised at the western boundary of the Hank Unit and have banks ranging from 3.0 to 15.2 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.

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 were estimated by Uranerz (2007) using the Lowham (1976) methodology and are presented in Table 3-3 below.

Table 3-3. Estimated Peak Flow of Major Drainages for Nichols Ranch ISR Project Site

	Cottonwood Creek	Tex Draw	Dry Willow Creek	Willow Creek
Drainage Area in ha (mi^2)	20,800 (80.2)	1350 (5.2)	3160 (12.2)	3420 (13.2)
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

Preliminary data collected in 1979 for Cottonwood Creek, Dry Willow Creek, Brown Water Pond, and Dry Willow Reservoir, as reported by Uranerz (Uranerz, 2007), suggest that surface water quality within the project areas was very good at this time. Total dissolved soils (TDS) and total suspended solids (TSS) were within the normal range for fresh water, and pH levels ranged from 7.7 to 9.6 (Uranerz, 2007). Generally, the data indicates that TDS levels and turbidity became elevated during the higher velocity spring snow melt compared to fall season runoff. Surface water quality was generally dominated by bicarbonate concentrates associated with CBM operations, but increased concentrations of calcium and sulfate also occurred with increasing residence time in channels.

Uranerz collected water quality data in June 2008 within channels with flowing water, namely Dry Willow Creek and Cottonwood Creek. Uranium and ammonia concentrations in Cottonwood Creek were higher than those in the 1979 samples; however, the overall water quality results from 2008 do not show any major deviations when compared to the 1979 sampling results. The concentrations for all nutrients regulated by the WDEQ were found to be below the state threshold for these contaminants (Uranerz, 2007).

3.5.1.5 Wetlands

A wetland assessment was performed for the Nichols Ranch ISR Project site in 2006 by a U.S. Army Corps of Engineers (USACE)-certified wetland delineator with TRC Environmental Corporation. 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 by excavation to the ground water table. The fourth wetland is also found 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 totals 0.5 ha (1.2 ac). The U.S. Fish and Wildlife (FWS) National Wetland Inventory (NWI) indicated potential for wetlands on the Hank Unit; however, the wetland assessment concluded that no wetlands exist on the unit.

The wetlands on the Nichols Ranch Unit comprise ephemeral drainages and man-made isolated pools resulting from surface runoff (snow melts and direct precipitation), excavation to the groundwater table, or overflow from a stock storage tank. 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. However, construction and operational activities as a result of the Nichols Ranch ISR Project will not disturb the four wetland areas.

3.5.2 Groundwater

This section is currently under revision.

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 Nichols Ranch ISR Project is located within the Powder River Basin of the Northwestern Great Plains ecoregion. The GEIS (Section 3.3.5.1) 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).

The GEIS (Section 3.3.5.1) 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) above mean sea level (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) located in the southern portion of this unit.

3.6.1 Terrestrial Ecology

The project area is comprised primarily of sagebrush shrubland and mixed grasslands, with sagebrush shrubland dominating the Hank Unit and mixed grasslands covering most of the Nichols Ranch Unit. No perennial streams or other permanent water bodies exist within the project area; however, four wetland areas 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 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.

The sagebrush shrubland community is dominated by Wyoming sagebrush (*Artemisia tridentata wyomingensis*) and perennial grasses, including needle-and-thread, Sandberg blue grass, prairie junegrass, and blue grama, and annual grasses including six-weeks fescue (*Festuca octoflora*) and Japanese and downy brome (*Bromus japanicus* and *B. tectorum*). A grasslike species, threadleaf sedge (*Carex filifolia*), is a dominate species in this community. Annual forbs such as alyssum (*Alyssum parvifolia*) and wooly plantain (*Plantago patagonia*) are more common in this community than any perennial forb. Several scattered cottonwood and juniper trees also occur in this community and are generally found growing along the drainages.

Vegetation of the mixed grassland community is mainly perennial grasses such as needle-and-thread, Sandberg bluegrass, blue grama, western wheatgrass, and bluebunch wheatgrass (*Elymus spicatus*) and grasslike species such as threadleaf sedge. Scurfpea (*Psoralea tenuiflora*), yucca (*Yucca glauca*), and globemallow (*Sphaeralcea coccinea*) are the common perennial forbs, and wooly plantain is the dominant annual forb in this community. Wyoming sagebrush and silver sagebrush (*Artemisia cana*) occur in scattered low-density stands throughout this community. Subshrubs such as fringed sage and broom snakeweed (*Gutierrezia sarothrae*) occur throughout this community. No trees occur in this plant community. The other communities represented on the project site include juniper outcrop, bottomland, greasewood shrubland, wetland, rock outcrop, and disturbed lands. A list of plant species identified in the project area is presented in the Table 3-4.

Table 3-4. Plant Species List and Occurrence

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	
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

Table 3-4. Plant Species List and Occurrence						
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	
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		

Table 3-4. Plant Species List and Occurrence						
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		
Trees						
Juniperus scopulorum	Rocky Mountain juniper			X		
Pinus flexilis	Limber pine			X		
Populus deltoides	Plains cottonwood	X			X	
Source: Uranerz, 2007						

Uranerz conducted baseline vegetation studies of the project area in June and July 2006 in accordance with a vegetation study plan approved by the WDEQ Land Quality Division (LQD) for noncoal project areas (Uranerz, 2007). Table 3-5 presents the results of the vegetation studies conducted in June and July 2006.

Table 3-5. Vegetation/Habitat Types and Number of Acres Identified in Project Area

Vegetation/ Habitat Type	No. of Acres	Percent of Project Area
Sagebrush shrubland	1,914.4	56.8
Mixed grassland	1,058.3	31.4
Juniper outcrop	148.3	4.4
Bottomland	124.6	3.7
Greasewood shrubland	64.0	1.9
Wetland	1.1	<0.1

Rock outcrop	17.5	0.5
Disturbed lands[1]	42.3	1.2
Total	3,370.5	100
Source: Uranerz, 2007		

Four wetland sites were found in the southeast corner of the Nichols Ranch Unit. There are no confirmed wetlands at the Hank Unit. No federal threatened, endangered, candidate, or proposed plant species were found, and none are known to occur in the project area. Only one designated noxious weed species, Canada thistle (*Cirsium arvense*), was found during surveys; it was found in small numbers in disturbed areas.

3.6.1.2 Wildlife

Uranerz conducted baseline wildlife inventories on the project area in April, May, June, and July 2006 and February 2007 (Uranerz, 2007). The baseline 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, lagomorphs (jackrabbits and cottontails), small mammals, reptiles, and amphibians).

3.6.1.2.1 Wildlife Habitat Description

The vegetation communities presented in Section 3.6.1.1 have the potential to provide habitat for mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), pronghorn antelope (*Antilocapra Americana*), jackrabbit (*Lepus townsendii*), cottontail rabbit (*Sylvilagus audubonii*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), mountain lion (*Puma concolor*), red fox (*Vulpes vulpes*), badger (*Taxidea taxus*), raccoon (*Procyon lotor*), skunk, chipmunk, rodents, songbirds, waterfowl, eagles, hawks, owls, sage-grouse (*Centrocercus urophasianus*), chukar (*Alectoris chukar*), wild turkey (*Meleagris gallopavo*), gray partridge (*Perdix perdix*), mourning dove (*Zenaida macroura*), magpie (*Pica pica*), and crow. Most of these species are yearlong residents. However, during migration periods, some species such as elk, eagles, songbirds, and waterfowl are more abundant (Uranerz, 2007). This characterization of the predominant wildlife is consistent with the Draft Environmental Impact Statement for the Wright Area Coal Lease Applications (BLM, 2009a), which analyzes lands in Campbell County.

During the baseline inventories conducted by Uranerz, several wildlife species were identified in the project area, as shown in Table 3-6.

3.6.1.2.2 Big Game

During the baseline wildlife inventories conducted by Uranerz, two species of big game, pronghorn antelope and mule deer, were observed (Uranerz, 2007). Pronghorn

antelope were mainly observed in mixed grassland and sagebrush shrubland vegetation types. The project area lies within habitat designated by the Wyoming Game and Fish Department (WGFD) as winter/yearlong and yearlong range for pronghorn antelope. 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 project area (University of Wyoming, 2008).

Table 3-6. Wildlife Species That Were Observed Within or in the Vicinity of the Nichols Ranch ISR Project Area

Common Name	Scientific Name
MAMMALS	
Desert cottontail	*Sylvilagus auduboni*
Mountain cottontail	*Sylvilagus nutallii*
White-tailed jackrabbit	*Lepus townsendii*
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
Black-tailed prairie dog	*Cynomys ludovicianus*
Porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Badger	*Taxidea taxus*
Mule deer	*Odocoileus hemionus*
Pronghorn	*Antilocapra americana*
BIRDS	
Mallard	*Anas platyrhynchos*
Bald eagle	*Haliaeetus leucocephalus*
Red-tailed hawk	*Buteo jamacensis*
Rough-legged hawk	*Buteo lagopus*
Golden eagle	*Aquila chrysaetos*
American kestrel	*Falco sparverius*
Prairie falcon	*Falco mexicanus*
Gray partridge	*Perdix perdix*
Greater sage-grouse	*Centrocercus urophasianus*
Great horned owl	*Bubo virginianus*
Long-eared owl	*Asio otus*
Horned lark	*Eremophila alpestris*
Black-billed magpie	*Pica pica*
Brewer's sparrow	*Spizella breweri*
REPTILES AND AMPHIBIANS	
Prairie rattlesnake	*Crotalus viridis viridis*
Bullsnake	*Pituophis melanoleucas sayi*
Eastern yellowbelly racer	*Coluber constricter flaviventris*
Source: Uranerz, 2007	

Mule deer were generally observed in mixed sagebrush grassland and juniper outcrop vegetation types. The project area lies within habitat designated as winter/yearlong and

yearlong range for mule deer. There are no crucial mule deer ranges within the project area. The nearest mule deer crucial winter range occurs approximately 77 km (48 mi) southwest of the project area (University of Wyoming, 2008).

3.6.1.2.3 Upland Game Birds

During the baseline wildlife inventories conducted by Uranerz, two species of upland game birds (greater sage-grouse and gray partridge) were sighted. None of the lek locations are within the project area. According to a BLM database containing sage grouse information, ten greater sage grouse leks were identified within the 3.2 km (2 mi) buffer surrounding the project area.

3.6.1.2.4 Raptors

Uranerz monitored the raptor nesting activities as part of the baseline wildlife inventories. A total of five raptor species were observed nesting within the project area and 3.2 km (2 mi) buffer surrounding the project area (Uranerz, 2007). These included red-tailed hawk (Buteo jamaicensis), golden eagle (Aquila chrysaetos), prairie falcon (Falco mexicanus), long-eared owl (Asio otus), and great horned owl (Bubo virginianus). In addition, 40 raptor nests were found within the project area, of which 10 were determined to be active. Nine of the ten active nests are located in the Hank Unit and one of the active nests is located in the Nichols Ranch Unit. The nine active nests observed in the Hank Unit included that of three red-tailed hawks, three long-eared owls, and three great horned owls. The red-tailed hawks nests were located in isolated cottonwood trees in drainages. The long-eared owls utilized junipers for nesting. The great horned owl nest was located in a cliff/bank of an incised drainage. In the Nichols Ranch Unit, an active golden eagle nest was observed in a cottonwood tree. The remaining 30 nests were inactive or status unknown and ranged from poor to fair in general condition. The species that either built or previously occupied these nests is unknown.

Winter occurrences of raptors within the project area and 3.2 km (2 mi) buffer surrounding the project area were recorded. Raptors observed included the bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk, golden eagle, and rough-legged hawk (*Buteo lagopus*).

3.6.1.2.5 Waterfowl and Shorebirds

Four wetlands occur within a channel located in the southeast portion of the Nichols Ranch Unit. These wetlands contain three man-made, disconnected depressions cut into the ground decades ago that serve as livestock watering holes. Water collects and ponds in these depressions during portions of the year and have the potential to provide a resting/loafing area for migrating waterfowl and shorebirds. The actual use of these systems by waterfowl and shorebirds is relatively low due to the small size and low quality of surface waters present in the project area. During the baseline wildlife inventories conducted by Uranerz, only one mallard duck (*Anas platyrhynchos*) was

observed utilizing one of the ponds on the Nichols Ranch Unit. No open-water systems occur on the Hank Unit that could be utilized by waterfowl or shorebirds.

3.6.1.2.6 Nongame/Migratory Birds

The project area may provide potential nesting and foraging for several Migratory Birds of High Federal Interest (MBHFI) bird species. Very limited habitat is available for wetland/riparian/aquatic obligate bird species. The sagebrush, grasslands, and juniper vegetation dominated communities may provide habitat for species such as lark bunting (*Calamospiza melanocorys*), Brewer's sparrow (*Spizella breweri*), northern shrike (*Lanius excubitor*), ferruginous hawk (*Buteo regalis*), Swainson's hawk (*Buteo swainsoni*), sage sparrow (*Amphispiza belli*), sage thrasher (*Oreoscoptes montanus*), Vesper sparrow (*Pooecetes gramineus*), and lark sparrow (*Chondestes grammacus*). Brewer's sparrow was the only MBHFI bird species recorded during the baseline wildlife inventories conducted by Uranerz. Potential habitat for burrowing owls (*Athene cunicularia*) occurs in the prairie dog colonies, discussed in the next section.

3.6.1.2.7 Other Mammals

Three species of mammalian predators were observed during the baseline wildlife inventories conducted by Uranerz: bobcat, badger, and coyote. In addition, a swift fox (*Vulpes velox*) was observed approximately 8 km (5 mi) east of the project area crossing Van Buggenum Road.

Numerous sightings of desert cottontail rabbits and white-tailed jackrabbits were documented during the baseline wildlife inventories. These sightings occurred in all of the available habitats; however, the highest concentration of rabbits was observed around disturbed areas such as the existing CBM well pads, a CBM compression station, and along existing roads. In addition to observations of live lagomorphs (jackrabbits and cottontails) and numerous dead ones, mainly cottontail rabbits were observed throughout the project area due to an outbreak of Tularemia, or rabbit fever, which is an infectious bacterial disease that typically affects rabbits, hares, and rodents.

Ground squirrel (*Spermophilus tridecemlineatus*) and black-tailed prairie dog (*Cynomys ludovicianus*) were the only species of small mammals observed. Approximately 144 ha (356 ac) of black-tailed prairie dog colonies occur in the project area.

3.6.1.2.8 Reptiles and Amphibians

During the baseline wildlife inventories, two species of reptiles were observed: the prairie rattlesnake (*Crotalus viridis*) and bullsnake (*Pituophis melanoleucas sayi*). Several prairie rattlesnakes ranging from 0.6 to 0.9 m (2 to 3 ft) in length were observed in the juniper outcrop community. One rattlesnake of an undetermined length was observed in a hole in the bottomland community in the Nichols Ranch Unit. One bullsnake (approximately 122 cm [48 in] long) was observed along a two-track road in the northern portion of the Hank Unit.

3.6.2 Aquatic Ecology

The majority of the surface water features on the 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. In addition, these systems are located in the southeast corner of the Nichols Ranch Unit outside of the proposed milling operations, and would not be disturbed. As noted in Section 3.5.2 (Wetlands), there are no confirmed wetlands at the Hank Unit.

3.6.3 Threatened and Endangered Species

The following description provides background information regarding plant and animal species that have been afforded protected status by Federal law and are known to occur in the region or in habitats similar to those found in the project area. The information on Federally listed threatened and endangered species was provided by the FWS (FWS, 2008).

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is listed as a threatened species, which is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. This species was not observed, nor is it known to occur within the project area.

The blowout penstemon (*Penstemon haydenii*) is the only endangered plant species in Wyoming and is known to occur in only three locations in the northeastern Great Divide Basin in northwestern Carbon County. Blowout penstemon grows exclusively in sand blowout areas, a habitat type typically absent in the project area. Therefore, this species is not present in the project area.

The black-footed ferret (*Mustela nigripes*) is listed as an endangered species that inhabits prairie dog colonies. Prairie dogs are the main food of the endangered black-footed ferret and several black-tailed prairie dog colonies occur in and adjacent to the Nichols Ranch and Hank Units. The FWS has determined that black-footed ferret surveys are no longer required in black-tailed prairie dog towns statewide; therefore, Uranerz did not conduct any black-footed ferret surveys as part of its baseline wildlife inventories.

The bald eagle was delisted from threatened status in 2007, but is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The BLM has recorded several locations showing consistent use by bald eagles near the project area, two on the south side of the North Pumpkin Butte and two in the North Middle Butte. During the baseline wildlife inventories conducted by Uranerz, several bald eagles were observed flying or roosting in areas adjacent to the project area. While a

few bald eagles may hunt or forage in the Nichols Ranch ISR Project area, there are no areas that are consistently used by bald eagles within the project area (Uranerz, 2007).

3.6.4 Special Status Species

The BLM Buffalo Field Office monitors and manages non-listed (under the federal Endangered Species Act [ESA]) special status species that could occur on federal lands to reduce potential impacts that might lead to their listing by the FWS. The BLM defines these species to be ones that are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the ESA; those listed by the State in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by the State as sensitive (BLM, 2001). The BLM special status species policy aims to conserve listed species and the ecosystems on which they depend and improve their condition to a point where their special status recognition is no longer warranted (BLM, 2001). The BLM list of special status species included 6 mammals, 15 birds, 2 amphibians, and 1 fish species. The project area has suitable habitat to support 17 of these special status species.

No mountain plovers (*Charadrius montanus*) were seen during the baseline wildlife inventories. The closest BLM sighting of mountain plover was approximately 6.4 km (4.0 mi) from the project area (Uranerz, 2007).

As stated earlier, a swift fox was observed crossing the Van Buggenum Road approximately 8.0 km (4.9 mi) east of the project area during the baseline wildlife inventories. It is likely that swift foxes inhabit the area because of the suitable short mixed grassland habitat.

As stated earlier, the greater sage-grouse is a year-long resident in the project area and ten greater sage-grouse leks occur within the 3.2 km (2.0 mi) buffer surrounding the project area. However, none of the lek locations are within the project area.

Other BLM special status species documented in the Wyoming Natural Diversity Database (WNDD) and by BLM as being observed in the vicinity of the project area include the sage sparrow, Brewer's sparrow, loggerhead shrike (*Lanius ludovicianus*), sage thrasher, burrowing owl, ferruginous hawk, and northern leopard frog (*Rana pipiens*) (UWYO, 2006). None of these were observed during the baseline wildlife inventories conducted by Uranerz.

3.7 Meteorology, Climatology, and Air Quality

3.7.1 Meteorology and Climatology

The majority of Wyoming is dominated by mountain ranges and rangelands of the Rocky Mountains and high plains, 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. 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 (WRCC, 2009). Generally, Wyoming's elevation results in cool temperatures. Fall, winter, and spring experience frequent varations with rapid change from cold to mild temperatures, and freezes in early fall and late spring create a short growing season (NRC, 2009).

The 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 3-7, 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 Nichols Ranch ISR Project, and Midwest, about 37 km (23 mi) southwest of the Nichols Ranch ISR Project.

3.7.1.1 Temperature

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 project area ranges from 21.7 °F in January to 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 3-7. 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, 2009 Table 3.3-6

3.7.1.2 Wind

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). 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 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 foot hills and plain regions such as Powder River Basin. Wind data for the project area was obtained from Casper/Natrona County International Airport, approximately 100 km (60 mi) south-southwest of the project area. The spring exhibits the highest monthly mean wind speeds, with May having the monthly mean high of 10 mph, and August having the mean monthly low of 5 mph (Uranerz, 2007).

3.7.1.3 Precipitation

The 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 (13.7 in) based on data collected in Midwest from

1971 to 2000 (Curtis and Grimes 2004). On average, May is the wettest month and January is the driest month. Highest volumes of snowfall generally occur between February and April. Severe storms are rare due to the surrounding mountains that block or weaken storms (NRC, 2009).

3.7.2 Air Quality

The terrain in both Units of the Nichols Ranch ISR Project is moderate, consisting of gently rolling hills and low ridges intersected by numerous ephemeral drainage channels. The hilly terrain and windy conditions lends itself to good conditions for dispersion of air pollutants (Uranerz, 2007). 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. The nearest recreational area, the Powder River, is located approximately 14 km (9 mi) to the west of the project area.

The U.S. Environmental Protection Agency (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. The Nichols Ranch ISR Project, which includes the Nichols Ranch and the Hank Unit sites, is located in Johnson and Campbell Counties, Wyoming. Both counties are classified as attainment areas for all the primary pollutants.

This SEIS considers the effects on air quality of carbon monoxide and particulate matter because these would be the dominant emissions from the Nichols Ranch ISR Project. Carbon monoxide is an odorless and colorless pollutant that can interfere with oxygenation of the bloodstream. Exposure to high concentrations of carbon monoxide over prolonged periods of time can result in unconsciousness and can be fatal. At lower levels of exposure, carbon monoxide causes mild effects, such as headaches, dizziness, disorientation, nausea and fatigue. The effects of carbon monoxide exposure can vary greatly from person to person depending on age, overall health and the concentration and length of exposure. For the Nichols Ranch ISR Project, the primary source of carbon monoxide would be engine combustion of vehicles and stationary motors such as generators.

Particulate matter is a term referring to small particles in the air that may be composed of a number of compounds, including acids, organic chemicals, metals, and dust particles. Particulate matter smaller than 10 micrometers is able to travel through the nose and throat and into the lower regions of the respiratory tract, which may lead to adverse health effects. EPA has promulgated NAAQS for particulate matter, referred to as PM_{10} and $PM_{2.5}$, to limit the allowable concentration of particulate matter particles

smaller than 10 and 2.5 micrometers, respectively. For the Nichols Ranch ISR Project, the primary source of particulate matter would be fuel combustion and industrial processes, and fugitive dust from roads and construction activities.

The most recent (2007) air quality monitoring data reported to the EPA by WDEQ indicates that Campbell and Johnson Counties, in which the Nichols Ranch ISR Project is located, have maintained attainment status. The WDEQ Air Quality Division (AQD) collects air quality data from 26 stations located throughout the state to insure ambient air quality is maintained in accordance with NAAQS. Because a monitoring station does not exist directly near the Nichols Ranch ISR Project site and not all monitoring stations monitor all pollutants, baseline air quality conditions were determined by evaluating data from four monitoring stations in the region around the Nichols Ranch ISR Project in order to provide a reasonable representation of the air pollutant levels that can be expected in the area. Monitoring data for these stations, Wamsutter, Casper, Lander, and Murphy Ridge is presented in Table 3-8.

Table 3-8. Air Quality in the Vicinity of the Nichols Ranch ISR Project

Monitoring Station	Wamsutter	Casper	Lander	Murphy Ridge
Distance to Site	290 km (180 mi)	105 km (65 mi)	241 km (150 mi)	483 km (300 mi)
Pollutant				
CO (8-hour)	-	-	-	0.7 ppm
CO (1-hour)	-	-	-	0.9 ppm
Lead (quarterly)	1.5 ug/m^3	-	-	-
NO_2 (annual)	0.007 ug/m^3	-	-	0.003 ug/m^3
PM_{10} (24-hour)	227.0 ug/m^3	30 ug/m^3	40 ug/m^3	64 ug/m^3
$PM_{2.5}$ (annual)	-	-	26.0 ug/m^3	-
$PM_{2.5}$ (24-hour)	-	-	7.6 ug/m^3	-
O_3 (8-hour)	0.064 ppm	-	-	0.068 ppm
SO_2 (annual)	0.001 ppm	-	-	0.001 ppm
SO_2 (24-hour)	0.010 ppm	-	-	0.002 ppm

Source: WDEQ, 2009

3.7.3 Climate Change

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, 2009). 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 project area. The Dry Fork Ranch is located approximately 1.4 km (0.9 mi) west of the Nichols Ranch Unit project area.

3.9 Historic, Cultural, and Paleontological Resources

The historical and cultural resources investigations for the Nichols Ranch ISR Project and the associated Hank Satellite Unit included archaeological surveys, a paleontological survey, ethnographic review, and tribal consultation. No standing structures were evaluated for the project; the only structures in the project 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 on to 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 8500 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 project; 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. The Archaic period (8500 to 1800 B.P.) in eastern

and northeastern Wyoming is broken into three subperiods: Early (8500 to 5000 B.P.), Middle (5000 to 3000 B.P.), and Late (3000 to 1500 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 were playing 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 (1500 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, 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 1000 and 600 B.P., there is considerable movement of people into Wyoming from several directions. 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. 1801-1842), Pre-territorial (A.D. 1843-1867), Territorial (A.D. 1868-1889), Expansion (A.D. 1890-1919), Depression (A.D. 1920-1939), World War II (A.D. 1940-1946), and Post-World War II (A.D. 1947-1959). Various themes have been identified which crosscut the periods. The 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 project 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 Historical and Cultural Resources Identified and Places of Cultural Significance

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

3.9.2.1 Nichols Ranch Unit

Within the Nichols Ranch Unit, the past Class III surveys resulted in the identification of 13 archaeological sites (Table 3-9). 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.

3.9.2.2 Hank Unit

Within the Hank Unit, the past Class III surveys resulted in the identification of 23 archaeological sites (Table 3-10). Except for Site 48CA6146/6147, all of the resources 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.

Table 3-9. 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		

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. What is lacking from the sites is temporally diagnostic items such as ceramics or projectile points. The reason for this 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 Pumpkin Buttes has been utilized by Native Americans into the Historic period.

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 two project areas. The Pumpkin Buttes is comprised of five individual buttes (North, North Middle, South Middle, Indian, and South). The western boundary of the North Middle Butte (part of the Pumpkin Buttes) 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 archaeological Site 38CA6751 is adjacent to it, all of which are recommended eligible to the NRHP.

Table 3-10. 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: Russell, 2009; Brunette, 2007; Uranerz, 2007; Brunette, 2006; Hutchinson, 2006		

The Pumpkin Buttes was identified as eligible to the NRHP (Uranerz, 2007) during investigations not related to the proposed Nichols Ranch ISR Project. The Pumpkin Buttes was 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 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 (Anadarako Petroleum Corporation). Because of anticipated development within the viewshed of Pumpkin Buttes, BLM entered into a 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 Memorandum of Agreement (MOA), they and the other tribes chose not to formally comment on the Programmatic Agreement (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..." The PA outlines various measures that must be taken by the proponent to mitigate the adverse effect of their proposed actions on the TCP. These are discussed in Chapter 4.

3.9.3 Tribal Consultation

Consultation with Native American tribes that have heritage interest in the project area is ongoing. 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 responded to the December 24 request. Fisher noted that "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.

3.9.4 Paleontological Resources

A paleontological survey was conducted as part of the Uranerz license application (Connely, 2007). 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 Nichols Ranch ISR Project is located is characterized as basin and range country with prominent buttes and ridges interspersed by rolling grasslands. 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 Nichols Ranch ISR Project area is composed of two noncontiguous units, the Nichols Ranch Unit and the Hank Unit, which lie 9.7 km (6.0 mi) apart and total 1,364 ha (3,370 ac) of land, the majority of which is privately owned by the T-Chair Livestock Company. The remaining 113 ha (280 ac) is owned by the U.S. Government and is administered by the BLM. The Pumpkin Buttes, which flank the northern and southeastern boundaries of the Hank Unit are recognized by the BLM as a TCP.

3.10.1 Visual Resource Management Classes

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 the Hank Unit (NRC, 2009). The VRM classifications for the region are shown in Figure 3.3-17 of the GEIS (NRC, 2009). 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 Nichols Ranch ISR Project includes the project site, access roads, and a 3.2 km (2 mi) buffer area outside of the 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 study areas; major travel routes; and residential areas.

3.10.2 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)

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

3.10.3 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 Pumpkin Buttes are located north, west, and southwest of the Nichols Ranch ISR Hank Unit project area. 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 1,829 m (6,000 ft) AMSL and their bases lie at about 1,524 m (5,000 ft) AMSL. The flanks of the buttes are cut by intermittent drainages which are effectively headwaters for local intermittent drainages. There are currently several oil and gas wells within the Hank Unit Project Area, and in very close proximity to the Pumpkin Buttes. Several transmission towers are completed outside of the Hank Unit boundary on top of South Middle Butte. The Hank Unit would not be visible from the main T-Chair Livestock Company ranch road, but would be visible from the top of Pumpkin Butte.

The Pumpkin Buttes have been recognized as a TCP by the BLM. Visual concerns from CBM development and CBM development in general were addressed in 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 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 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 has begun 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 sited as one cause for decreased growth (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 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. Gillette became a symbol for boomtowns following the oil boycott in 1973, and experienced numerous problems associated with rapid population growth, including inadequate public services, social disruption, and inadequate funding for public services. Over the last thirty years, 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 70 km (44 mi) from the project site. The closest town to the 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 Nichols Ranch ISR Project, and have populations of 170 and 408 people, respectively (USCB, 2009).

3.11.1 Demographics

Campbell County has 40,433 residents, the majority of which lie in the 35-54 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 3-11. The city of Gillette is the urban center of Campbell County, and is home to over half of the counties' population (USCB, 2009).

Table 3-11 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 3-12. 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 3-12 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 city 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/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 project site with a population of 285, has few vacancies for temporary or permanent housing, as well. Buffalo, which is approximately 90 km (55 mi) from the project site with a population of 4,500, has new residential apartments under construction that could fill potential housing needs for ISR workers at Nichols Ranch.

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 people.

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 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 associated decline in price for natural gas, oil and coal, exploration/extractive activities have decreased. This 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. for year over year employment growth at 2.9 percent growth for 2008. Natural resources and mining was the leading industry 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; double that 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, 2009).

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 increased to 19.2 to 1, which is higher than the state-wide ratio of 12.4 to 1 (CCESC, 2009; WDE, 2007). With the slowdown of the extractive industries, it is likely that the student-to-teacher ratio would improve temporarily during the course of the Nichols Ranch ISR Project.

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 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 the town of Wright. The branch clinic in Wright is located approximately 52 km (33 mi) south of the project area. The closest medical center offering full service emergency services is the Wyoming Medical Center in Casper, located approximately 100 km (64 mi) south of the project area. 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.

The closest police stations to the project area are the Midwest Police Station in Midwest and the Campbell County Police Station #9 in Wright. Both are 52 km (33 mi) from the project area. 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

The purpose of this section is to summarize the natural background radiation levels in and around the Nichols Ranch 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 ISR operations. Also included in this chapter 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 10 CFR 40, Appendix A, Criterion 7, a pre-operational monitoring program was developed and implemented to establish site baseline conditions at the proposed site. Descriptions and summaries of the survey data are presented in the Nichols Ranch ISR Project ER and TR (Uranerz, 2007). In TR Section 2.9, Background Radiological Characteristics, the applicant provides results of a baseline radiological environmental monitoring program which represent existing background levels for the site and surrounding environs (Uranerz, 2007).

Following the guidance found in NRC Regulatory Guide 4.14 (NRC, 1980), some of the specific sampling methods included:

- Integrated gamma scan survey to map the ambient gamma radiation levels across the site;
- Surface soil samples (to a depth of 15.4 cm [6 in]) in wellfields analyzed for radium-266. 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 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 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 raged from 11 to 18 μR per hour and also averaged 13 μR per hour. Complete results are presented in Section 6.1.2 of the applicant's ER (Uranerz, 2007a). 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. 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. As presented in Section 6.1.1 of the applicant's ER, 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. 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. The applicant 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, 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 Unit and the Hank Unit exhibited typical background radiological characteristics.

Sediment samples were analyzed for radium-226, uranium, thorium-230, and lead-210. As presented in Section 6.1.1 of the applicant's ER, 40 percent of the Nichols Ranch Unit sediment samples were greater than background values for radium-226 (i.e., > ~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. The applicant 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 Regulatory Guide 4.14, four radon detectors were placed at the location of the nearest residences, locations at or near the license boundary, and at control points upwind of the site. Four quarters of sampling results for a 1-year period of October 2006 to October 2007 are presented in the applicant's TR. Reported quarterly site average radon-222 results for all sampling locations range between 0.6 to 1.9 picocuries per liter (pCi/l) in air and are somewhat consistent with typical background levels (~0.8 pCi/l) in this region of Wyoming (based on historic data from the North Butte ISL Project), though higher than the U.S. average of 0.4 pCi/l (U.S. EPA). Gamma measurements presented in the applicant's ER 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.

Insert paragraphs on baseline groundwater and surface water sampling results

Section 6.1.4 of the applicant's ER presents results of flora and fauna (vegetation) sampling conducted for both the Nichols Ranch Unit and Hank Unit to serve as a baseline if it is determined that vegetation is a significant pathway contributing to human dose. In addition to vegetation, the term "flora and fauna" includes crops, livestock, and fish. Given that the applicant asserts there is a lack of crop-growing areas or permanent surface water and, therefore, fish at or immediately adjacent to the sites 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, an assumption can be made that samples from livestock (grazing cattle) would also be within background. Therefore, no livestock were sacrificed to obtain samples.

3.12.2 Public Health and Safety

The NRC has the statutory responsibility, under the AEA, to protect the public health and safety and the environment. NRC's regulations in 10 CFR 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 3.11.1.

There are several nuclear facilities within 80 km (50 mi) of the Nichols Ranch ISR Project area (NRC, 2009). The Smith Ranch – Highland Uranium Project is approximately 64 km (40 mi) south of the Nichols Ranch ISR Project, and is an operational ISR facility. A license to restart operations was recently granted for the Irigary and Christensen Ranch ISR Project, which is within 80 km (50 mi) of the Nichols Ranch ISR Project area. An application for an ISR facility has been received for the Moore Ranch site, located approximately 14 km (9 mi) to the southwest and there are several inactive and decommissioned 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 Nichols Ranch ISR Project area. Therefore, the natural background represents the only radiation exposure to individuals in the area surrounding the Nichols Ranch ISR Project area.

Other than CBM, there are no major sources of non-radioactive, chemical releases to the atmosphere or water receiving bodies in the immediate area surrounding the 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 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 uranium 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 wellfield activities, and various chemicals used in the in situ extraction process. Industrial safety aspects associated with the use of hazardous chemicals at Nichols Ranch 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 Nichols Ranch ISR Project operations will generate both liquid and solid wastes, which will require proper disposal. The main waste disposal options for these wastes are a landfill for non-radioactive municipal solid wastes, an NRC-licensed waste disposal site or mill tailings facility for 11e.(2) byproduct material, deep disposal wells for the liquid effluent wastes, and on-site septic systems for sanitary wastes.

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 capacity with approximately 2,714,000 yd^3 remaining (Swan, 2009). Based on the past and estimated future growth in the area, Mr. Swan estimates that the remaining capacity will allow for the landfill to remain open for another 30 to 40 years. 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. According to Mr. Swan, the existing construction and demolition pit is planned for expansion such that the pit can remain open for another 10 to 15 years. 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.

Uranerz would dispose of 11e.(2) byproduct material in an NRC-licensed waste disposal site or mill tailings facility. Options considered by Uranerz include the low-level waste

disposal sites at Pathfinder-Shirley Basin in Wyoming, Envirocare in Utah, or White Mesa in 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) waste disposal.

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 2.72 of the GEIS, Uranerz would have to obtain approval from the NRC as an acceptable method to dispose of liquid effluent wastes and obtain an underground injection control (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.

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

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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 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 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, historic, 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 to Land Use

In NUREG-1910, *Generic Environmental Impact Statement (*GEIS*) for In-Situ Leach Uranium Milling Facilities*, Vol. 1 and 2 (NRC 2009a) (Section 4.3.1.1), land use impacts during construction may occur from land disturbances (including alterations of ecological cultural or historic 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, or 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 (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 project area. Topsoil would be stripped and stockpiled and land would be graded for the construction of access roads and processing facilities. Livestock that currently reside within the property boundaries would be moved as a result of construction, which would temporarily alter current rangeland leases within the affected area.

Access to existing land uses may be restricted for safety enforcement. Uranerz Energy Corporation (Uranerz) may need to establish a temporary right-of-entry for safer access but this could result in inconveniencing ongoing activities including coal bed methane (CBM) and oil and gas operators in the project area. This could be minimized through arrangements with individual land owners with respect to leases, mineral rights sales and royalties. The setting of Pumpkin Buttes Traditional Cultural Property (TCP) could be adversely impacted by construction equipment and activities, as discussed along with mitigations measures for anticipated visual impacts later in Chapter 4. Open spaces for hunting and off-road vehicle access would be minimally impacted by any fencing associated with the ISR facility. Many construction impacts would be temporary, though some would be continue until decommissioning and thus be long-term. Overall, construction impacts would be SMALL.

4.2.1.2 Operation Impacts to Land Use

As discussed in the GEIS (Section 4.3.1.2), 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 would take an estimated three to four years to extract the uranium from the Nichols Ranch Unit and an estimated four to five years to extract the uranium from the Hank Unit. During this time, the day to day operations would affect the surrounding environment similarly to the impacts seen in the construction phase. Livestock would be removed from the project area and the setting of the Pumpkin Buttes TCP may be impacted by operations. Mitigation measures implemented during the construction phase would also apply to the operational phase. 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 of the site to another. Sequentially moving active operations from one well field to the next would shift potential impacts. For example, a well field where uranium recovery activities have stopped could be restored and reopened fully for grazing or recreation while a new well field is being developed elsewhere. Because access restriction and land disturbance impacts would be similar to, or less than those expected for construction, the site-specific overall potential impacts to land use from operational activities would be SMALL.

4.2.1.3 Aquifer Restoration Impacts to Land Use

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 would decrease as fewer wells and pump houses are used and overall equipment traffic and use diminish. There would be temporary disturbances to rangeland and cultural uses as the restoration phase of the ISR process commences, but these impacts would be temporary, and are anticipated to have a SMALL impact.

4.2.1.4 Decommissioning Impacts to Land Use

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. 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 project facilities and roads, as well as the reseeding and placement of soil would have impacts similar in scale to the construction, operations and aquifer

restoration phases, but the intensity of activities disturbing the land uses would temporarily increase due to increased use of earth- and material-moving equipment and other heavy equipment. 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 plant areas. Continued impacts to rangelands and cultural uses may occur during the decommissioning process. 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 Nichols Ranch ISR Project, decommissioning impacts are anticipated to be similar in scale to the impacts anticipated for construction, operations, and aquifer restoration, all of which are SMALL.

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 to Land Use

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. Visual impacts on the Pumpkin Buttes TCP would be minimized since this resource is located along the eastern boundary of the Hank Unit, away from the Nichols Ranch Unit. Open spaces for hunting and off-road vehicle access would be minimally impacted by any fencing associated with the ISR facility. Many construction impacts would be temporary, though some would be continue until decommissioning and thus be long-term. Overall, construction impacts would be SMALL.

4.2.3.2 Operation Impacts to Land Use

The type of land use impacts for operational activities is expected to be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Operations would take an estimated 3 to 4 years to extract the uranium from the Nichols Ranch Unit, which is slightly shorter than the length of operations expected from the Hank Unit. During this time, the day to day operations would affect the surrounding environment similarly to the impacts seen in the construction phase. Livestock would be removed from the project area. Because access restrictions and land disturbance impacts would be similar to, or less than those expected for construction, the overall potential impacts to land use from operational activities would be SMALL.

4.2.3.3 Aquifer Restoration Impacts to Land Use

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. There would be temporary disturbances to rangeland and cultural uses as the restoration phase of the ISR process commences, but these impacts would be temporary, and are anticipated to have a SMALL impact.

4.2.3.4 Decommissioning Impacts to Land Use

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, but the intensity of activities disturbing the land uses would temporarily increase due to increased use of earth and material-moving equipment and other heavy equipment. 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 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 to Transportation

In the GEIS (Section 4.3.2.1), 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.

Transportation to the project area from the north would follow State Route (SR) 50 south to Van Buggenum Road, proceeding west to T-Chair ranch roads. From the south, project traffic would proceed north from SR 387 on a T-Chair ranch road located at T41N R76W, Section 3. Two access roads would be built to connect both the Nichols Ranch central processing plant and the Hank Unit satellite facility with the existing T-Chair ranch roads and thereby to the greater county and state road networks (see Section 3.3 Transportation). The length of the Nichols Ranch central processing plant road is approximately 0.32 km (0.20 mi) in length, running straight and easterly from the ranch road to the location of the proposed central processing plant. The Hank Unit satellite facility road would also be approximately 0.32 km (0.20 mi) in length. It would extend in an easterly direction towards the flank of North Middle Butte from an existing spur road that currently terminates at a pumpjack. A more detailed description as well as figures of transportation routes and locations of the proposed access roads can be found in Section 3.3 of this SEIS.

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 existing T-Chair ranch roads have been constructed to accommodate tractor trailer traffic related to CBM activities and are four-season roads. Impacts related to the development of new access roads to the Nichols Ranch Unit central processing plant and Hank Unit satellite facility have been minimized by the fact that the proposed building location was optimized for topographic setting and proximity to existing roads and off of the ore zone. Though road construction represents a long-term impact on land use in the project area, with roads persisting throughout the roughly 10-year lifespan of the project, most of these impacts are temporary. All roads except for those roads specifically requested by the landowner to remain would be reclaimed. Road design plans and specifications would illustrate features such as drainages, elevation contours, stockpile areas, erosion and sedimentation control measures, sequence of construction, and land rights/location of easements to ensure the least amount of impact. If a new road was to cross an ephemeral drainage, Uranerz would make efforts to cross the drainage at right angles to minimize erosion and install correctly sized culverts. Appropriate measures for erosion control would be examined and implemented with

topsoil being removed and stockpiled for re-application during the reclamation phase. Soil surfaces disturbed during construction and embankments would be seeded after road grading.

At all stages of the project, trip frequency to the project area from offsite locations is estimated to be eight passenger cars per day (standard light duty and ¾-ton trucks, with either gas or diesel engines) and six tractor trailers per week (diesel engines). 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. On SR 50, project related traffic would result in an increase in annual average daily traffic (AADT) counts of roughly 3 percent. For SR 387, AADT counts would increase an estimated 0.6 percent to 2 percent, depending on the location between 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.

4.3.1.2 Operation Impacts to Transportation

As discussed in the GEIS (Section 4.3.2.2), 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 ISR 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). Uranerz would ensure that accepted industry codes and standards are used for handling and transporting hazardous chemicals. Onsite traffic would include routine inspections of the well heads and pipelines by light duty pickup trucks as well as regular tractor trailer 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 trunks that are modified, three-compartment cement trailers. These trucks and trailers 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 Nichols Ranch ISR Project is 1,932 km (1,200 mi). 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 in 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 provided in the GEIS (NRC, 2009a). This number is likely a conservative estimate since the proposed Nichols Ranch ISR Project site has a relatively low population density. Thus, this presents a very low risk.

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 minimal.

Based on data presented in NUREG-0706 (NRC, 1980), the overall probability of a truck accident associated with the Nichols Ranch ISR Project has been calculated as 1.4×10^{-6} accidents per km (2.2×10^{-6} 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. Shipments of outgoing yellowcake would not be combined with other shipments or include multiple destinations and drivers would maintain appropriate licenses, which would minimize the risk of an accident involving a yellowcake spill. Environmental impacts would be also be minimized by compliance with existing NRC transportation regulations in 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) by-products 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 to increase driver safety and reduce conflicts with big game and other vehicles.

Shipments of process chemicals to the site and the shipment 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 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 project area during the life of the Nichols Ranch ISR Project.

As for all phases of the project, the overall volume of traffic during the operation phase is low. Approximately one tractor-trailer per day, along with approximately eight passenger cars, would utilize the roads in the region of the proposed site. The estimated increase in AADT counts on local highways remains per Section 4.3.2.1. 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 (2.2×10^{-6} 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 operational phase are considered to be SMALL.

4.3.1.3 Aquifer Restoration Impacts to Transportation

The GEIS (Section 4.3.2.3) 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 fro 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 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. Uranerz would Accordingly, transportation impacts are expected to be less than during construction and operations and thus, SMALL.

4.3.1.4 Decommissioning Impacts to Transportation

As discussed in the GEIS (Section 4.3.2.4), 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 Nichols Ranch ISR Project may increase slightly relative to the aquifer restoration phase, on account of the need for radiological surveys, infrastructure inspection and decontamination, extraction of buried pipelines and in-situ 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 NRC-licensed facilities capable of receiving 11e.(2) byproduct waste materials. 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 waste materials would be transported to an NRC-licensed facility such as the Pathfinder-Shirley Basin in Wyoming, Envirocare in Utah, or White Mesa in Utah. As the trip distance is less than

that of transporting yellowcake to the Metropolis conversion facility, the inherent risks of an accident involving the release of uranium are lower.

The eventual fate of the access roads built to connect existing T-Chair ranch roads with both the Hank Unit satellite plant 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, ripping or discing the surface, and redressing with stockpiled topsoil and establishing native vegetation by seed.

Traffic estimates would remain consistent during the decommissioning phase, at eight passenger vehicles per day and six tractor trailer visits per week (Uranerz, 2007). Because of these relatively low 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 are expected to be SMALL.

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 and possibly intensify in the future. This alternative would have no impacts to transportation.

4.3.3 Modified Action – No Hank Unit (Alternative 3)

4.3.3.1 Construction Impacts to Transportation

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 be undertaken as necessary, as project access via SR 50 would persist throughout each phase of the project, 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. Considering the lower 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.

4.3.3.2 Operation Impacts to Transportation

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, which would be very low. Based on the low 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 operational phase are considered to be SMALL.

4.3.3.3 Aquifer Restoration Impacts to Transportation

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 are expected to be less than during construction and operations and thus, SMALL.

4.3.3.4 Decommissioning Impacts to Transportation

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 waste 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 relatively low 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 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 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 to Geology and Soils

As indicated in the GEIS (Section 4.3.3.1) 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 top soil and preparing surfaces for the 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 the Nichols Ranch ISR Project 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, the applicant would implement construction BMPs, which would prevent or substantially reduce the impacts of erosion to SMALL

The GEIS further indicates that ISR activities 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 subsidence would result at the site from the collapse of overlying rock strata in the mining zone which would happen in underground mining operations. No other geologic impacts are anticipated to occur with ISR activities.

Uranerz estimates that 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 disturbance of soil to construct plant facilities, well fields, and access roads. The applicant indicates that 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. Uranerz indicates that all topsoil in the area of central processing plant, satellite facility, and well field header houses will be stripped from these areas prior to the construction of these facilities. Topsoil that is salvaged during construction activities will be stored in designated topsoil stockpiles that are in accordance with Wyoming Department of Environmental Quality (WDEQ) requirements. Topsoil removed to construct well field access roads will be made in accordance with the landowner's preferred road construction practices. Stockpiles will be located onsite and in way that will best minimize topsoil losses from wind erosion. Topsoil stockpiles will also not be located in any drainage channels or other locations that could lead a loss of material. Berms will be constructed around the base of the stockpiles and they will be seeded with wheatgrass to reduce the risk of sediment runoff.

During construction of the well fields, drilling activities and the installation of piping may also impact soils. The drilling activities will include the construction of mud pits. Uranerz has indicated that during the excavation of mud pits, the topsoil will first be removed and then placed in a separate location. The subsoil is then removed and deposited next to the mud pit. When the use of the mud pit is complete (usually within 30 days of initial excavation), the subsoil is then re-deposited in the mud pit followed by replacement of the topsoil. Uranerz further indicates that pipeline ditch construction will follow a similar approach, with topsoil stored separately from subsoil and with topsoil deposited on the soil after the pipeline ditch has been backfilled.

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 Nichols Ranch ISR Project would be SMALL.

4.4.1.2 Operation Impacts to Geology and Soils

As discussed in the GEIS (Section 4.3.3.2) during ISR operations, a non-uranium-bearing (barren) solution or lixiviant is injected through wells into the mineralized zone. The lixiviant moves through the pores in the host rock, dissolving uranium and other metals. Production wells withdraw the resulting "pregnant" lixiviant, which now contains uranium and other dissolved metals, and pump it to a 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 will 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.

The GEIS (Section 4.3.3.2) 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.

Uranerz indicates that if soil were contaminated by a spill, the soil would be removed and disposed of at a licensed NRC 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. The applicant has also indicated that the Nichols Ranch ISR Project will 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) will 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 intends to dispose of process-related liquid effluents via deep disposal wells instead of land-application or evaporation ponds. Uranerz would be expected to construct and monitor these deep disposal wells in accordance with WDEQ requirements and obtain the necessary permits for operation. No other geologic impacts are anticipated to occur during the ISR mining at the Nichols Ranch site. Therefore, the potential environmental impacts to geology from operations are expected to be SMALL.

4.4.1.3 Aquifer Restoration Impacts to Geology and Soils

As indicated in the GEIS (Section 4.3.3.3), 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 wellfield being restored to ensure water flows into the wellfield 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 will 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 leak, the GEIS (Section 4.3.3.3) 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.

Uranerz would conduct the same spill and leak detection program as planned during operations. Similarly, Uranerz would be required to conduct the same spill response and cleanup program as required during operations (Section 4.4.1.2). Consequently, the impact to soils from spills and pipeline leaks should be similar to that indentified for the operation phase to the project. Thus, the potential environmental impacts to soils from spills during aquifer restoration at the 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.

The applicant has also indicated that ISR activities during aquifer restoration at the Nichols Ranch ISR Project site will 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. No other geologic impacts are anticipated to occur during the ISR mining at the Nichols Ranch ISR Project site. Therefore, the potential environmental impacts during aquifer restoration on geology are expected to be SMALL.

4.4.1.4 Decommissioning Impacts to Geology and Soils

As indicated by the GEIS (Section 4.3.3.4), 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 Title 10 of the *Code of Federal Regulations* (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. During the reclamation process, WDEQ guidelines would be followed, and the WDEQ would determine the success of final revegetation by comparing the area to a reference area (Uranerz 2007).

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 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.

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 land use. As a result the potential environmental impacts to geology and soils associated with decommissioning at the Nichols Ranch ISR Project area would be detectable but SMALL.

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 project area, including grazing lands, natural resource extraction, and recreational activities, would continue. There could be impacts to the project area from the CBM activities also going on at the site. As a result of the no-action alternative, there would be no impacts on existing soils and/or topography and geology present within the project area.

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 and auxiliary facilities, 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 top soil stockpiles that are in accordance with WDEQ requirements. During construction of the Nichols Ranch Unit well fields, 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. Due to the smaller area affected by this alternative than 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 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 wellfield 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 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 to Surface Waters and Wetlands

As discussed in the GEIS (Section 4.3.4.1.1), 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, but potentially MODERATE if a permit from the USACE was required.

During construction, a new 0.32-km (0.2-mi)-long spur road would be created. This road 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. Particularly steep and incised channel banks may be graded to create gently sloping approaches to these channel crossings. Proper sedimentation and erosion control would be implemented to minimize sedimentation into the channels, and disturbed soil would be re-seeded. Riprap and/or hay bales could be used to armor areas prone to erosion.

Electric lines would be routed through both the Nichols Ranch Unit and Hank Units as overhead lines on utility poles. 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.

Well construction would avoid channels and washes when possible; however, avoidance would not always be possible due to the nature of the land surface immediately above the ore bodies. An estimated 15 wells (5 production and 10 injection) would be placed in ephemeral channels during the dry season within the Nichols Ranch Unit and 22 wells would be placed in ephemeral channels on the Hank Unit (11 production and 11 injection). Impacts would be minimized 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.

Plastic polyvinyl chloride (PVC) pipelines would connect the injection and production wells with the central processing plant and satellite facility, which would require that pipes bisect ephemeral channels at numerous locations. Pipelines would be buried approximately 40 to 46 cm (16 to 18 in), and crossings would be perpendicular to flow, and work would be performed 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.

The processing at Nichols Ranch Unit central processing plant and Hank Unit satellite facility would be constructed in the center of the respective properties landward of all ephemeral channels and above the peak flow elevation. Proper erosion and sedimentation measures pursuant to WDEQ requirements would be installed and maintained 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. Accidental spills of petrochemicals such as oil and gas would be mitigated by routine vehicle maintenance and inspection and the implementation of an emergency response plan (ERP) tailored to such occurrences. Training personnel in proper handling and transport of hazardous materials would avoid spills as well. Waste disposal via properly installed septic systems, deep injection wells, or offsite transport to an appropriate disposal site(s) would mitigate the effects of chemicals onsite and potential chemical spills.

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.

4.5.1.1.2 Operation Impacts to Surface Waters and Wetlands

The GEIS (Section 4.3.4.1.2) 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 to MODERATE.

A storm water management plan, implemented in accordance with WDEQ, would detain or treat runoff from the Nichols Ranch Unit central processing plant and Hank Unit satellite facility. Runoff would be divert away from the facilities and absorbed into soils, rather than to any surface waters channels.

During routine maintenance of wells, vehicles would need to cross ephemeral channels via formal, purposed built crossings (i.e., those with culverts) to access portions of the well fields. Some channel crossings would occur at unimproved, streambed elevations. Such crossings would occur preferentially 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. Avoidance of drainage and wash areas that could loosen soil, damage channel banks, or disturb vegetation would reduce impacts to surface waters as a result of routine maintenance. Such impacts would be SMALL.

The Nichols Ranch Unit central processing plant would be constructed on a concrete slab 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. Training personnel in proper handling and transport of hazardous materials would avoid spills as well. Waste disposal via properly installed septic systems, deep injection wells, or offsite transport to an appropriate disposal site(s) would mitigate the effects of chemicals onsite and potential chemical spills. Impacts to surface water from operational activities are expected to be SMALL.

4.5.1.1.3 Aquifer Restoration Impacts to Surface Waters and Wetlands

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 to MODERATE.

The restoration of groundwater aquifers 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. Automated sensors would 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 4.5.1.2.2 are possible. Impacts to surface water from aquifer restoration are expected to be SMALL.

4.5.1.1.4 Decommissioning Impacts to Surface Waters and Wetlands

As discussed in the GEIS (Section 4.3.4.1.4), impacts from decommissioning are expected to be similar to impacts from construction. Activities to clean up, recontour, 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 to MODERATE.

Decommissioning would require all buildings and pipelines to be removed, and all wells to be plugged and abandoned (Uranerz, 2007). The removal of project improvements would be similar to construction impacts discussed in Section 4.5.1.1. 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. 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.

Impacts to surface water features associated with decommissioning activities are expected to be SMALL.

4.5.1.2 No Action (Alternative 2)

Under the No-Action alternative, there would be no change in the water quality at or in the vicinity of this site. Any Wyoming Pollutant Discharge Elimination System (WYPDES) permit holders near the Nichols Ranch ISR Project site would be expected to continue to adhere to the conditions of their WYPDES permits, which would result in similar water quality as discussed in Chapter 3 of this SEIS. This alternative would result in neither beneficial nor adverse impacts to surface water quality.

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. Under all phases, impacts of this alternative are expected to be similar in nature, but less than under the proposed action and SMALL.

4.5.2 Groundwater Impacts

4.5.2.1 Proposed Action (Alternative 1)

4.5.2.2 No Action (Alternative 2)

4.5.2.3 Modified Action – No Hank Unit (Alternative 3)

4.6 Ecological Resources Impacts

Potential environmental impacts to ecological resources at the Nichols Ranch site, to both flora and fauna, 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 to Ecological Resources

4.6.1.1.1 Construction Impacts to Terrestrial Ecology

4.6.1.1.1.1 Construction Impacts to Vegetation

As discussed in the GEIS (Section 4.2.5.1), 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.

Approximately 121 ha (300 ac) or less of land would be disturbed by the proposed Nichols Ranch ISR Project. The impacts to vegetation would be short term as most disturbances are associated with wellfield development that would be reclaimed and reseeded. Additionally, the small amount of vegetation that may be affected by the proposed project would occur over the life of the project with only 24 to 32 ha (60 to 80 ac) of land being affected at any given time.

The construction of the processing plant, main access roads and well fields would involve vegetation removal and disturbance. Most of the impacted area would affect the sagebrush community type (Uranerz, 2007). Only a relatively small portion of vegetation would be affected compared to the overall project area. Existing access roads would be utilized and possibly upgraded to minimize new disturbance of sagebrush habitat. The roads would be upgraded and constructed following U.S. Bureau of Land Management (BLM) and Wyoming Game and Fish Department (WGFD) recommendations to minimize road width, revegetate road shoulders, and limit vehicle speeds. Impacts from mud pit and pipeline constructions would be short-term, which would be reclaimed by re-seeding native plant seed. Topsoil stockpiles, along with as many as practical disturbed

areas of the well field, would be seeded with vegetation to reduce wind and water erosion. Surface disturbance associated with the construction activity of the Nichols Ranch ISR Project could result in the spread of invasive and noxious weeds. One noxious weed species, Canada thistle, is found in the project area. Uranerz commits to mitigation measures such as keeping vehicles that come into the Nichols Ranch ISR Project washed and the herbicide spraying of weeds.

Overall, impacts resulting from vegetation removal and surface disturbance would be SMALL. Based on the disturbed land area compared to the total project area, some individual plants would be affected, but impacts would not generally affect a sizeable segment of the species' population over a relatively large area.

4.6.1.1.1.2 Construction Impacts to Wildlife

As discussed in the GEIS (Section 4.3.5.1), 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 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 disturbing areas near active nests and prior to the fledgling of young (APLIC 2006).

4.6.1.1.1.2.1 Construction Impacts to Big Game

Direct impacts to pronghorn antelope and mule deer as a result of project activities would include the reduction of available habitat due to fencing of primary facilities, disturbance of a portion of winter/yearlong range, loss of forage, and vehicular collision accidents. An estimated 121 ha (300 ac) would be incrementally disturbed during the approximate 10-year life of the ISR facility, with only 24 to 32 ha (60 to 80 ac) withdrawn from use as wildlife habitat at any given time. As a result of these habitat disturbances, the winter/yearlong range carrying capacity for big game would be reduced during the life of the ISR facility and for several years thereafter until vegetative growth on the restored areas becomes productive enough to support big game. No significant increase in the potential for vehicle collision with big game is expected because of the short distances and low speeds required on the access roads.

Direct impacts to pronghorn antelope and mule deer would be SMALL because they would affect only a few individuals and are not expected to threaten the continued

existence of the species in the project area. Indirect impacts to pronghorn antelope and mule deer may include displacement into surrounding areas due to increased human activity and increased potential for poaching. In addition, increased human presence due to construction would affect pronghorn antelope and mule deer use of areas adjacent to the project. Some long-term disturbance (during the life of the ISR facility operation) of big game habitat would occur with project construction. There is adequate pronghorn antelope and mule deer habitat in the surrounding area and these species would possibly return to the project area once initial construction activities have concluded. The proposed staged reclamation of disturbed areas would provide grass and forb forage within a few years of habitat disturbance. The number of employees and the nature and intensity of uranium extraction activities would be comparable to those already taking place on this site and no increase in the potential for poaching and general harassment of big game is anticipated. Uranerz (Uranerz, 2007) has identified mitigation plans that would be enacted such as speed limits and fencing to aid in the reduction of big game conflicts associated with the Nichols Ranch ISR Project. Indirect impacts to pronghorn antelope and mule deer would be SMALL because these species are highly mobile and long-term impacts on the total population of these species are not anticipated.

4.6.1.1.1.2.2 Construction Impacts to Upland Game Birds

Direct impacts to greater sage-grouse 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 by the public leading to legal and illegal harvest; direct mortality from increased vehicular traffic; and an increase in mortality from raptors if power poles are placed in occupied greater sage-grouse habitat.

To minimize impacts to greater sage-grouse and other upland bird species, removal and disturbance of vegetation would be kept to a minimum through the use of existing ranch roads for travel and for the placement of pipelines. All lands disturbed by project activities would be revegetated following approved reclamation practices.

To minimize impacts to breeding greater sage-grouse, Uranerz would limit project activities and vehicular traffic to areas within 0.25 mi of an active lek between the hours of 8:00 pm and 8:00 am during the greater sage-grouse strutting period, which typically occurs between March 1 and May 15. In addition, project activities such as drilling and construction would be minimized in areas adjacent to an active lek between March 15 and July 15. To minimize raptor predation on greater sage-grouse, the construction of overhead power lines, permanent high-profiled structures (i.e., storage tanks), and other perch sites would not be constructed within 0.25 mi of an active lek. Uranerz also commits to keeping vegetation removal and disturbance to a minimum through the use of existing roads for travel and for the placement of pipelines.

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). If BMPs are implemented that minimize noise, vehicular traffic, and human proximity in the vicinity of leks, direct and indirect impacts to greater sage-grouse would be SMALL.

4.6.1.1.1.2.3 Construction Impacts to Raptors

Raptors are particularly sensitive to noise and the presence of human activity. These impacts would be heightened during the period of construction when heavy equipment and building contractors are fully active. Potential impacts to raptors include primarily the loss of foraging habitat as vegetative communities used by prey species is removed, collisions with structures and vehicles, nest abandonment and reproductive failure due to increased human disturbances, possible reduction in prey populations, and displacement of birds into adjacent areas. Seasonal guidelines with respect to noise, vehicular traffic, and human proximity have been established by the WGFD (WGFD, 2009) and BLM (BLM, 2008b).

Based on the proposed project boundaries, those trees with nests would not be removed during project activities. Potential conflicts between active nest sites and project-related activities would be mitigated by annual raptor monitoring, plans to avoid such areas, and limiting construction of overhead power lines near raptor nest sites so that they will not come in contact with the lines or use them as perches for viewing prey. The temporary disturbance of approximately 121 ha (300 ac) of raptor prey species habitats is unlikely to result in a reduction in the raptor population in the area because only 24 to 32 ha (60 to 80 ac) would be disturbed at any time. Additionally, this reduction is expected to be temporary.

If the BLM and WGFD guidelines and APLIC (2006) power line construction standards are implemented in the vicinity of known raptor nests, impacts to raptors would be SMALL. Impacts may affect a few individuals, but are not expected to threaten the continued existence of the species in the project area.

4.6.1.1.1.2.4 Construction Impacts to Waterfowl and Shorebirds

Due to the seldom observation of waterfowl at the site and the lack of waterfowl habitat in the project area, the construction of the Nichols Ranch ISR Project is expected to have no impacts on waterfowl or shorebirds.

4.6.1.1.1.2.5 Construction Impacts to Nongame/Migratory Birds

The temporary disturbance of approximately 121 ha (300 ac) of habitat would result in some reduction in the carrying capacity for nongame/migratory birds within the project area. Birds may be displaced by the uranium extraction activities and the temporary disturbance of wildlife habitat; however, the amount of habitat lost would be minimal in relation to the amount of comparable habitats that are available in the general area.

Therefore, impacts on any nongame/migratory bird populations would be SMALL and would not affect a sizeable segment of an individual bird species' population over a relatively large area.

4.6.1.1.1.2.6 Construction Impacts to Other Mammals

The use of the project area by mammalian predators such as the bobcat, badger, coyote, and swift fox would be temporarily reduced due to uranium extraction activities at the Nichols Ranch ISR Project. In addition, the recent outbreak of Tularemia in 2006 to 2007 (Uranerz, 2007) may have an effect on the prey base (i.e., rabbits) for mammalian predators, which may have already resulted in a shift of predators to other areas to seek prey. Therefore, impacts on mammalian predators would be SMALL.

Rabbits were abundant within the project area. Direct impacts to lagomorphs (jackrabbits and cottontails) as a result of the project may include vehicular collision accidents, loss of habitat, increased motorized access by the public leading to legal and illegal hunting, and the displacement of lagomorphs into surrounding areas due to human activity and project related noise. Since lagomorphs are relatively abundant in the project area and they show an affinity to disturbed areas with existing facilities such as culverts and well pads, the Nichols Ranch ISR Project is expected to have SMALL impacts on lagomorph populations. Any impacts would affect only a few individuals and are not expected to threaten the continued existence of the species in the project area.

Because suitable habitat exists throughout the project area, some small mammals (squirrel, black-tailed prarie dog) may be affected by the uranium extraction activities over the life of the operation. Some disturbance would be unavoidable, but Uranerz would take steps to minimize disturbance to known small mammal habitat such as black-tailed prairie dog towns, though specific measures are not provided by the applicant in the ER (Uranerz, 2007). Because of the limited amount of disturbance (121 ha [300 ac] over the life of the operation) and the low frequency of small mammal occurrence in the project area, the Nichols Ranch ISR Project is expected to have SMALL impacts on small mammal populations. Only a few individuals would be affected and small mammal species would likely travel to adjacent suitable habitat adjacent to the construction areas.

4.6.1.1.1.2.7 Construction Impacts to Reptiles and Amphibians

The ISR activities and temporary disturbance may result in some reduction in the population levels of reptile and amphibian species in the area (prairie rattlesnake and bullsnake); however, these impacts are expected to be short-term. Therefore, the impacts to reptiles or amphibian populations would be SMALL.

4.6.1.1.2 Construction Impacts to 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 so 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 Wyoming Game and Fish Department would help to limit impacts to aquatic life.

Due to the minimal and ephemeral surface water features located on site, no impacts to aquatic wildlife or wetland species are anticipated.

4.6.1.1.3 Construction Impacts to 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 federal- and state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the project area. The bald eagle (formerly listed as threatened, currently delisted) and black-footed ferret (endangered) are the only federally-listed, previously listed, or candidate wildlife species that may potentially occur in the area (FWS, 2008). The bald eagle was the only protected species observed in the area and may use the area for foraging during the winter months and migration; however, no nests or communal roosts occur within the Nichols Ranch ISL Project wildlife study area (personal communication, July 6, 2009, with Courtney Frost, Wildlife Biologist, BLM Buffalo Field Office). Project lands disturbed as a result of uranium extraction activities would be unavailable for foraging bald eagles until these areas are reclaimed and prey species return; however, only 24 to 32 ha (60 to 80 ac) would be withdrawn from use as wildlife habitat at any given time. The area has been block-cleared (surveys are no longer necessary) for the black-footed ferret; therefore, the uranium extraction activities would have a negligible effect on black-footed ferrets. No impacts are anticipated from project construction to the bald eagle or black-footed ferret.

Because no listed species or designated critical habitats occur within the project area, no adverse impacts on threatened or endangered species are anticipated as a result of construction activities.

4.6.1.1.4 Construction Impacts to Special Status Species

Of the 17 special status species that could be found at the project site, only two were observed within or adjacent to the project area (swift fox and Brewer's sparrow). These species would potentially be affected by construction activities. Direct impacts could include injury or mortality due to encounters with vehicles or heavy equipment during construction operations. Indirect impacts could include habitat loss or fragmentation and increased noise and activity that may deter use of the area by some species. Since only 24 to 32 ha (60 to 80 ac) would be withdrawn from use as wildlife habitat at any given time, impacts to species of special concern would be SMALL and are not expected to threaten the continued existence of these species in the project area.

4.6.1.2 Operation Impacts to Ecological Resources

As discussed in the GEIS (section 4.3.5.2), impacts to vegetation from facility operations resulting from spills around well heads and leaks from pipelines would be SMALL and would be handled using BMPs (NRC, 2009a). Leak detection systems and spill response plans to remove affected soils and capture release fluids would be expected to reduce the impacts.

During operation activities, well fields and supporting facilities would be accessed frequently using the defined road network. Surface disturbance increases the susceptibility of the project area to invasive and noxious weeds. As such, surface disturbance would be minimized and vehicular access would be restricted to specific roads. Disturbed areas would be reseeded with WDEQ and BLM approved seed mixture preventing the establishment of competitive weeds. Invasive and noxious weeds would be monitored and if they become an issue, other alternatives, such as herbicide application, would be considered.

As discussed in the GEIS (Section 4.3.5.2), 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. Mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys would be expected to reduce the significance of overall impacts to SMALL; however, the applicant has not committed to these implementation of these specific mitigation measures.

Wildlife use of areas adjacent to ISR operations is anticipated to increase as animals become habituated to the activity. Because wildlife may be in close proximity to facility buildings, roads, and well fields, some impacts to wildlife would be expected to occur from direct conflict with vehicular traffic and the presence of on-site personnel. Generally these impacts would be SMALL because they would affect only a few individuals and would not threaten the continued existence of any particular species in the project area. Adherence to seasonal guidelines established by the WGFD (2009) and BLM (2008b) for active sage-grouse leks or raptor nests 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 be mitigated by annual raptor monitoring and mitigation plans such as avoiding areas when possible where raptor nest sites are located.

During facility operations, spills around well heads and leaks from pipelines could expose wildlife to toxic chemicals. Leak detection systems and spill response plans to remove affected soils and capture release fluids would be expected to reduce the impact. If spills or leaks are handled using BMPs, impacts to wildlife would be SMALL.

No impacts to federal T&E species are anticipated during facility operation. Impacts to species of concern during facility operation would be similar to those discussed for construction, but at a significantly lesser degree, because facilities would remain in place during the life of the uranium extraction operation. If BMPs discussed above are followed, impacts to species of concern during facility operation would be SMALL because they would affect only a few individuals and would not threaten the continued existence of any particular species in the project area.

4.6.1.3 Aquifer Restoration Impacts to Ecological Resources

The GEIS (Section 4.2.5.3) discusses the potential impacts to ecological resources during the aquifer restoration phase. Impacts could include habitat disruption, but existing (in-place) infrastructure would be used during aquifer restoration, with little additional ground disturbance. Migratory birds could be affected by exposure to constituents in evaporation ponds, but perimeter fencing and netting would limit impacts.

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. Mitigation measures such as perimeter fencing, netting, and leak detection and spill response plans would reduce the significance of overall impacts to SMALL. Impacts to threatened and endangered species would be similar to those from operations, because existing infrastructure would continue to be used.

Because the existing infrastructure would be used during aquifer restoration, potential impacts to ecological resources would be similar to the impacts from operation; therefore, they would be SMALL.

4.6.1.4 Decommissioning Impacts to Ecological Resources

As discussed in the GEIS (Section 4.3.5.4), during decommissioning and reclamation, there would be a 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 Endangered Species Act consultations with the U.S. Fish and Wildlife Service 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.

Much of the disturbances to vegetation at the Nichols Ranch ISR Project site described in previous sections would occur within the sagebrush vegetative community type. This community type is gaining increasing importance within its range as areas are being lost due to wildfire and human disturbances and converted to grassland habitats. Compounding the issue is the difficulty in successfully re-establishing sagebrush, resulting in long-term impacts to vegetation, wildlife habitat, and visual and scenic resources. Refined techniques in seeding sagebrush have shown significant improvements in successful establishment of the species (Lambert, 2005). Such improved methods may include the use of cased-hole punched seeding with polypropylene casings as described by Booth (2005). For those areas previously dominated by sagebrush, Uranerz might consider re-establishing sagebrush using such techniques.

Wildlife could be impacted during the decommissioning phase of the project by conflicts with heavy equipment. During reclamation, restoration activities would revegetate previously disturbed areas for the returned use as wildlife habitat. As required, Uranerz would submit an updated reclamation plan for approval, following review and approval by the appropriate state and federal agencies. It is expected that temporarily displaced wildlife would return to the area once decommissioning and reclamation are completed. With the implementation of BMPs, decommissioning impacts would be SMALL overall.

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, there would be no land disturbance or vegetation removal associated with these activities. The area would continue to provide vegetation communities and wildlife habitat typical of the region. Land would continue to be used for pastureland and grazing leases would continue. As a result of the no-action alternative, there would be no impacts on terrestrial or aquatic ecological resources.

4.6.3 Modified Action - No Hank Unit (Alternative 3)

4.6.3.1 Construction Impacts to Ecological Resources

Construction impacts under this alternative would be less than those resulting from the 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. Therefore, the impacts to ecological resources would be SMALL.

4.6.3.2 Operation Impacts to Ecological Resources

Ecological resource impacts from operations under this alternative would be similar to those anticipated under the proposed action, although somewhat lessened. The same types of infrastructure and the same processes would be in place. Operations would take an estimated 3 to 4 years to extract the uranium from the Nichols Ranch Unit, which is slightly shorter than the length of operations expected from the Hank Unit. During this time, the day to day operations would affect the surrounding environment similarly to the impacts seen in the construction phase. Because ecological resource impacts would be similar to, or less than those expected for construction, the overall potential impacts to ecological resources from operational activities would be SMALL.

4.6.3.3 Aquifer Restoration Impacts to Ecological Resources

During aquifer restoration, the ecological resource 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. Ecological resource impacts from aquifer restoration would decrease as fewer wells and pump houses are used and overall equipment traffic and use diminish. There would be temporary disturbances to rangeland as the restoration phase of the ISR process commences, but these impacts would be temporary, and are anticipated to have a SMALL impact.

4.6.3.4 Decommissioning Impacts to Ecological Resources

Dismantling of project facilities and roads, as well as the reseeding and placement of soil would have impacts similar in scale to the construction, operations, and aquifer restoration phases, but the intensity of activities would temporarily increase due to increased use of earth and material-moving equipment and other heavy equipment. Impacts would be less for this alternative because land associated with the Hank Unit would not be involved. Vegetation re-establishment would be accomplished in the same manner and techniques as described under the proposed action. As decommissioning and reclamation proceed, the amount of disturbance would decrease, and the overall impacts to ecological resources during the decommissioning phase would be SMALL.

4.7 Meteorology, Climatology, and Air Quality Impacts

As discussed in the GEIS (Section 4.3.6), air quality impacts from ISL milling 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 are within regulatory limits and requirements

2. Air quality in the region is in compliance with the NAAQS

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 Nichols Ranch ISR Project. A discussion of air quality during construction, operation, aquifer restoration, and decommissioning phases of the Nichols Ranch ISR Project is provided in the following sections.

The air quality analysis focuses on carbon monoxide (CO) and particulate matter (PM_{10}, and $PM_{2.5}$) as these pollutants would be the primary sources of air emissions from project-related motor vehicle traffic traveling to and from the Nichols Ranch ISR Project. The EPA's CAL3QHC/CAL3HCR model (EPA, 1992) was used to predict worst-case CO and PM concentrations at various receptor locations, including the property line, open space, and the nearest residence at Pfister Ranch, which is 0.95 km (0.6 mi) north of the Hank Unit project area. Vehicular releases of CO and PM were obtained using the EPA's MOBILE 6.2 (EPA, 2004) and AP-42 (EPA, 2006) emissions models. Background concentrations obtained from the regional monitoring stations (WDEQ, 2009), which represent constant and diffuse levels of pollution that are present due to other sources of emissions throughout the area.

4.7.1 Proposed Action (Alternative 1)

4.7.1.1 Construction Impacts to Meteorology, Climatology, and Air Quality

As discussed in the GEIS (Section 4.3.6.1), 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 ISL construction are expected to be well below the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and for PM_{10}. Additionally, particulate, sulfur dioxide, and nitrogen dioxide emissions from ISR facilities are expected to a small percentage (1 to 9 percent) of the PSD Class II allowable increments. For NAAQS attainment areas, like the area around the Nichols Ranch ISR Project site, non-radiological air quality impacts would be SMALL.

The potential for impacts of emissions of CO and PM are localized because their concentrations disperse with time and distance. Due to the moderate terrain and wind climate, the emissions generated by the Nichols Ranch ISR Project would be expected to be reduced to background levels by 610 to 914 m (2,000 to 3,000 ft) from the point of generation. The emission of pollutants that have the potential to result in regional or cumulative impacts, such as ozone precursors and greenhouse gases, would be insignificant.

Vehicular traffic estimates of 35 light truck and 5 heavy truck trips each day for a similar facility proposed in Sweetwater County were employed (Lost Creek ISR, 2008) in this

analysis. The Lost Creek ISR Project estimated higher traffic volume than those given in the environmental report for the Nichols Ranch ISR Project, and these numbers were used to ensure a conservative estimate. The results of the site-specific impacts from travelling construction and workforce vehicles and construction equipment are presented below in Table 4-1.

The air quality within the proposed Nichols Ranch ISR project area would not be substantially affected by construction because of the temporary nature of the activity, the limited footprint of the construction area relative to the overall project area, the relatively low volume of traffic and heavy equipment compared with conventional mining activities, and the low background concentrations of pollutants. PM impacts caused by the emissions from the operation of construction machinery and by fugitive dust would be short-term and SMALL. CO impacts from engine combustion would be short-term and SMALL.

Mitigation measures that could further reduce these SMALL impacts would include implementing BMPs to ensure that the construction air quality control equipment would be maintained to mitigate fugitive dust emissions, wetting and stabilization of unpaved roads and disturbed land to suppress dust generation, cleaning paved roadways, and scheduling construction activities to minimize the amount and duration of exposed earth.

Table 4-1. Pollutant Concentrations during Construction

Project Concentrations

Receptor Location	Distance from Site in km (mi)	$PM_{2.5}$ (Industrial)		PM_{10} (Industrial)	CO	
		24-hr	Annual	24-hr	1-hr	8-hr
NAAQS	N/A	35	15	150	35	9
Background	N/A	26.0	7.6	60.0	0.9	0.7
Project Area	0.3 (0.2)	7.2	1.4	70.8	0.0	0.0
Pfister Ranch	0.95 (0.6)	3.2	0.6	30.8	0.0	0.0
Dry Fork Ranch	1.4 (0.9)	2.4	0.5	23.6	0.0	0.0
Pumpkin Buttes Ranch	1.6 (1)	2.0	0.4	20.4	0.0	0.0
T-Chair Ranch	3.2 (2)	1.2	0.2	13.6	0.0	0.0
Christensen Ranch	4.8 (3)	0.8	0.2	7.2	0.0	0.0
Van Buggenum Ranch	6.4 (4)	0.8	0.2	6.4	0.0	0.0
Ruby Ranch	9.7 (6)	0.4	0.1	3.6	0.0	0.0

Total Concentrations(1)

Receptor Location	Distance from Site in km (mi)	$PM_{2.5}$ (Industrial)		PM_{10} (Industrial)	CO	
		24-hr	Annual	24-hr	1-hr	8-hr
NAAQS	N/A	35	15	150	35	9
Background	N/A	26.0	7.6	60.0	0.9	0.7
Project Area	0.3 (0.2)	33.2	9.0	130.8	0.9	0.7
Pfister Ranch	0.95 (0.6)	29.2	8.2	90.8	0.9	0.7
Dry Fork Ranch	1.4 (0.9)	28.4	8.1	83.6	0.9	0.7
Pumpkin Buttes	1.6 (1)	28.0	8.0	80.4	0.9	0.7

Ranch						
T-Chair Ranch	3.2 (2)	27.2	7.8	73.6	0.9	0.7
Christensen Ranch	4.8 (3)	26.8	7.8	67.2	0.9	0.7
Van Buggenum Ranch	6.4 (4)	26.8	7.8	66.4	0.9	0.7
Ruby Ranch	9.7 (6)	26.4	7.7	63.6	0.9	0.7

(1) Total concentrations represent pollutant concentrations from the project plus background concentrations of pollutants present in the area based on information obtained from WDEQ data (WDEQ, 2009).

insert climate change impacts

4.7.1.2 Operation Impacts to Meteorology, Climatology, and Air Quality

The GEIS (Section 4.3.6.2) 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 spill 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.

Vehicular traffic estimates of 20 light truck and 5 heavy truck trips each day for a similar facility proposed in Sweetwater County were employed (Lost Creek ISR, 2008) in this analysis. The Lost Creek ISR Project estimated higher traffic volume than those given in the environmental report for the Nichols Ranch ISR Project, and these numbers were used to ensure a conservative estimate. The results of the site-specific impacts from travelling operations and workforce vehicles and construction equipment are presented below in Table 4-2.

Table 4-2. Pollutant Concentrations during Operations
Project Concentrations

Receptor Location	Distance from Site in km (mi)	$PM_{2.5}$ (Industrial)		PM_{10} (Industrial)	CO	
		24-hr	Annual	24-hr	1-hr	8-hr
NAAQS	N/A	35	15	150	35	9
Background	N/A	26.0	7.6	60.0	0.9	0.7
Project Area	0.3 (0.2)	7.2	1.4	44.4	0.0	0.0
Pfister Ranch	0.95 (0.6)	3.2	0.6	19.2	0.0	0.0
Dry Fork Ranch	1.4 (0.9)	2.4	0.5	14.8	0.0	0.0
Pumpkin Buttes Ranch	1.6 (1)	2.0	0.4	12.8	0.0	0.0
T-Chair Ranch	3.2 (2)	1.2	0.2	8.4	0.0	0.0
Christensen Ranch	4.8 (3)	0.8	0.2	4.4	0.0	0.0
Van Buggenum Ranch	6.4 (4)	0.8	0.2	4.0	0.0	0.0
Ruby Ranch	9.7 (6)	0.4	0.1	2.4	0.0	0.0

Total Concentrations[1]

Receptor Location	Distance from Site in km (mi)	$PM_{2.5}$ (Industrial)		PM_{10} (Industrial)	CO	
		24-hr	Annual	24-hr	1-hr	8-hr
NAAQS	N/A	35	15	150	35	9
Background	N/A	26.0	7.6	60.0	0.9	0.7
Project Area	0.3 (0.2)	33.2	9.0	104.4	0.9	0.7
Pfister Ranch	0.95 (0.6)	29.2	8.2	79.2	0.9	0.7
Dry Fork Ranch	1.4 (0.9)	28.4	8.1	74.8	0.9	0.7
Pumpkin Buttes Ranch	1.6 (1)	28.0	8.0	72.8	0.9	0.7
T-Chair Ranch	3.2 (2)	27.2	7.8	68.4	0.9	0.7
Christensen Ranch	4.8 (3)	26.8	7.8	64.4	0.9	0.7
Van Buggenum Ranch	6.4 (4)	26.8	7.8	64.0	0.9	0.7
Ruby Ranch	9.7 (6)	26.4	7.7	62.4	0.9	0.7

[1] Total concentrations represent pollutant concentrations from the project plus background concentrations of pollutants present in the area based on information obtained from WDEQ data (WDEQ, 2009).

During operations, the already SMALL impacts caused by CO and PM would be further reduced and would remain below the NAAQS. PM impacts caused by the emissions from operations equipment and by fugitive dust would be long-term and SMALL. CO impacts from engine combustion would be long-term and SMALL. The mitigation measures described under Section 4.7.2.1 would also be implemented during the operation phase. insert climate change impacts

4.7.1.3 Aquifer Restoration Impacts to Meteorology, Climatology, and Air Quality

As discussed in the GEIS (Section 4.3.6.3), 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 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. PM impacts caused by the emissions from restoration equipment and by fugitive dust would be SMALL. CO impacts from engine combustion would be SMALL. The mitigation measures described under Section 4.7.2.1 would also be implemented during the aquifer restoration phase. insert climate change impacts

4.7.1.4 Decommissioning Impacts to Meteorology, Climatology, and Air Quality

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 Nichols Ranch ISR Project site would not exceed those described in Section 4.7.2.1. PM impacts caused by the emissions from decommissioning equipment and by fugitive dust would be SMALL. CO impacts from engine combustion would be SMALL. The mitigation measures described under Section 4.7.2.1 would also be implemented during the decommissioning phase. insert climate change impacts

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. This alternative would result in neither beneficial nor adverse impacts to air quality. insert climate change impacts

4.7.3 Modified Action – No Hank Unit (Alternative 3)

4.7.3.1 Construction Impacts to Meteorology, Climatology, and Air Quality

Under this alternative, the construction activities for the Hank Unit would not occur. The air pollution levels in the project area or at any surrounding receptors would be equal to or lower than the air pollution levels for the proposed action. Fugitive dust and engine

combustion emissions from equipment performing land disturbing activities would not occur within the Hank Unit project boundary. 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. The nearest residential receptor, which is located approximately 1.4 km (0.9 mi) north of the Nichols Ranch Unit, would not experience an increase in pollution concentrations due to construction activities at the proposed project site, therefore resulting in no impact. PM impacts caused by the emissions from the operation of construction machinery and by fugitive dust associated with the Nichols Ranch Unit would be short-term and SMALL. CO impacts from engine combustion would be short-term and SMALL. insert climate change impacts

4.7.3.2 Operation Impacts to Meteorology, Climatology, and Air Quality

The impacts of operation of this alternative would be largely the same as those stated for the proposed action. The nearest residential receptor location would not experience any change in air pollution levels due to operations. Because the Hank Unit would not be constructed, stationary sources of CO and PM (e.g., generator and compressor engines) would not be present. More importantly, emissions related to the transfer of ion exchange resin between the Hank Unit satellite facility and the Nichols Ranch Unit CPP 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. Emissions from these activities include fugitive dust generated by rolling traffic of tractor trailers and commuting workers and PM and CO from diesel truck exhaust. Therefore, for this alternative, PM impacts caused by the emissions from operations equipment and by fugitive dust associated with the Nichols Ranch Unit would be long-term and SMALL. CO impacts from engine combustion would be long-term and SMALL. insert climate change impacts

4.7.3.3 Aquifer Restoration Impacts to Meteorology, Climatology, and Air Quality

The impacts of aquifer restoration for this alternative would be the same as those stated for the proposed action. The nearest residential receptor location would not experience any change in air pollution levels due to aquifer restoration activities. With the exception of passing traffic along the gravel ranch road, sources of emissions would not be present in the vicinity of the Hank Unit. PM impacts caused by the emissions from restoration equipment and by fugitive dust associated with the Nichols Ranch Unit would be SMALL. CO impacts from engine combustion would be SMALL. insert climate change impacts

4.7.3.4 Decommissioning Impacts to Meteorology, Climatology, and Air Quality

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. The nearest residential receptor would not experience an increase in air pollution levels due to decommissioning activities. PM impacts caused by the emissions from decommissioning equipment and by fugitive dust associated with the Nichols Ranch Unit would be long-term and SMALL. CO impacts from engine combustion would be SMALL. insert climate change impacts

4.8 Noise Impacts

Potential environmental impacts from noise at the Nichols Ranch 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. These impacts may affect both humans and wildlife in the vicinity of the site.

Detailed 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

4.8.1.1 Construction Impacts to Noise

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 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 300m (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 total sound levels generated by the Nichols Ranch ISR Project include construction equipment, motor vehicles, and pre-construction background noise levels. Using the typical equipment sound levels listed in the GEIS and the Federal Highway Administration (FHWA)'s Traffic Noise Model Version 2.5 (TNM), construction phase sound levels were projected to receptor locations by established relationships of sound propagation over distance. Specifically, for a stationary source of sound and beginning at a distance of 15 m (50 ft), noise levels diminish by 6 decibels (dBA) for each doubling of the distance from the source. TNM's inputs include, but are not limited to, roadway geometry, pavement type, site topography, vehicle volume, vehicle type, and vehicle speed. Using noise addition, sound levels from construction equipment located on the site and construction vehicles accessing the site were combined with existing background sound levels to determine the extent of noise impacts to nearby receptors. The results of the noise analysis associated with the construction phase of the project are presented in Table 4-3.

Table 4-3. Construction Phase Sound Levels (dBA)

	Receptor Locations							
	Project Area 0.3 km (1,000 ft)	Pfister Ranch 0.95 km (0.6 mi)	Dry Fork Ranch 1.4 km (0.9 mi)	Pumpkin Buttes Ranch 1.6 km (1 mi)	T-Chair (Rolling Pin) Ranch 3.2 km (2 mi)	Christ-ensen Ranch 4.8 km (3 mi)	Van Buggenum Ranch 6.4 km (4 mi)	Ruby Ranch 9.7 km (6 mi)
Background Sound Level	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
Construction Equipment	50.3	40.3	36.8	35.0	30.4	25.3	24.2	21.0
Construction Traffic	30.8	21.4	18.2	16.6	12.0	6.7	5.4	1.5
Combined Sound Level	50.6	42.7	41.0	40.5	39.6	39.2	39.1	39.1
Sound Level Increase	11.6	3.7	2.0	1.5	0.6	0.2	0.1	0.1

Source: Estimates based on input to the Federal Highway Administration's Traffic Noise Model Version 2.5; program information available at: <http://www.fhwa.dot.gov/environment/noise/tnm/tn_ver25.htm>

Based upon the noise analysis, it is expected that the sound levels at the project boundary would experience an increase of approximately 11.6 dBA. This value is less that the 15 dBA threshold noted in Section 5 of WYDOT's Noise Analysis and Abatement Guidelines, above which is considered a substantial noise impact (WYDOT,

1996). The nearest residential receptor, which is located approximately 0.95 km (0.6 mi) north of the Hank Unit at Pfister Ranch, would experience an increase of just 3.7 dBA. As stationary, onsite sources of noise will have a minor impact on just one offsite receptor (Pfister Ranch), truck transport of construction materials would be the primary noise source that would affect offsite receptors. However, because of the limited traffic volume associated with the project as a whole (see Section 4.3), this impact would be minor. 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. Therefore, the impacts to noise are SMALL.

4.8.1.2 Operation Impacts to Noise

As discussed in Section 4.3.7.2 of the GEIS, noise-generating activities in the central uranium processing facility 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. As for construction, 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 site, access roads within the 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.

To evaluate noise impacts during the operation phase, it was assumed that a variety of mechanical equipment, such as generators, pumps, air compressors, and heating, ventilation, and air conditioning systems at the plant would generate sound levels. Using the properties of noise propagation over terrain, the sound levels generated by these stationary sources during the operation phase were determined. Potential sound levels generated by traffic accessing the site during operations were also evaluated. TNM was utilized to determine the noise impact due to the truck activities along the access route. Using projected traffic volumes, the distance from the center line of the roadway to the area of noise impact was determined. Applying noise addition, sound levels from onsite equipment and vehicles assessing the site were combined with existing background sound levels to determine the extent of noise impacts to nearby receptors. The results of the noise analysis associated with the operation phase of the project are presented in Table 4-4.

Table 4-4. Operations Phase Sound Levels (dBA)

	Receptor Locations							
	Project Area 0.3 km (1,000 ft)	Pfister Ranch 0.95 km (0.6 mi)	Dry Fork Ranch 1.4 km (0.9 mi)	Pumpkin Buttes Ranch 1.6 km (1 mi)	T-Chair (Rolling Pin) Ranch 3.2 km (2 mi)	Christ-ensen Ranch 4.8 km (3 mi)	Van Buggenum Ranch 6.4 km (4 mi)	Ruby Ranch 9.7 km (6 mi)
Background Sound Level	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
Construction Equipment	40.8	30.9	27.5	25.9	21.7	18.0	17.3	15.9
Construction Traffic	30.8	21.4	18.2	16.6	12.0	6.7	5.4	1.5
Combined Sound Level	43.3	39.7	39.3	39.2	39.1	39.0	39.0	39.0
Sound Level Increase	4.3	0.7	0.3	0.2	0.1	0.0	0.0	0.0
Source: Estimates based on input to the Federal Highway Administration's Traffic Noise Model Version 2.5; program information available at: <http://www.fhwa.dot.gov/environment/noise/tnm/tn_ver25.htm>								

Based on the results of the model, sound levels at the project boundary line would experience an increase of 4.3 dBA. This value is less that the 15 dBA threshold noted in Section 5 of the Wyoming Department of Transportation (WYDOT)'s Noise Analysis and Abatement Guidelines, above which is considered a substantial noise impact (WYDOT, 1996). Receptor locations beyond 1,067 m (3,500 ft) from the construction site would experience sound levels equivalent to existing background sound levels. Based upon the noise analysis, it is expected that the nearest residential receptor location, which is located approximately 0.95 km (0.6 mi) north of the Hank Unit, would experience virtually no change in sound levels due to the activities during operations at the proposed site (+0.7 dBA). Therefore, the impacts to noise are SMALL.

4.8.1.3 Aquifer Restoration Impacts to Noise

The GEIS (Section 4.7.3.3) 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 Nichols Ranch ISR Project restoration phase include cement mixers, compressors, and pumps used for the plugging and abandonment of production and injection wells. Noise impacts from aquifer restoration activities are expected to be similar to or lower than the operation phase activities at the site.

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. Sound levels from the aquifer restoration activities would be localized and would be reduced with distance, similar to the sound levels of the other phases of activities. 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. Table 4-5 shows the results of the noise analysis using TNM.

Table 4-5. Aquifer Restoration Phase Sound Levels (dBA)

	Receptor Locations							
	Project Area 0.3 km (1,000 ft)	Pfister Ranch 0.95 km (0.6 mi)	Dry Fork Ranch 1.4 km (0.9 mi)	Pumpkin Buttes Ranch 1.6 km (1 mi)	T-Chair (Rolling Pin) Ranch 3.2 km (2 mi)	Christ-ensen Ranch 4.8 km (3 mi)	Van Buggenum Ranch 6.4 km (4 mi)	Ruby Ranch 9.7 km (6 mi)
Background Sound Level	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
Construction Equipment	40.8	30.9	27.5	25.9	21.7	18.0	17.3	15.9
Construction Traffic	30.8	21.4	18.2	16.6	12.0	6.7	5.4	1.5
Combined Sound Level	43.3	39.7	39.3	39.2	39.1	39.0	39.0	39.0
Sound Level Increase	4.3	0.7	0.3	0.2	0.1	0.0	0.0	0.0

Source: Estimates based on input to the Federal Highway Administration's Traffic Noise Model Version 2.5; program information available at: <http://www.fhwa.dot.gov/environment/noise/tnm/tn_ver25.htm>

Based on the results of the noise analysis, aquifer restoration activities are expected to increase the sound levels at the project boundary line by approximately 4.3 dBA. Sound levels generated by aquifer restoration would be expected be at the existing background levels of 39 dBA at a distance of approximately 1,067 m (3,500 ft) from the project site. Based upon the noise analysis, it is expected that the nearest residential receptor location, which is located approximately 0.95 km (0.6 mi) north of the Hank Unit, would experience virtually no change in sound levels due to aquifer restoration activities at the proposed project area (+0.7 dBA). Therefore, the impacts to noise are SMALL.

4.8.1.4 Decommissioning Impacts to Noise

The GEIS (Section 4.7.3.4) 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 to the construction activities and would include earth moving, excavation, and building demolition. Table 4-6 shows the results of the noise analysis using TNM.

Table 4-6. Decommissioning Phase Sound Levels (dBA)

	Receptor Locations							
	Project Area 0.3 km (1,000 ft)	Pfister Ranch 0.95 km (0.6 mi)	Dry Fork Ranch 1.4 km (0.9 mi)	Pumpkin Buttes Ranch 1.6 km (1 mi)	T-Chair (Rolling Pin) Ranch 3.2 km (2 mi)	Christ-ensen Ranch 4.8 km (3 mi)	Van Buggenum Ranch 6.4 km (4 mi)	Ruby Ranch 9.7 km (6 mi)
Background Sound Level	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
Construction Equipment	50.3	40.3	36.8	35.0	30.4	25.3	24.2	21.0
Construction Traffic	30.8	21.4	18.2	16.6	12.0	6.7	5.4	1.5
Combined Sound Level	50.6	42.7	41.0	40.5	39.6	39.2	39.1	39.1
Sound Level Increase	11.6	3.7	2.0	1.5	0.6	0.2	0.1	0.1

Source: Estimates based on input to the Federal Highway Administration's Traffic Noise Model Version 2.5; program information available at: <http://www.fhwa.dot.gov/environment/noise/tnm/tn_ver25.htm>

Noise impacts from decommissioning activities are expected to be similar to or lower than the construction activities at the site. Decommissioning activities would result in a substantial but temporary noise impact to the areas surrounding the proposed area. As was the case with the construction activities, the sound levels from the decommissioning activities are expected to increase by 11.6 dBA at the project boundary. Based upon the noise analysis, it is expected that the nearest receptor, which is located approximately 0.95 km (0.6 mi) north of the Hank Unit (Pfister Ranch), would experience an increase of 3.7 dBA due to decommissioning activities at the proposed project site. Sound levels

are expected to be at the existing background levels of 40 dBA just beyond Pfister Ranch, at a distance of approximately 1,067 m (3,500 ft) from the project site. Therefore, the impacts to noise are SMALL.

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. These activities, coupled with the remote and rural setting of the project area, would result in sound levels remaining within the range listed in the GEIS. This alternative would result in no impacts on noise.

4.8.3 Modified Action – No Hank Unit (Alternative 3)

4.8.3.1 Construction Impacts to Noise

Under this alternative, the construction activities for the Hank Unit would not occur. Noise levels in the Nichols Ranch Unit project area and at any surrounding receptors would be equal to or lower than those for the proposed action. No construction-related sound would be generated from the Hank Unit project area, with the exception of traffic passing through the area on the main T-Chair Livestock 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). Therefore, noise impacts from the construction activities for this alternative are expected to be SMALL.

4.8.3.2 Operation Impacts to Noise

The nearest residential receptor location, which is located approximately 1.4 km (0.9 mi) north of the Nichols Ranch Unit, would experience virtually no change in sound levels due to the activities during operations at the proposed site (+0.3 dBA), resulting in no impact. 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.

4.8.3.3 Aquifer Restoration Impacts to Noise

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. The nearest residential receptor location, which is located approximately 1.4 km (0.9 mi) north of the Nichols Ranch Unit, would experience virtually no change in sound levels due to the activities during operations at the proposed site (+0.3 dBA), resulting in no impact. Therefore, noise impacts from the aquifer restoration activities for this alternative are expected to be SMALL.

4.8.3.4 Decommissioning Impacts to Noise

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. The nearest receptor, which is located approximately 1.4 km (0.9 mi) north of the Nichols Ranch Unit, would experience an increase of 2 dBA due to decommissioning activities at the proposed project site. 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 historic and cultural resources at the 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 historic and cultural 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 to Historical, Cultural, and Paleontological Resources

As discussed in the GEIS (Section 4.3.8.1) the potential impacts during ISR facility construction could include loss of, or damage to, historic and cultural resources due excavation activities as a part of construction. Additionally, access to, historical, cultural, and archaeological resources could be temporarily restricted during construction.

It is expected that an applicant would conduct the appropriate historic 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 Traditional Cultural Properties (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.

The evaluation of impacts to any historic 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, State Historic Preservation Offices (SHPO), other government agencies (e.g., U.S. Fish and Wildlife Service [FWS] and State Environmental Departments), and Native American Tribes (the THPO) 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 historic 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 historic and cultural resources from construction could be SMALL to LARGE depending on the presence or absence of historic and cultural resources on the site.

The construction resulting from the proposed action would have an adverse, direct impact on specific archaeological sites determined eligible to the NRHP. However, the effects would be mitigated by avoidance of archaeological sites and development and implementation of a memorandum of agreement (MOA), which are discussed below. Therefore, the impacts would be MODERATE.

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) 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.

Uranerz has not proposed avoidance or mitigation for these sites. If it is determined that the sites cannot be avoided, then mitigation must be completed prior to construction. Treatment plans would be established following the development of an MOA between all interested parties. The MOA would outline the mitigation process for each affected resource and why the sites cannot be avoided. Prior to construction, an Unexpected Discovery Plan should also be developed 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 impacts to these sites is ongoing.

The existing Pumpkin Buttes Memorandum of Understanding (BLM, 2008a) 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). 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 Chapter 4. If mitigation measures 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. If mitigation measures are not implemented, the impacts could range from MODERATE to LARGE.

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 Nichols Ranch ISR project would not significantly impact the fossil remains identified. Uranerz will 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.

4.9.1.2 Operation Impacts to Historical, Cultural, and Paleontological Resources

There would be minimal impacts from plant operations on archaeological sites recommended eligible to the NRHP within the plant site. 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 but BLM has noted that mitigation responses have to be developed. If a mitigation plan is developed and 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 any ground disturbing activities related to maintenance would be short-term. If mitigation is not implemented, the impacts could range from MODERATE to LARGE.

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 their

procedures would cover inadvertent discovery. Therefore, any impact from operations on paleontological resources would likely be SMALL and short-term.

4.9.1.3 Aquifer Restoration Impacts to Historical, Cultural, and Paleontological Resources

There would be minimal aquifer restoration impacts on historical and cultural resources recommended eligible to the NRHP. 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 but BLM has noted that mitigation responses have to be developed. If a mitigation plan is developed and 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 any ground disturbing activities related to aquifer restoration would be short-term. If mitigation is not implemented, the impacts could range from MODERATE to LARGE.

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.

4.9.1.4 Decommissioning Impacts to Historical, Cultural and Paleontological Resources

There would be minimal decommissioning impacts on historical and cultural resources recommended eligible to the NRHP. 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 but BLM has noted that mitigation responses have to be developed. If a mitigation plan is developed and 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 project site would be returned to the natural landscape during this stage.

Regarding paleontological resources, 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 unanticipated discoveries are identified during this phase, then impact could be MODERATE. However, it is likely that aquifer impacts to geologic units containing potentially significant resources would be SMALL as these units are at depth and impact at such depth would be minimal.

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.

4.9.2 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 facilities for ISR uranium milling and processing at the Nichols Ranch site. No archaeological sites, isolated cultural resources, or paleontological resources would be affected by direct or indirect effects locally or in the long-term. If the No-Action Alternative is selected, there would be no impact to cultural and paleontological resources when compared to the action alternatives.

4.9.3 Modified Action – No Hank Unit (Alternative 3)

4.9.3.1 Construction Impacts to Historical, Cultural and Paleontological Resources

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. In addition, a treatment plan along with an unexpected discovery plan would be established following the development of an MOA between all interested parties. Should mitigation measures be implemented, the impact to site 48CA5391 would be MODERATE. If mitigation measures are not implemented, then the impact to site 48CA5391could be MODERATE to LARGE. Section 106 consultation between the NRC, SHPO, BLM, and Uranerz regarding impacts to these sites is ongoing.

The existing Pumpkin Buttes Programmatic Agreement (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 will have a monitor present during construction activities involving depths in excess of a few feet, therefore the impact is SMALL. If fossil remains are discovered during the construction activities, then the impacts could be MODERATE. Construction would be halted and the monitor would immediately contact the appropriate state and federal agencies.

4.9.3.2 Operation Impacts to Historical, Cultural, and Paleontological Resources

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 will be halted and contact will 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 will be halted and contact will 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 to Historical, Cultural, and Paleontological Resources

There would minimal no aquifer restoration impacts on historical and cultural resources eligible to the NRHP. Most impacts would occur during initial plant construction and impacts to historic 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 will be halted and contact will 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.

Activities associated with aquifer restoration could impact paleontological resources. Should ground disturbing activities occur, then a monitor should be in place during these actions. If unanticipated discoveries are identified during this phase, then impact could be MODERATE. However, it is likely that aquifer impacts to geologic units containing potentially significant resources would be SMALL as these units are at depth and impact at such depth would be minimal.

4.9.3.4 Decommissioning Impacts to Historical, Cultural and Paleontological Resources

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 historic 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.

Paleontological resources could be impacted by decommissioning. If ground disturbing activities occur to depths in excess of a few feet, then excavation should be monitored. If unanticipated discoveries are identified, then impact could be MODERATE. However, it is likely that aquifer impacts to geologic units containing potentially significant resources would be SMALL as these units are at depth and impact would be minimal.

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 landscapes in the Wyoming West and East Uranium Milling Regions identified in the GEIS are identified as VRM Class II or Class IV, thus allowing for an activity to contrast with basic

elements of the characteristic landscape to a limited extent (Class II) or to a much greater extent (Class IV).

4.10.1 Proposed Action (Alternative 1)

The Nichols Ranch Unit and Hank Unit, 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 Unit and Hank Unit are discussed separately with regard to the Pumpkin Buttes TCP.

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 Pumpkin Buttes TCP, an NRHP-eligible property, 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.

The Hank Unit would contain a satellite facility and one maintenance building. The Hank Unit would be serviced by the T-Chair Ranch Road, an existing unnamed two-track road, and a new access road that would extend into the interior of the Hank Unit from the existing two-track. 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 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 on-site evaluation with BLM. This process will ensure that the effects of both units of the Nichols Ranch ISR Project on visual resources are mitigated.

4.10.1.1 Construction Impacts to Visual and Scenic Resources

As discussed in the GEIS (Section 4.3.9.1), visual impacts during construction can result from equipment (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 best management practices (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, Prevention of Significant Deterioration (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 or West 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.

Most visual and scenic impacts associated with earth-moving activities during construction would be temporary. During construction of the project well fields and facilities, mitigation through BMPs (e.g., dust suppression and coloration of well covers) would further reduce overall visual and scenic impacts of project construction so that total impacts would be SMALL; however, the presence of Pumpkin Buttes TCP and the physical separation of the units complicate the discussion. To clearly describe the potential impacts of the Nichols Ranch Unit versus the Hank Unit, which is located 9.6 km (6 mi) away, the following discussion is broken into two sections.

4.10.1.1.1 Nichols Ranch Unit

With regard to visual and scenic impacts of the Nichols Ranch Unit on the Pumpkin Buttes TCP, a visual contrast rating evaluation, if performed, would determine the extent to which proposed actions at Nichols Ranch Unit can be seen from the buttes. If any of the operations are visible, coordination with the BLM would ensure that mitigation options are considered for these effects. Under the PA for the Pumpkin Buttes TCP, mitigation strategies have been developed for areas within 3.2 km (2 mi) of the individual Pumpkin Buttes TCP elements. However, mitigation responses for actions greater than 3.2 km (2 mi) have not yet been developed and may be determined, upon consultation with BLM and SHPO, to be unnecessary. In this event, the construction impact to the Pumpkin Buttes TCP would be SMALL. If mitigation is put in place, then the impact to the resource would likely remain SMALL if these measures are properly employed.

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. However, because of the proximity of the Hank Unit to the Pumpkin Buttes TCP, some visual and scenic effects from construction are likely, and therefore, impacts are anticipated to be MODERATE.

4.10.1.2 Operation Impacts to Visual and Scenic Resources

The GEIS (Section 4.3.9.2) 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 uranium processing facility (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. Best management practices, and design (e.g., painting buildings) and landscaping techniques would be used to mitigate potential visual impact. The uranium districts in the four regions are all located more than 16 km (10 mi) from the closest VRM Class II region, and the visual impacts associated with ISL 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, the applicant intends to implement measures to lessen the visual impact from the Nichols Ranch ISR Project. Buildings and other structures would be painted so that they blended in would 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.

4.10.1.2.1 Nichols Ranch Unit

With regard to visual and scenic impacts of the Nichols Ranch Unit on the Pumpkin Buttes TCP, a visual contrast rating evaluation and coordination with the BLM and SHPO, as discussed in Section 4.10.2.1.1, would determine the extent to which operations activities at Nichols Ranch Unit can be seen from the buttes and identify appropriate mitigation options. Concern was expressed by the Northern Cheyenne that traffic, noise, dust, and extraction, in general, may affect the integrity of the setting of the Pumpkin Buttes TCP. If mitigation is put in place, then the impact to the resource would likely remain SMALL if these measures are properly employed.

4.10.1.2.2 Hank Unit

With regard to visual and scenic impacts of the Hank Unit on the Pumpkin Buttes TCP, operations impacts to visual and scenic resources would be SMALL according to the nature of routine maintenance described by the applicant (Uranerz, 2007). Additionally, implementation of the requirements of the PA for the Pumpkin Buttes TCP would limit the impacts to visual and scenic resources from the Hank Unit.

4.10.1.3 Aquifer Restoration Impacts to Visual and Scenic Resources

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 at both units.

4.10.1.4 Decommissioning Impacts to Visual and Scenic Resources

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 (expected to remain predominantly VRM Class III and IV). 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 at both units.

Mitigation through BMPs (e.g., dust suppression) would further reduce the SMALL visual and scenic impacts of decommissioning.

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 Nichols Ranch 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.

Past impacts of cattle operations and by oil and gas exploration and production on the Pumpkin Buttes (Site 48CA268) TCP spurred the development of a PA (BLM, 2009b) by the Wyoming SHPO, BLM, and the Native American tribes in order to curtail continued direct and indirect impact to the buttes proper and their immediate environs. With regards to the Pumpkin Buttes TCP, the No-Action Alternative would have a beneficial effect to this region.

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. Under all phases, impacts of this alternative are expected to be considerably less than under proposed action and thus, SMALL.

4.11 Socioeconomic Impacts

Potential environmental impacts to socioeconomics from activities at the 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 ISL 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.

4.11.1 Proposed Action (Alternative 1)

4.11.1.1 Construction Impacts to Socioeconomics

In the GEIS (Section 4.3.10.1), the potential impacts to socioeconomics from construction of an ISR facility are discussed. These impacts would result predominantly from employment at an ISL 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 to MODERATE.

4.11.1.1.1 Demographics

Construction is anticipated to last for approximately three years. 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. Given the general current global recession and the downward pressure on natural gas prices (suppressing exploration and development of CBM projects) and lower demand for electricity, impacts of the proposed action on demographics are expected to be SMALL.

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.

4.11.1.1.3 Housing

While vacancy rates are near zero in Gillette, a large construction project (Basin Electric) is expected to be completed in 2011, thus freeing up some housing. 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 Nichols Ranch ISR Project and therefore, impacts to housing are expected to be MODERATE.

4.11.1.1.4 Employment Rate

Given the increase in unemployment, a slight positive effect on employment rates may occur as a result of construction activities associated with the Nichols Ranch ISR Project. Uranerz anticipates a combined operations and construction workforce of 55 to 65 company employees and 10 to 20 contract employees during the life of the project. Uranerz plans to employ local employees and contractors whenever possible. Since the 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.

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 ISR project would also add to the Campbell and Johnson County tax base. 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.

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 for such a short period of time (approximately six months), impacts to the local infrastructure, schools, and public services from the proposed project would be SMALL.

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.

4.11.1.2 Operation Impacts to Socioeconomics

As discussed in Section 4.3.10.2 of the GEIS, employment levels during ISR facility operations (50 to 80 workers) would be expected to be less than those for construction, with total peak employment depending on timing and overlap with other stages of the ISL 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, 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.

4.11.1.2.1 Demographics

It is anticipated that the operations staff would be smaller than the construction staff, 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.

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.

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.

4.11.2.2.4 Employment Rate

Operation of the 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 been experiencing a boom over the last several years which has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. Diversified economies are more equipped to weather fluctuations in one industry. Jobs provided by the Nichols Ranch ISR Project would contribute to the observed decreased in economic diversification. Impacts to employment rate during operations are expected to be MODERATE.

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 4.11.2.1.5. 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.

4.11.1.2.6 Education

The added population associated with workers and their families relocating during operations would impact local schools and infrastructure. The already high teacher to student ratio in Campbell and Johnson counties might initially increase. 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 MODERATE.

4.11.1.2.7 Health and Social Services

As during the construction phase, an increased demand would be expected for doctors, hospitals, and police during the operations phase of the Nichols Ranch ISR Project in response to workers and their families relocating to the area. These 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, less workers will be required than during the construction phase. Impacts to health and social services during operations are expected to be SMALL.

4.11.1.3 Aquifer Restoration Impacts to Socioeconomics

The GEIS (Section 4.2.10.3) 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 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, workers would likely commute in from outside the local area, and impacts on the local housing inventory would be SMALL especially if some project workers are carried over from the operations stage of the project. Impacts on local infrastructure, as well as health, social and educational services would be SMALL since it is not likely that workers would relocate their families to the local 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. Thus, the impacts of aquifer restoration on local and state economies would be long-term, beneficial, and SMALL. By this stage of the project, local governments have adapted to the changes brought on by the project years earlier.

4.11.1.4 Decommissioning Impacts to Socioeconomics

The GEIS (Section 4.3.10.4) 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 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 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.

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.

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 changes as a result of this alternative. Impacts from construction would remain SMALL, impacts from operations would be SMALL to MODERATE, 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 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 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 region of influence (ROI) for purposes of this environmental justice analysis. 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 4-7) (USCB, 2009).

In 2007, the most recent year for which data is 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 4-8) (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 Nichols Ranch ISR Project; therefore, no adverse environmental impacts would result to minority populations or those living below the poverty level. Impacts to environmental justice during all phases of the project (construction, operation, aquifer restoration, and decommissioning) are expected to be SMALL.

Table 4-7. Minority Population Estimates, 2005-2007

	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	0	0.0	0	0.0	74	0.1	74	0.0

Islander								
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 4-8. Percent of Individuals Below Poverty Level, 2007

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 demographics of the project area due to the Nichols Ranch ISR Project. No construction workers or employees would be attracted to the area, and the relative proportion of minority or low-income residents would not be affected. This alternative would result in neither beneficial nor adverse impacts to environmental justice.

4.12.3 Modified Action – No Hank Unit (Alternative 3)

Under this alternative, the impacts to environmental justice during all four phases of the Nichols Ranch ISR Project would be the same as stated for Alternative B. Impacts to environmental justice under this scenario are anticipated to be SMALL.

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 Title 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 1910, Occupational Health and Safety Standards. Public exposures are addressed in Section 4.7.

4.13.1 Proposed Action (Alternative 1)

4.13.1.1 Construction Impacts to Public and Occupational Health and Safety

As described in Chapter 2 of this SEIS, construction activities associated with the 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. Well installation impacts are discussed in the next section. 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.

The GEIS concludes, in Section 4.2.11.1, 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. Construction is expected to have a SMALL impact on workers and the general public.

4.13.1.2 Operation Impacts to Public and Occupational Health and Safety

4.13.1.2.1 Radiological Impacts to Public and Occupational Health and Safety from Normal Operations

As discussed in the GEIS, some amount of radioactive material will 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 Nichols Ranch ISR Project site would be extraction of uranium-bearing solution from the wellfields, 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 were 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. The application of this methodology for the Nichols Ranch and Hank units and the resultant source terms are discussed in the applicant's TR, Section 7.3 (Uranerz, 2007). The following table summarizes releases for each major functional activity:

Table 4-9 Estimated Radon-222 Releases (Ci/yr)				
Location	Drilling	Production	Restoration	Total
Nichols Ranch Unit Area #1	0.045	170	180	350
Nichols Ranch Unit Area #2	0.045	170	180	350
Hank Unit Area #1	0.038	260	230	490
Hank Unit Area #2	0.038	260	230	490
Total	0.17	860	820	1,680

Based on the ISR facility radioactive source term presented in the ER, 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 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 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 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. The population dose for one year's operation to the total continental U.S. population was calculated to be 0.08 person-Sv (8 person-rem), which is a very small fraction of the 1.2×10^6 person-Sv calculated to this same population from natural background radiation exposure.

All radioactive and potentially toxic liquid waste from the processing operations would be disposed of by deep well injection. Therefore, there are no anticipated routine liquid releases or pathways of exposure from the facility operations. Leaks and spills in the wellfield 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 the applicant, 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. The applicant has conducted MILDOS modeling to demonstrate that normal operation of the yellowcake dryer would result in a total dose equivalent (TEDE) to members of the public of less than 1 mrem. Additionally, the applicant will install air particulate monitors, Rn-222 detectors, and gamma dosimeters to monitor the area to verify that expected radiation levels outside the dryer are maintained. The GEIS presents historical data for ISR operations, providing a range of estimated off-site 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, 2009). 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 [1994-2006] 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.

The applicant's dose evaluation for flora and fauna concluded that any potential dose would be negligible, attributable to negligible particulate releases and minimal radon releases. The staff's evaluation concluded that any doses to flora and fauna would not be significantly greater than that as evaluated for individuals at the site and the surrounding environment. Additionally, as noted by the applicant, there are no significant food pathways for domestic or wild animals.

In summary, potential radiation doses to occupationally exposed workers and members of the public from normal operation and restoration activities are expected to be SMALL. As an industry, ISR represents a lower level of health and safety risks to its workers compared with conventional mining, considering the less intrusive mining methods and reduced exposure to hazards common with open pit or shaft mining. Calculated radiation doses from the modeling of releases of radioactive materials to the environment are small fractions of the limits of 10 CFR 20 that have been established for the protection of the public health and safety. The staff has not identified any new and significant information during its independent review of the Nichols Ranch ISR Project ER or evaluation of other available information. 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.

4.13.1.2.2 Radiological Impacts to Public and Occupational Health and Safety from Accidents

The GEIS provides an identification, discussion, and consequence assessment for the abnormal and accident conditions that may occur with ISR operation. As discussed in Section 4.2.11.2.2 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 wellfield leaks and transportation accidents involving both, the transport of yellowcake from the facility to an offsite uranium conversion facility and the transport of loaded resin from the satellite facility to the central processing facility. 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 off-site 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 500 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. Off-site, 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 the applicant'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 packing facilities will be located on curbed concrete pads to prevent any liquids from spills or leaks from exiting the building and contaminating the outside environment of the facility. Therefore, except for wellfield leaks, 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 x 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. The GEIS did not evaluate public dose; however, considering that atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, any dose to a member of the public would be less than the 1 mSv (100 mrem) public dose limit of 10 CFR 20. 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 will 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).

The Nichols Ranch ISR Project application proposes to use rotary vacuum dryers with the use of heat transfer fluid that circulates through the dryer shell. This configuration separates the heater combustion source from the dryer itself, thereby nearly eliminating 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 are required as part the Radiation Protection Program. Both of these would further reduce the consequences of this accident, as well as others. Table 4-10 presents generic accident dose analysis for ISR Operations using data adapted from the GEIS (NRC, 2009a).

Table 4-10. 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)

Well Field Leaks. This scenario is considered an abnormal operating event, different from the more typical accident where large quantities of radioactive materials can be released in a very short time period. Wellfield leaks, if unidentified or left uncorrected, have the potential for causing large scale radioactive and chemical contamination of the surrounding environment (predominantly from uranium and radium in the pregnant lixiviant). As evaluated in the GEIS Section 2.11.2, if a pipeline ruptures or fails, process solution can be released, leading to contamination of the surrounding soil, potential runoff into surface water bodies, and/or infiltration and percolation to groundwater. The reporting of such events is addressed in NRC regulations 10 CFR 20, Subpart M and 10 CFR 40.60. Also, in accordance with 10 CFR 40.36 records of spills and other unusual occurrences involving spread of contamination are to be maintained to facilitate decommissioning. The conclusion of the GEIS is that temporary contamination of soils from leaks and spills would be detected with appropriate and timely remediation, limiting the magnitude of overall impact to SMALL.

In Section 2.9 of the TR, the applicant describes the use of wellfield monitoring system (e.g., flow/pressure indicators) and daily visual wellfield surveillance and observation as the means for timely identification of a wellfield piping leaks. Spills exceeding 1,591 L (420 gal) are to be reported to the WDEQ and the NRC.

In TR Section 7.5.3, the applicant provides an evaluation of wellfield pipe failure, indicating that probability of failure is small since pipelines will be buried 1 to 2 m (2 to 5 ft) below surface and composition will be corrosion-free high density polyethylene. Testing and inspection prior to burial would be performed. The applicant identified a worst-case pipeline failure scenario could result in 795455 L (210,000 gal) of lixiviant being released. However, no further analysis was performed as to consequences; reference was made to NUREG-1508, the NRC's FEIS for Crownpoint Uranium Solution Mining project (NRC, 1997).

Leaks or breaks would be reported immediately. In the event of a break, the wetted area would be surveyed, sampled and recorded on a spill map. Soils with significantly elevated levels of uranium and radium-226 would be removed and disposed at a licensed site. A Safety RAI has been issued requesting additional information on wellfield inspections and contingency plans for system failures. Pending resolution of this topic, this issue remains an Open Item.

Transportation of Yellowcake. The transportation accident of concern would be the transport of yellowcake from the facility to an offsite uranium conversion facility. Such shipments would be conducted in accordance with the packaging and shipping regulations of the USDOT 49 CFR 171 – 173 and NRC 10 CFR 71. NRC has evaluated

the consequences for this type accident associated with uranium mills in NUREG-0706 (NRC, 1980). As discussed in GEIS for radioactive shipments, compliance with transportation regulations would limit radiological risks. Emergency response protocols would help mitigate long-term consequences of severe accidents involving release of uranium. In Section 7.5 of the TR, the applicant evaluates effects of accidents. The impact for transport for approximately 21 shipments of 17,000 kg (7,720 lb) of yellowcake each was considered. The transport distance of 1,932 km (1,200 mi) from the Nichols Ranch central processing plant to a uranium conversion facility was considered. To minimize the potential impact from transportation accidents, the applicant has proposed the use of the Uranerz Energy Corporation Incident Response Guide. The carrier will be required to maintain accident response capabilities to specifically include spill response. Since the shipment of yellowcake from Nichols Ranch to an offsite processor does not pose a different type accident, either in frequency or consequences, from that as evaluated in NUREG-0706 and discussed in the GEIS, no further analyses were performed. As characterized in the GEIS, radiological impact from potential transportation accidents are SMALL to MODERATE.

Loaded Resin Transport from Satellite Facility. For the Nichols Ranch ISR Project, it has been proposed that loaded resin from the Hank Unit will be transported to the central processing facility at the Nichols Ranch Unit for processing. The loaded resin will 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 will be dewatered with a minimal amount of barren lixiviant. Due to the nature of the resin with minimal water, any transportation accident during transport would be 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 absence of water bodies, any spilled resin would be expected to remain in the immediate area of the accident. Any resulting contamination, resin and solids, would be easily 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 Nichols Ranch ISR Project. The NRC has not identified any new and significant information during its independent review or evaluation of other available information. 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 to MODERATE; whereas impacts to the general pubic would be SMALL.

4.13.1.2.3 Non-Radiological Impacts to Public and Occupational Health and Safety from Normal Operations

The GEIS includes an identification of the various chemicals, hazardous and non-hazardous, 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 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.

- 40 CFR Part 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.

Listed below are the bulk hazardous chemicals and their associated protective provisions expected to be used at the Nichols Ranch ISR PRoject, according to Table 7-11 of the TR and Table 4-1 of the ER:

- 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.

Typical on-site quantities for some of these chemicals exceed the regulated, minimum reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices. Compliance with applicable regulations reduces the likelihood of a release. Off-site impacts would be small and do not typically pose a significant risk to the public, while workers involved in a response and cleanup can experience moderate impacts if the proper emergency and cleanup procedures and worker training are not adequate or absent.

In general, the handling and storage of chemicals at the facility will 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. As discussed in Section 3.3 of the applicant's TR, Uranerz plans to use chemicals to extract uranium, process waste water, and restore groundwater. The Nichols Ranch Unit and the Hank Unit will store chemicals that are both hazardous and non-hazardous. The different types of chemicals will be stored in separate locations. Any bulk hazardous materials that could impact the radiological safety of the facility will be isolated and stored in accordance with regulatory agency requirements. Chemicals that are considered nonhazardous and will not affect radiological safety can be stored inside the main buildings. Material Safety Data Sheets (MSDS) for each of the chemicals will be reviewed for facility safety and for radiological effects and the sheets will be located at the Nichols Ranch Unit and the Hank Unit.

Uranerz identifies anhydrous ammonia as the most hazardous chemical to be used on-site. 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 non-hazardous) for use at Nichols Ranch and Hank Units are consistent with those evaluated in the GEIS. Information provided by the applicant does not contain any new or significant information that is outside the bounds of the information and conclusions presented in the GEIS regarding potential impacts to public or occupational health and safety. Therefore, the impact to public and occupational health and safety from chemical usage at Nichols Ranch Unit and Hank Unit are expected to be SMALL.

4.13.1.2.4 Non-Radiological Impacts to Public and Occupational Health and Safety from Accidents

The risks from accidents associated with the use of the typical hazardous and non-hazardous chemicals for an in situ uranium recovery operation 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 these facilities can be designed and operated with appropriate measures to ensure proper safety for workers and the public.

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 does 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-WQD Rules and Regulations, Chapter 17, Part E and 40 CFR 302 (CERCLA).

The types and quantities of chemicals (hazardous and non-hazardous) for use at Nichols Ranch Unit and Hank Unit are not different from those evaluated in the GEIS. Information provided does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS regarding non-radiological impacts on public and occupational health and safety from chemical accidents. Therefore, it has been determined that there would be no significant non-radiological impacts from potential accidents to the public or occupational exposed workers beyond those discussed in the GEIS; therefore, the impact would be SMALL.

4.13.2.3 Aquifer Restoration Impacts to Public and Occupational Health and Safety

As discussed in the GEIS, aquifer restoration activities involve activities similar to those during operations (e.g., operation of well fields and waste water treatment and disposal) 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.

4.13.1.4 Decommissioning Impacts to Public and Occupational Health and Safety

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 will also provide 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, 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.

Information provided by the applicant does not contain any new or significant information that is contrary or varies with the information and conclusions presented in the GEIS regarding potential impacts to public and occupational health and safety. Impacts from and following decommissioning are expected to be SMALL.

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. Under this alternative, the existing residual radioactivity would remain in these areas and would not be remediated.

4.13.3 Modified Action – No Hank Unit (Alternative 3)

4.13.3.1 Construction Impacts to Public and Occupational Health and Safety

Issuing a license to conduct ISR operations solely at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit site will result in a smaller scope of construction activities. There will be no change in the types of facilities constructed, but fewer total wells would be drilled. Also, soil samples taken from the Hank Unit were closer to background levels than those taken from the Nichols Ranch Unit. Therefore, potential construction impacts from human interaction with high concentrations of radioactive material in soil would not greatly decrease by eliminating the Hank Unit. Construction impacts to public and occupational health under this alternative would be reduced, though still SMALL.

4.13.3.2 Operation Impacts to Public and Occupational Health and Safety

Issuing a license to conduct uranium mining operations at the Nichols Ranch without permitting activities at the adjacent Hank Unit site will result in a smaller uranium mining operation. There will be no change in the types of activities conducted, though fewer extraction wells will 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 would reduce many of the impacts to public and occupational health and safety seen with the proposed action from ISR operation.

4.13.3.3 Aquifer Restoration Impacts to Public and Occupational Health and Safety

Issuing a license to conduct uranium mining operations at the Nichols Ranch Unit without permitting activities at the adjacent Hank Unit site would result in a smaller scope of aquifer restoration activities. There would be no change in the types of activities conducted but, because fewer extraction wells would be utilized, there would be fewer aquifer restoration activities required. Choosing this alternative would reduce many of the impacts to public and occupational health and safety seen with the proposed action from aquifer restoration.

4.13.3.4 Decommissioning Impacts to Public and Occupational Health and Safety

Issuing a license to conduct uranium mining operations at the Nichols Ranch without permitting activities at the adjacent Hank Unit site will 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, but because fewer extraction wells will be constructed, 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, 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.

4.14 Waste Management Impacts

Potential environmental impacts from waste management at the 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 wastes to be disposed are process-related liquid wastes and process-contaminated structures and soils.

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 to Waste Management

As discussed in the GEIS (Section 4.3.12.1), 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 and can still receive municipal solid waste and construction and demolition waste for several more years. Thus, the waste management impacts at the Nichols Ranch site due to construction are SMALL.

4.14.1.2 Operation Impacts to Waste Management

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, the GEIS (Section 4.3.12.2) 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, a 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 (GEIS, Section 2.8).

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 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 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 Nichols Ranch ISR Project site is expected to be SMALL.

4.14.1.3 Aquifer Restoration Impacts to Waste Management

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. The site-specific conditions at the Nichols Ranch ISR Project site are consistent with those mentioned in the GEIS. As a result, waste management impacts from aquifer restoration at the Nichols Ranch ISR Project site would be expected to be SMALL.

4.14.1.4 Decommissioning Impacts to Waste Management

The GEIS (Section 4.3.12.4) 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 an NRC-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, Uranerz expects that a large fraction of the process equipment and materials would be reusable. Materials will 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 Nichols Ranch ISR Project. Transport of radioactive materials (waste and reusable materials) would be in accordance with the USDOT (49 CFR 173) and NRC (10 CFR 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.

4.14.2 No Action (Alternative 2)

If no action is taken, there will be no waste generated of any kind. There will be no deep well injection of liquid wastes, and a decommissioning plan will not be submitted. In addition, there will 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 Nichols Ranch ISR Project site without permitting activities at the adjacent Hank Unit site will 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.

4.15 References

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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 1500-1508) 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 impacts 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.

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 a 25,900 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.

The various past, present, and reasonably foreseeable future actions in the vicinity of the 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 and Christensen Ranch/ Irigaray ISR facilities. Three of the five conventional sites are in the decommissioning process and the other two are listed as either an Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I or II processing 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 NRC for the Moore Ranch site, located approximately 14 km (9 mi) to the southwest 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 (Powder River Basin) Uranium Milling Region[a]

Site Name	Company/Owner	Type[b]	County, State	Status[c]
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.	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	Power Resources Inc.	ISR[2,3]	Campbell, WY	Licensed - on standby
Reno Creek[1]	Rocky Mountain Energy Co.	ISR[1]	Campbell, WY	License terminated
Collins Draw	Cleveland Cliffs Iron Co.	ISR[1]	Campbell, WY	License terminated
Shirley Basin South	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
Highland 1	Exxon Minerals	ISR[3]	Converse, WY	Licensed, but not pursued
Reynolds Ranch	Power Resources Inc.	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	Power Resources Inc.	ISR[3]	Converse, WY	Operating
Bear Creek	Bear Creek Uranium Co.	Conv.	Converse, WY	Decommissioning
Highlands	Exxon Mobile Corp.	Conv.	Converse, WY	Decommissioning

Table 5-1. Uranium Recovery Sites in Wyoming East (Powder River Basin) Uranium Milling Region[a]				
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	Department of Energy	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	ISR1	Johnson, WY	License terminated with approval of Irigaray license
Shirley Basin	Pathfinder Mines Corp.	Conv.	Natrona, WY	Decommissioning
North Platte	Uranium Resources	ISR1	Platte, WY	License terminated

[a] Information on potential future uranium recovery applications is based on indication from industry summarized in 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>.

[b] Type: 1 = Research and Development/Pilot, 2 = Satellite, 3 = Commercial scale, Conv. = Conventional uranium mill

[c] Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I and Title II sites are uranium mill processing or tailings sites that have been decommissioned. The U.S. Department of Energy is the long-term custodian of these sites.

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 28,350 ha (70,000 ac). Reasonably foreseeable future development projects for cumulative acres disturbed range from 47,385 ha (117,000 ac) to 50,625 ha (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 (230kV) transmission lines, and coal technology projects. The total land area of other coal-related disturbance in the Powder River Basin in 2003 was nearly 2,025 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 (Powder River Basin) Uranium Milling Region[a]

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 2001-2005)
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
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
[a] As identified by the Wyoming Mining Association (data through 2008). "Wyoming Coal Data." <http://www.wma-minelife.com/coal/coalfrm/coaldat.htm>.				

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 40 billion cubic feet 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, 2008c). 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 (ibid).

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 76,140 ha (188,000 ac). The corresponding projection for the year 2015 is 123,525 ha (305,000 ac) (BLM, 2005a, 2005b, 2005c). Depth to gas and oil-bearing strata generally ranges from 1,200 m (4,000 ft) to 4,100 m (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 61 m (200 ft) 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 CBM 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 RFFAs

One final indicator of present and reasonably foreseeable future actions (RFFAs) is the number of draft and final EISs prepared by federal agencies within a recent time period. Using information in NUREG-1910, *Generic Environmental Impact Statement* (GEIS) *for In-Situ Leach Uranium Milling Facilities*, Vol. 1 and 2 (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, based on the CEQ guidance (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.

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.

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. As defined previously in this SEIS, SMALL impacts are those for which 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." Therefore, the staff considers that, for these resource areas (i.e., those for which all phases of the proposed ISR facility's 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.

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.

5.2 Land Use

The Powder River Basin encompasses approximately 25,900 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 Nichols Ranch ISR project are anticipated to be SMALL for all stages of the project and are discussed in detail in Chapter 4 of this SEIS. In addition to the Nichols Ranch ISR project, a variety of ongoing natural resource extraction and production facilities exist within the Powder River Basin 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, oil and gas production units, operational uranium ISR facilities, and wind energy operations in the Powder River Basin.

Construction and operational improvements and activities such as roads and infrastructure systems associated with the multiple facilities represent a long-term impact, as they will likely be present throughout the Nichols Ranch ISR Project lifespan and will remain beyond this time to accommodate the processing of other potential projects in the Powder River Basin. However, most facility and road construction impacts to the project area are impermanent, since the land will ultimately be returned to its natural condition.

Cumulatively, the SMALL and mitigated impacts to land use from the Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the LARGE potential impacts to the Powder River Basin when added to past, present, and reasonably foreseeable future actions.

5.3 Transportation

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 will 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 project area can be considered permanent, since the land will ultimately be returned to its natural condition after approximately ten years, when production and decommissioning are complete. Transportation related impacts from the Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

Like the Nichols Ranch ISR Project area, 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. 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 mining is by road, future projects like the Nichols Ranch ISR Project will require the construction of new road surfaces or the improvement of existing roads within the Powder River Basin. 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 will also require use of roadways, and traffic will 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 Powder River Basin to markets outside the area.

Cumulatively, the roads at the Nichols Ranch ISR Project will be reclaimed and overall project-related transportation impacts are thus relatively minor. However, past and ongoing natural resource development and extraction activities in the Powder River Basin have resulted in an extensive network of roads. Future activities (ISR and otherwise) will require the construction of additional road surfaces and other transportation-related developments. The SMALL impacts to transportation from the 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

The principal impacts on geology and soils from the 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 top soil and preparing surfaces for the central processing plant, satellite facility, header houses, access roads, drilling sites, and associated structures. As discussed in Chapter 4, all phases of the Nichols Ranch ISR are anticipated to have a SMALL impact to geology and soils.

Development activities from ongoing and future activities in the Powder River Basin have been, and will 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 2008c). 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 soil 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 reestablish 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 40.5 ha (100 ac) of temporary disturbance anticipated for the Nichols Ranch ISR Project amounts to less than 0.1 percent of the land area disturbed in the Powder River Basin in the year 2003. The way in which soils are impacted for Nichols Ranch are also far less damaging or adverse then the impacts which result from surface coal mining.

Cumulatively, the SMALL impacts to geology and soils from the Nichols Ranch ISR Project discussed in Chapter 4 are not expected to contribute to a perceptible increase in the MODERATE to LARGE potential impacts to the Powder River Basin when added to past, present, and reasonably foreseeable future actions.

5.5 Water Resources

5.5.1 Surface Waters and Wetlands

The 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 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 Nichols Ranch ISR Project: the Power Resources' North Butte ISR Project, located 2 mi north of the Hank Unit, and the COGEMA's Christensen Ranch ISR Project, located 6 mi north of the Nichols Ranch Unit and 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 include necessitate new roads, powerlines, 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, and required mitigation measures would reduce construction impacts to surface waters.

Cumulatively, the SMALL impacts to surface waters from the 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

5.6 Ecological Resources

Land disturbance resulting from the construction of the Nichols Ranch ISR Project and accompanying roadways would be the primary source of impacts to ecological resources. Ecology related impacts from the 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 208,394 ha (514,732 ac) from 2003 to 2020. Of these land areas disturbed, 111,786 ac was reclaimed in 2003 and a total of 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 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 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 habitats within the Powder River Basin when added to past, present, and reasonably foreseeable future actions.

5.7 Meteorology, Climatology, and Air Quality

Air quality impacts from the 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 Nichols Ranch ISR Project is located is in attainment status 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 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 2000.

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 SO_2 and 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.

Cumulatively, the SMALL impacts to air quality from the 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 Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

Noise associated with construction of the Nichols Ranch ISR Project is anticipated to be greater than other phases with an increase of 2.0 dBA at the nearest residential receptor located approximately 1.4 km (0.9 mi) north of the Nichols Unit. However, because some noise can be detected beyond this point, a radius of 8 km (5 mi) is considered as a conservative radius for the assessment of cumulative noise impacts. Past, present, and reasonably foreseeable future noise-generating activities in the vicinity of the Nichols Ranch ISR Project are primarily traffic noise, oil and gas operations, CBM operations, and uranium mining operations. The Final Environmental Impact Statement 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 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 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 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 Historic and Cultural Resources

Historic and cultural impacts from the 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.

Twenty-one cultural resources were identified in the vicinity of the Nichols Ranch ISR Project area that were determined not eligible to include in the NRHP. Six additional cultural resources in the project are recommended as eligible to be included in the NRHP. The analysis of cumulative impacts on historic and cultural resources will 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, 2008b) lists various actions which have the greatest potential for cumulative effects on cultural resources in the Powder River Basin region. These actions include: coal extraction actions, oil and gas operations, utility transmission and distribution actions, other mining 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 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 will be subject to 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, 2008a) 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 the many of the actions require inventory, evaluation, mitigation, avoidance, or protection of the cultural resources, it is acknowledged that adverse impacts to cultural resources will occur (NRC, 2009). These impacts are anticipated to be MODERATE.

Cumulatively, the SMALL to MODERATE impacts to historic and cultural resources from the Nichols Ranch ISR Project discussed in Chapter 4 may contribute to a perceptible

increase in the MODERATE potential impacts to nearby historic and cultural resources when added to past, present, and reasonably foreseeable future actions. However, mitigation will likely take place for the three cultural resources in the 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 historic and cultural resources are adequately considered.

5.10 Visual and Scenic Resources

Visual and scenic impacts from the Nichols Ranch ISR Project are anticipated to be SMALL and are discussed in detail in Chapter 4 of this SEIS.

Developments within the Powder River Basin region, in which the Nichols Ranch ISR Project is situated, are expected to continue over the next 15 to 20 years and will involve construction of railroads, coal-fired power plants, major (230kV) transmission lines, coal technology projects, oil and gas transportation pipelines and refineries, and coal-bed methane processing plants. Some of these facilities can be expected to be within the viewshed of the Nichols Ranch ISR Project site. Because the Nichols Ranch ISR Project is within close proximity to the Pumpkin Buttes TCP, and a 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 will limit some visual impacts within the Nichols Ranch ISR Project viewshed, as well.

Cumulatively, the SMALL impacts to visual resources from the Nichols Ranch ISR Project discussed in Chapter 4 are not likely to contribute to a perceptible increase in the MODERATE potential impacts to the Nichols Ranch ISR Project viewshed when added to past, present, and reasonably foreseeable future actions.

5.11 Socioeconomics

Socioeconomic impacts from the 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.

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, 2008b). While Campbell County and the entire Powder River Basin region 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/year), the local economy could be positively affected by multiple mining operations that would bring in local and state economic revenue.

Cumulatively, the SMALL to MODERATE impacts to socioeconomics from the 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 or no concentrated minority populations are located near the project area; therefore, no adverse environmental impacts would result to minority populations or those living below the poverty level from the Nichols Ranch ISR Project. Environmental justice impacts related to the Nichols Ranch ISR Project are discussed in more detail in Chapter 4 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 Million region (NRC, 2009).

The relative homogeneity of Wyoming despite 40 years of energy/natural resource development indicates that environmental justice issues will 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 project and there are no high and adverse impacts are predicted throughout the life cycle of the project; therefore, no adverse cumulative environmental justice impacts are predicted.

5.13 Public and Occupational Health and Safety

The proposed project would make a minor contribution to cumulative impacts to public and occupational health and safety. 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 project are expected to be far below any applicable limits. For the types of accidents evaluated, 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.

According to the GEIS (NRC, 2009) the Nichols Ranch ISR Project site is located in the Wyoming East Uranium Milling Region which contains 21 previous, current or potential uranium handling sites. Two of the 21 are operating uranium mines (Smith Ranch and 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 8 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 and are specific to 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 follow-up review for any "new" projects (since February 2008 as addressed in the GEIS) did not identify any projects that would likely increase cumulative impacts on radiological public health and safety for the study area. The contribution of the small impacts to health and safety associated with the proposed Nichols Ranch Project when considered cumulatively with these is negligible.

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 currently, prior to activities at the proposed Nichols Ranch ISR Project site, there is not a public and occupational health and safety impact concern. The past, present, and reasonably foreseeable future activities mentioned above are anticipated to have a SMALL impact on radiological public health and safety for the study area.

The maximum expected exposure to any member of the public from the 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. This exposure, combined with exposures from other facilities, is expected to remain far below the 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 Nichols Ranch ISR Project combined with the past, present and reasonably foreseeable future activities of the Powder River Basin are anticipated to be SMALL.

5.14 Waste Management

Waste management impacts from the 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 Powder River Basin that could generate hazardous or radioactive wastes include uranium mining activities, CBM activities, and oil and gas exploration. Each of these facilities would be responsible for complying with regulations and site-specific license agreements that manage any wastes generated. Because hazardous and radioactive wastes are so closely monitored throughout the United States, the impact from activities in the Powder River Basin is anticipated to be SMALL.

Cumulatively, the SMALL impacts to waste management from the 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 Powder River Basin 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* (GEIS) *for In-Situ Leach Uranium Milling Facilities*, Vol. 1 and 2 (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 Nichols Ranch ISR Project is organized in the following manner:

- Radiological monitoring (Section 6.2)
- Physiochemical monitoring (Section 6.3)
- 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 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 the applicant'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 central processing plant and satellite facility proposed by Uranerz. 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 will be conducted in accordance with or equivalent to NRC Regulatory Guide 8.25 "Air Sampling in the Workplace" (NRC, 1992) and will be consistent with NRC Regulatory Guide 8.30 "Health Physics in Uranium Recovery Facilities" (NRC, 2002).

Airborne uranium particulate monitoring will 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 will measure the worker's intake of uranium. Area samplers will be placed in areas where there is the potential for generation of airborne radioactive materials. These samplers will verify the effectiveness of confinement or containment and provide warning of elevated concentrations for planning or response actions. Area sampling frequency will 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.

Radon monitoring with the use of track-etch type radon detectors will be conducted in the general work areas. The radon detectors will be exchanged quarterly and analyzed for total radon. Radon daughter concentration monitoring will also be conducted in the process areas. Sampling frequency and action levels will be conducted in accordance with NRC Regulatory Guide 8.30 (NRC, 2002).

Continuous gamma monitoring will also be conducted at the same locations as the radon sampling. The gamma measurements will be taken with passive integrating detectors and will be changed once per calendar quarter.

Uranerz conducted baseline monitoring of Radon-222 and direct gamma exposure rates. The one-year radon monitoring results showed that the annualized average at the Nichols Ranch Unit and the Hank Unit 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 Unit and Hank Unit are 42.5 and 45.4 mrem. These values are within the range of typical background exposure rates in the Western United States.

6.2.2 Soils and Sediments Monitoring

Surface soil and sediment samples will be collected annually at the same locations as the radon sampling identified in Section 6.2.1. The surface soil samples will 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 will be analyzed for total uranium, Th-230, Ra-226 and Pb-210.

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 (insert regulatory basis) of the applicable radiation protection standard.

6.2.4 Surface Water Monitoring

Surface water samples will be collected annually or on a quarterly basis at the same locations sampled for pre-operational surface water sampling. Based on the ephemeral and intermittent nature of the onsite streams, the samples will be taken only if water is present. The samples will be taken either as a grab sample or by self samplers. The samples will be analyzed for total uranium, Th-230, Ra-226 and Pb-210. The locations of the surface water self samplers are shown on Figure 6-7.

6.2.5 Groundwater Monitoring

The groundwater monitoring program for radiological constituents will be similar to the groundwater monitoring program for chemical constituents as discussed later in Section 6.3.1 except that the areal extent of monitoring will go beyond the well field.

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 one well per four acres. During operation, these ore zone monitoring wells would be sampled twice per month at intervals of approximately two weeks. Horizontal monitoring wells will be installed on the edge of the well field, approximately 500 feet from the well field and spaced 500 feet 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 four acres. 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 will consult with 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
- TDS @ 180 degrees F
- 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
- Radium-226 (pCi/L)
- Radium-228 (pCi/L)
- 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
- Bicarbonate
- Boron
- Cadmium
- Calcium
- Carbonate
- Chloride
- Chromium
- Copper
- Electrical conductivity @ 25 degrees C
- Fluoride
- Iron
- Lead
- Magnesium
- Mercury
- Molybdenum
- Nickel
- Nitrate
- pH
- Potassium
- Radium-226
- 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.

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.

Private wells within one km 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. This monitoring program overlaps somewhat with the radiological monitoring programs discussed in Section 6.2 of this chapter. 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 the GEIS (Section 8.3), 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 will occur as part of the Nichols Ranch ISR Project is discussed below in Section 6.3.1.1. The groundwater quality monitoring that will 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 wellfield. 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.

Uranerz has installed a monitoring well network to provide an evaluation of baseline conditions within the project area. Details on the monitoring well network, baseline water

quality assessment conducted by Uranerz, and frequency and duration of sample are described in Section 6.2.5.

6.3.1.2 Groundwater Quality Monitoring

As discussed in the GEIS (Section 8.3.1.2), 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 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.

As mentioned in Section 6.2.5, 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. 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 excellent indicator of overall groundwater quality. Total alkalinity concentrations should be affected during an excursion as bicarbonate is the major constituent added to the lixiviant during mining.

The final number of monitoring wells and production pattern will 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 will 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 will 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 will include monitoring of the injection well and production well flow rates and pressures at each header house. Individual well flow readings will be recorded during each shift and the overall wellfield flow rates will be balanced daily. Flow and totalizer data will be transferred to and checked automatically at the central processing plant or satellite facility. The recovery and injection trunk lines will have electronic pressure gauges. Information from these gauges will be monitored from each unit's control room. The control system will have both high and low alarms for pressure and flow. If the pressure and/or flow is out of range, the alarms will sound, alerting personnel to make adjustments. Certain high or low readings will signal automatic shutoffs or shutdowns. Activation of the flow alarms will 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. To ensure the protection of surface water systems, each injection and production well would have a monitoring device that emits an alarm in the event of a change in flow pressure that might indicate a leak or rupture in the system. Once an alarm is emitted, 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. 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 48 mi southeast of the proposed site. The Antelope meteorological station has a similar climate to that of the Nichols Ranch ISR Project site because they are both located in open rolling hill areas and are at similar elevations.

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 on conducting any vegetation monitoring. 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 on-site.

6.4.2 Wildlife Monitoring

Uranerz proposes wildlife monitoring at the project site to include annual raptor and sage grouse surveys as required by the WDEQ. These surveys would likely take place in late April or early May. The purpose of the surveys would be to observe identified raptor nesting activity within the Nichols Ranch ISR Project area, observe and count sage grouse activity on known leks within 1.6 km (1 mi) of the permit boundary, and to observe if any new nests or leks are within the permit boundary or surrounding 1.6 km (1 mi) area.

As mentioned in Chapter 3, baseline field studies conducted by Uranerz for the Nichols Ranch ISR Project found that there are no sage grouse leks within the project area, but 10 leks are located within 3.2 km (2 mi) of the project area. Forty raptor nests were found within the project area of which 10 were determined to be active. All active nests were located in areas that would not be affected by well field or plant activities. All active nests would be monitored for continued activity. In the unlikely event that it becomes necessary to disturb a raptor nest, Uranerz would develop a mitigation plan and consult with the WDEQ, Wyoming Game and Fish Department, and the U.S. Fish and Wildlife Service. Any required permits would be obtained from the appropriate agencies.

6.5 References

NRC (U.S. Nuclear Regulatory Commission). 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. NUREG-1910, Vol. 1 and 2. June 2009.

NRC (U.S. Nuclear Regulatory Commission). 2003. Standard Review Plan for In-Situ Leach Uranium Extraction License Applications – Final Report. NUREG-1569. June 2003.

NRC (U.S. Nuclear Regulatory Commission). 2002. Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities, Revision 1. May 2002.

NRC (U.S. Nuclear Regulatory Commission). 1992. Regulatory Guide 8.25, Air Sampling in the Workplace, Revision 1. June 1992.

NRC (U.S. Nuclear Regulatory Commission). 1980. Regulatory Guide 4.14, Radiological Effluent and Environmental Monitoring at Uranium Mills, Revision 1. April 1980.

Uranerz Energy Corporation (Uranerz). 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.

6.6 Figures

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7 Cost-Benefit Analysis

This chapter summarizes the costs and benefits associated with the proposed action and the no action alternative. Chapter 4 of this draft 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 the Uranerz Energy Corporation (Uranerz).

The implementation of the proposed action would generate national, regional, and local costs and benefits. The primary national benefit of the proposed Nichols Ranch ISR Project would be a greater assurance of a stable domestic supply of low-enriched uranium. The regional benefits of building the proposed 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, accrue specifically to Campbell County and the City of Gillette. Other benefits may extend to the neighboring Johnson County and Natrona County. 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 land use, water use, increased road traffic, and increased noise. However, the overall impact of these environmental costs on the local community is considered to be SMALL.

7.1 No Action Alternative

Under the no action alternative, the proposed Nichols Ranch ISR Project would not be constructed or operated in Campbell and Johnson Counties, Wyoming. The proposed project site would remain undisturbed and ecological, natural, and socioeconomic resources would remain unaffected. All potential local environmental impacts related to water use, land use, increased road traffic, and increased noise would be avoided. Similarly, all socioeconomic impacts related to employment, economic activity, population, housing, community resources, and financing would be avoided.

7.2 Benefits from the Proposed Action

Under the proposed action, Uranerz would construct, operate, restore the aquifer, and decommission the proposed Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming. The Nichols Ranch Unit would have a six month ramp up to full annual production. Following the Nichols Ranch Unit ramp up, the Hank Unit would start a six month ramp up phase to full annual production. 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. The principal socioeconomic impact or benefit from the proposed Nichols Ranch ISR Project would be an 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 55 to 65 employees and 10 to 20 contractors during the life of the project. If the majority of operational requirements is filled by a workforce from outside the region, assuming a multiplier of about 0.7[3], there could be an influx of 46 to

[3] 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

60 jobs. Based on the current population of the region (i.e., Wright, the closest major population center, has an estimated population of 1,462 (USCB, 2008)), the additional jobs resulting from the proposed project will have a MODERATE beneficial impact to the town of Wright 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 (e.g., restaurants, hotels, retail stores) of the town of Wright and a SMALL to MODERATE beneficial impact to the Campbell County businesses.

Additionally, severance taxes associated with uranium mining are levied by the State of Wyoming, Mineral Tax Division of the Department of Revenue with a four percent uranium severance tax of taxable market value coming from mining operations (Uranerz, 2007). Uranerz estimates the U_3O_8 content is 1,144,868 kg (2,521,000 lb) for the Nichols Ranch Unit and 841,054 kg (1,852,000 lb) for the Hank Unit (Uranerz, 2007). If these were sold at current market prices of approximately $46 per pound, the severance tax would yield approximately $7,900,000 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.

7.2.1 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 and the cost of production. Since 2007, the spot-market price has been very volatile, fluctuating from a high of over $130 in 2007 to as low as $40 in 2009. The project's potential benefits to the local community depend on Uranerz's costs being lower than the future price of U_3O_8, which has been quite volatile. If the price of U_3O_8 is less than the costs of operation, then operations may be suspended and/or discontinued.

7.2.2 Costs to the Local Communities Associated with the Proposed Nichols Ranch ISR Project Activities

Table 7-1 lists the towns within 25 miles and just beyond 25 miles from the project site. The Table also presents the towns' population and distance from the project site.

Table 7-1 Towns Closest to the Proposed Project

Town	Population	Distance from Project Site (miles)
Towns within 25 miles from the project site		
Wright	1,462	22
Edgerton	176	23
Midwest	435	25
Towns just beyond 25 miles from the project site		
Kaycee	290	35
Gillette	26,871	46
Buffalo	4,832	57

of 0.7 was used as a typical employment multiplier for the milling/mining industry. (Economic Policy Institute, 2003).

Casper	54,047	61
Source: USCB, 2008		

As stated in Section 7.2, the proposed Nichols Ranch ISR Project is expected to provide jobs to approximately 55 to 65 employees and 10 to 20 contractors during the life of the project. If the majority of operational requirements are filled by a workforce from outside the region, there could be an influx of approximately 46 to 60 new jobs. These new jobs would have an influx of approximately 114 to 149 people based on 2.48 persons per household for the State of Wyoming (USCB, 2000).

Based on the current population of the region, a large fraction of the influx of the new workers along with their households could reside in the town of Wright. If all new households reside in Wright, then the town of Wright could experience an approximate 7.8 to 10.2 percent population growth. This would be considered a LARGE impact on the town of Wright. However, not all the new households may reside in the town of Wright and instead, according to GEIS (NRC, 2009), may prefer larger communities. The influx of these jobs along with the reduction in unemployment will have a MODERATE increase in the economic activity, housing demand, construction of new homes, and increase demand in public services. This will have a MODERATE impact to costs of infrastructure related to population growth in Campbell County.

Table 7-2 provides the estimated project costs to the local communities. The project's estimated costs in Table 7-2, consistent with Table 7-1, are addressed for the surrounding communities based on their proximity to the proposed project.

Table 7-2 Project Costs to the Local Communities

Costs	**Community of the Town of Wright (This will be the most impacted community)**	**Communities of towns within 25 miles from the project site**	**Communities of towns just beyond 25 miles from the project site**
Infrastructure related to population increases induced by employment	MODERATE costs	SMALL to MODERATE costs	SMALL to MODERATE costs
Fire and emergency related to potential accidents on public roads	SMALL impact for emergency response training and any costs for health care facility	No significant costs	No significant costs
Risk of contaminating and/or degrading public water supply	No risk to water supplies	No risk to water supplies	No risk to water supplies

7.3 Evaluation of Findings for the Proposed Nichols Ranch ISR Project

Implementation of the proposed action would have a MODERATE overall economic impact on the region. As stated earlier, the implementation of the proposed action would

generate national,-regional, and local costs and benefits. The primary national benefit of building the proposed Nichols Ranch ISR Project would be a greater assurance of a stable domestic supply of low-enriched uranium. The regional benefits of building the proposed 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, accrue specifically to Campbell County and the city of Gillette. Other benefits may extend to neighboring counties in Wyoming. 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 SMALL increased road traffic. The impact of these environmental costs on the local community is considered to be SMALL. Table 7-3 summarizes the costs and benefits.

Table 7-3 Summary of the Benefits and Costs of the Proposed Nichols Ranch ISR Project

Category	Proposed Action	No Action Alternative
BENEFITS		
Capacity Produced	4.3 million pounds of U_3O_8	None
Other Monetary	$7.9 million—severance tax	None
Non-Monetary	65-85 jobs 49-60 jobs from economic multiplier	None
COSTS		
Education Costs	MODERATE	None
Health and Social Services Costs	SMALL	None
Housing Costs	MODERATE	None
Measures and Controls to Reduce Environmental Impacts	Restoration and reclamation at end of project	Not Applicable
Environmental Costs	SMALL	None

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 will have accrued benefits that outweigh the economic, environmental, and social costs.

7.4 References

Economic Policy Institute. 2003. "Updated Employment Multipliers for the U.S. Economy." Washington, DC.

NRC (U.S. Nuclear Regulatory Commission). 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. NUREG-1910, Vol. 1 and 2. June 2009.

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USCB (U.S. Census Bureau). 2008. 2008 Population Estimates. http://factfinder.census.gov.

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8 Summary of Environmental Consequences

This chapter summarizes the potential environmental impacts and consequences of the proposed action and reasonable alternatives, including the no-action alternative. In doing so, the potential impacts and consequences are 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.

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.
- **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
>
> **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:

Alternative 1: Licensee Proposed Action

NRC would issue Uranerz a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISR uranium milling and processing at the Nichols Ranch site as proposed in the license application and related submittals.

The potential environmental impacts of this alternative are summarized in Table 8-1.

Alternative 2: No Action

Uranerz Energy Corporation (Uranerz) would not be issued a license for the construction and operation of ISR facilities at Nichols Ranch. 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.

Alternative 3: Modified Action – No Hank Unit

NRC would issue 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.

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 TCP, though they would be mitigated with measures such as those described in the Pumpkin Buttes Memorandum of Agreement (MOA) (BLM 2008) 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, regarding, and reseeding of land.	During all phases of the project there would be a SMALL long-term impact from altered land contouring. During decommissioning, wells, though abandoned, would remain on the site.
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 will persist after the life of the project, no long term impacts would result.
Geology and Soil 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 project area will be returned to its original condition during decommissioning, no long-term impacts to geology and soils are expected.

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**
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				
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.
Meteorology, Climatology, and 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	Not applicable	During all phases, impacts would be similar to those described as unavoidable adverse	Because noise impacts would not persist past the life of the project, no long-term impacts would

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**
	the site, but would result in SMALL impacts. During other phases, noise levels would be elevated, but to a lesser extent than during construction.		environmental impacts and SMALL.	result.
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, minor visual impacts from equipment and dust/diesel emissions would result in a SMALL impact. During all phases, impacts to the Pumpkin Buttes TCP would be SMALL and would be mitigated.	Not applicable	During all phases, all impacts associated with visual/scenic resources would be short-term.	Because project area will be returned to its original condition after during decommissioning, no long-term impacts would result.
Socioeconomic 4.11.1	During construction and operation, increased demand for housing may increase housing costs in the local	Not applicable	During all phases, increased demand for housing, educational services, and health and social services would	No long-term socioeconomic impacts are expected.

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**
	area and would result in a SMALL 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.		result in a short-term and SMALL impact.	
Environmental Justice 4.12.1	Not applicable[1]	Not applicable[1]	Not applicable[1]	Not applicable[1]
Public and Occupational Health 4.13.1	During operation, the radiological impacts from accidents would be SMALL to MODERATE for workers and SMALL to the public due as a result of the risks from accidents related to the transportation of yellowcake. During other phases, the impacts would be SMALL.	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,	During all phases, energy and space used to properly handle and dispose of all types of waste would represent an irretrievable commitment of	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.

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**
	operations wastes would include solids and liquids (brine, plant washdown water, and others), and decommissioning wastes would include some radioactive wastes.	resources resulting in a SMALL impact.		
[1] Section 4.12.1 of Chapter 4 concluded that no impacts to environmental justice would result from the Nichols Ranch ISR Project; therefore, no unavoidable adverse impacts, irreversible or irretrievable commitment of resources, or short-term or long-term impacts would result for this impact category.				

8.1 References

BLM (U.S. Bureau of Land Management). 2008. *Memorandum of Agreement Among the Bureau of Land Management, the Wyoming State Historic Preservation Officer, and Lance Oil and Gas/Anadarko Petroleum Corporation Regarding Mitigation of Adverse Effects to the Pumpkin Buttes Traditional Cultural Property and Associated Properties.* Campbell County, Wyoming. December 2008. ADAMS No. ML083400063.

NRC (U.S. Nuclear Regulatory Commission). 2003. NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC: NRC. August 2003.

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